World Health Organization | Patient Safety

A World Alliance for Safer Health Care

The institution follows the WHO's Patient safety curriculum Guide, Multi-professional edition

Patient Safety Curriculum Guide

Multi-professional Edition

Patient Safety Curriculum Guide:

Multi-professional Edition

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Contents

Abbreviations 5

Forewords 8

Introduction 18

Part A: Teacher's Guide

1. Background 22
2. How were the Curriculum Guide topics selected? 25
3. Aims of the Curriculum Guide 34
4. Structure of the Curriculum Guide 36
5. Implementing the Curriculum Guide 37
6. How to integrate patient safety learning into your curriculum 41
7. Educational principles essential for patient safety teaching and learning 51
8. Activities to assist patient safety understanding 56
9. How to assess patient safety 61
10. How to evaluate patient safety curricula 69
11. Web-based tools and resources 74
12. How to foster an international approach to patient safety education 75

Part B: Curriculum Guide Topics

Definitions of key concepts 80

Key to icons 82

Introduction to the Curriculum Guide topics 83

Topic 1: What is patient safety? 92

Topic 2: Why applying human factors is important for patient safety 111

Topic 3: Understanding systems and the effect of complexity on patient care 121

Topic 4: Being an effective team player 133

Topic 5: Learning from errors to prevent harm 151

Topic 6: Understanding and managing clinical risk 162

Topic 7: Using quality-improvement methods to improve care 176

Topic 8: Engaging with patients and carers 192

Introduction to Topics 9-11 209

Topic 9: Infection prevention and control 210

Topic 10: Patient safety and invasive procedures 227

Topic 11: Improving medication safety 241

Annexes

Annex 1: Link to the Australian Patient Safety Education Framework 260

Annex 2: Assessment method examples 261

Acknowledgements 268

Abbreviations

AHRQ	Agency for Healthcare Research and Quality
AMR	antimicrobial resistance
APSEF	Australian Patient Safety Education Framework
ARCS	accelerated recovery colectomy surgery
CBD	case-based discussion
CDC	Centers for Disease Control and Prevention
CPI	clinical practice improvement
CR-BSI	catheter-related bloodstream infection
CRM	crew resource management
ECG	electrocardiogram
EMQ	extended matching question
FMEA	failure mode effect analysis
HCAI	health care-associated infection
HBV	hepatitis B virus
HIV	human immunodeficiency virus
HRO	high reliability organization
ICU	intensive care unit
IHI	Institute for Healthcare Improvement
IOM	Institute of Medicine
IPE	interprofessional education
IV	intravenous
MRI	magnetic resonance imaging
MCQ	multiple choice question
MEQ	modified essay question
Mini-CEX	mini clinical evaluation exercise
MRI	magnetic resonance imaging
MRSA	methicillin-resistant *Staphylococcus aureus*
MSF	multisource feedback
NASA	National Aeronautics and Space Agency
NCPS	National Center for Patient Safety
NPSEF	National Patient Safety Education Framework
NSAID	non-steroidal anti-inflammatory drugs
OR	operating room
OSCE	objective structured clinical examination
OTC	over the counter
PBL	problem-based learning
PDSA	plan-do-study-act
PPE	personal protective equipment
RCA	root cause analysis
RLS	reporting and learning system
RPN	risk priority number
SBA	short best answer question paper
SSI	surgical site infection
TB	tuberculosis
UK	United Kingdom
USA	United States of America
VA	Veterans Affairs
VRE	vancomycin-resistant *Enterococcus*

Patient Safety Curriculum Guide:

Multi-professional Edition

World Health Organization

World Health Organization

Health care has evolved greatly over the past 20 years. Our knowledge of diseases and technological innovations have all contributed to improving life expectancy during the 20th Century. But one of the greatest challenges today is not about keeping up with the latest clinical procedures or the latest high-tech equipment. Instead, it is about delivering safer care in complex, pressurized and fast-moving environments. In such environments, things can often go wrong. Adverse events occur. Unintentional, but serious harm comes to patients during routine clinical practice, or as a result of a clinical decision.

Many countries in the world have already recognized that patient safety is important and are building ways and approaches to improve the quality and safety of care. They have also recognized the importance of educating health-care professionals on the principles and concepts of patient safety. Strengthening such competencies is needed in order to keep pace with the complexities of the system and the demands of workforce requirements.

The World Health Organization is currently leading a global drive to build on patient safety education, its principles and approaches that lead to a future health-care workforce educated to practise patient-centred care anywhere in the world. It has embarked on developing a patient safety curriculum guide with a multi-professional perspective, a health systems approach with a global reach. It has accelerated efforts in assisting universities and schools of health sciences to build and integrate patient safety learning into their existing curricula.

The World Health Organization, working with governments, universities and schools worldwide, international professional associations in the disciplines of dentistry, medicine, midwifery, nursing and pharmacy and their related student associations, have made patient safety education relevant to the needs and requirements of contemporary workforce environments. The combined energy, resources and expertise have been essential in developing the Multi-professional edition of the Patient Safety Curriculum Guide. The fruits of applying its recommendations will be immediate and measurable in terms of building the knowledge and skills of health sciences students that will better prepare them for safer practice.

Dr Margaret Chan
Director-General
World Health Organization

World Health Organization

World Health Organization

Commitment to patient safety worldwide has grown since the late 1990s. This was prompted by two influential reports: To Err is Human, produced by the Institute of Medicine in the USA, in 1999 and An Organization with a Memory, produced by the United Kingdom Government's Chief Medical Officer in 2000. Both reports recognized that error is routine during the delivery of health care and occurs in around 10% of hospital admissions. In a proportion of cases, the harm produced is serious, even fatal.

Since the publication of these two influential reports, the quest to improve the safety of care for patients has become a global movement. This has led to a remarkable transformation in the way that patient safety is viewed. Having begun as a subject of minority academic interest, it is now a firm priority for most health-care systems.

Yet, the current state of patient safety worldwide is still a source of deep concern. As data on the scale and nature of errors and adverse events have been more widely gathered, it has become apparent that unsafe care is a feature of virtually every aspect of health care.

The education and training of dentists, doctors, midwives, nurses, pharmacists and other health-care professionals has long been the foundation of safe, high quality health care. Yet, it has been under-used and under-valued as a vital tool for addressing the challenges of achieving improved patient safety. It is clear that a new approach is needed if education and training are to play the full role that they should in improving patient safety.

For the past three years, the World Health Organization has been exploring the links between education and health practice – between the education of the health-care workforce and the safety of the health system. As an outcome, it has developed this multi-professional Patient Safety Curriculum Guide, which addresses a variety of ideas and methods for teaching and assessing patient safety more effectively.

The WHO Curriculum Guide is a comprehensive programme for effective student learning about patient safety. It highlights the key risks of health care and how to manage them, shows how to recognize adverse events and hazards, report and analyse them. It teaches about team-work and the importance of clear communication across all levels of health care, whilst emphasizing the importance of engaging with patients and carers to build and sustain a culture of patient safety.

I hope this Curriculum Guide will inspire the future generation of health-care professionals to embark on a lifelong quest to provide their patients with the best quality and safest care they deserve.

Sir Liam Donaldson
Envoy for Patient Safety
World Health Organization

FDI World Dental Federation

Today there is a growing awareness and recognition of patient safety as a vital factor in health care. There is also a perceived need to look closely at procedures successfully adopted in other professional environments, notably business safety, to see how they can be adapted into the health-care situation. With this comes a pressing need for students in all forms of health-care practice to learn and understand how to manage and deal with adverse events, ensuring at the same time a high degree of patient safety.

The World Health Organization's (WHO) Patient Safety Curriculum Guide: Multi-professional Edition is an important resource: not only will it raise global awareness of the need for patient safety education, but it will also help educators integrate the concept of safety into existing health-care curricula.

This will contribute towards building a foundation of knowledge and skills to better prepare students for clinical practice and help develop a future workforce of health-care professionals educated in patient safety and capable of meeting the demands of today's complex environments.

In the past year, FDI World Dental Federation has sought to review its global oral health strategies and identify key global issues and regional priorities. One of the issues raised was quality assurance and improvement with respect to patient safety and patient communication/information. It is therefore heartening to see that issues raised are so immediately translated into workable, usable educational materials, based on concepts derived from industry practice.

The concept of patient safety as a 'core' attitude to be introduced early on in dental training is one that FDI has long championed. The prominence this WHO syllabus gives to training future dentists in the techniques of practising patient safety in all aspects of their work augurs well for their future careers and the future of dentistry in the world.

FDI is proud to have been involved in this collaborative project with WHO: it is very much a part of the process we have instigated to further the cause of oral health and pursue goals in continuing education. It also usefully integrates dentistry into the other health professions, highlighting the common principles that govern their approach to patient safety.

Dr Roberto Vianna
President
FDI World Dental Federation

International Pharmaceutical Federation

Patient safety is a high-priority issue for all professionals - like pharmacists - who care for the health and general well-being of people. For centuries, pharmacists have been the guardians/safeguards against "poisons" those substances which could cause harm to the public. Now more than ever pharmacists are charged with the responsibility of ensuring that when a patient receives a medicine, it will not cause harm.

The recent shift of paradigm of pharmacy practice from a product-focused to a patient centered approach has lead to the further development of pharmaceutical care, which focuses on preventing or solving actual and potential drug therapy problems, through the provision of comprehensive services to patients.

Pharmacists also contribute to collaborative practice in ambulatory and hospital settings, and there is strong evidence that patient safety can be increased through their active involvement in multi-disciplinary care teams. Believing that the strengthening of patient safety in pharmacists' curricula could further enhance their capability to contribute to patient safety, FIP contributed to this document and welcomes this precious tool.

Mr Ton Hoek
General Secretary
International Pharmaceutical Federation (FIP)

International Confederation of Midwives

Members of the International Confederation of Midwives (ICM) have dedicated considerable time and expertise to collaborating with the World Health Organization and other health professions, to create a truly multi-disciplinary and multi-professional Patient Safety Curriculum Guide, to teach patient safety principles to a wide range of health professionals. The case studies in this guide will help students not only recognize the role of patient safety in different care settings but will also highlight the need for improved inter-professional collaboration and communication to avoid health-related errors.

As President of ICM, I congratulate the numerous health professionals and WHO, who together have created this Guide. I am of course especially proud of the contributions from midwife members of ICM, who have worked tirelessly and collaboratively to bring this Curriculum Guide to fruition. May it serve the international health community well as it strives to respond to the health needs of the world.

Mrs Frances Day-Stirk
President
International Confederation of Midwives

International Council of Nurses

The International Council of Nurses is pleased to have contributed to the development of the WHO Patient Safety Curriculum Guide: Multi-professional Edition, which provides a common platform for health-care practitioners to address this important issue.

Nurses around the world have a major role to play in improving patient safety. Whilst individual professionals have a duty to ensure practice does no harm, increasingly care is being delivered by teams. Working from this comprehensive resource facilitates team work and provides a common knowledge base that also offers flexibility for each discipline to make its unique contribution. In addition, this guide raises awareness of the need to integrate patient safety into the curriculum of all health professionals.

Dr Rosemary Bryant
President
International Council of Nurses

World Medical Association

Safety is a cornerstone of quality in health care and its success requires individual and team commitment. Individuals and processes are rarely single causes of errors. Rather, separate elements combine and together produce high-risk situations. Understanding risk in the complex processes of health and medical care requires information about errors and so-called near misses. From them we can learn to close gaps of safety, reduce morbidity, mortality and to raise the quality of health care.

Therefore, it is crucial to have a non-punitive safety culture to deal with errors, with reporting mechanisms that help prevent and correct system failures and human errors instead of seeking individual or organizational culpability. In most health-care settings this blame-free culture still needs to be developed. One crucial step in this process is to educate health professional students on the concept of safety in health care, collaborative practice and how to implement it in their future day-to-day work.

Person-centred health care is becoming more complex and more specialised. This requires that more attention is paid to seamless teamwork in health care. A truly collaborative practice demands a high degree of communication, accurate passing on of task and results and clearly defined roles and responsibilities. A realistic understanding of the risks inherent in modern medicine makes it necessary that all health professionals are capable of cooperating with all relevant parties, of adopting a proactive systems approach to safety and of performing with professional responsibility. This includes first and foremost the dialogue with our patients and to pay respect to their needs, expectations, fears and hopes.

The World Medical Association advocates health professionals to recognize safety as one of the core elements for improving quality in health care. Facilitating the development of collective knowledge about unsafe situations and practices and taking preventive action to avoid unnecessary risks is key to success.

The WHO Patient Safety Curriculum Guide offers an educational tool for students of health professions to understand the concept of patient safety and collaborative practice. It gives guidance to teachers on how to teach this topic with modern educational methods.

Dr Wonchat Subhachaturas
President
World Medical Association




International Association of Dental Students
International Council of Nurses – Students' Network
International Federation of Medical Students' Associations
International Pharmaceutical Students' Federation

Given the importance of delivering safe care in today's health-care settings, there is an ever growing need for students to learn about adverse events in health care and an urgent necessity for patient safety. The introduction of patient safety in health professionals education will contribute to building a foundation of knowledge and skills that will better prepare students for clinical practice. It will help generate a future workforce of health-care professionals educated in patient safety and capable of meeting the demands of today's complex environments.

The International Association of Dental Students (IADS,) International Council of Nurses – Students' Network (ICN-SN), International Federation of Medical Students' Associations (IFMSA) and International Pharmaceutical Students' Federation (IPSF) jointly welcomes the WHO Patient Safety Curriculum Guide: Multi-professional Edition as an important resource, not only to raise global awareness of the need for patient safety education, but also to support educators to introduce this discipline into existing health-care curricula and help prepare students for safer practice in their workplace environments.

ICN-SN, IADS, IFMSA and IPSF endorse the WHO Patient Safety Curriculum Guide: Multi-professional Edition and welcomes WHO's efforts in supporting dentistry, medical, nursing and pharmacy universities and faculties worldwide to introduce patient safety education in health-care curricula. The student associations appreciate WHO's efforts in consulting with students as equal stakeholders, to ensure that their suggestions and views are incorporated into the Curriculum Guide. The associations strongly support the multi-professional edition of the WHO Patient Safety Curriculum Guide and congratulate WHO for making it possible for all stakeholders to move in this direction.

Mr Ionut Luchian
President
International Association
of Dental Students

Mr Chijioke Chikere Kadure
President
International Federation
of Medical Students' Associations

Ms Yasmin Yehia
Chairperson
International Council
of Nurses – Students' Network

Mr Jan Roder
President
International Pharmaceutical
Students' Federation

The patient voice in professional education

Having been involved in the development and piloting of the Patient Safety Curriculum Guide for Medical Schools, it was a natural progression that Patients for Patient Safety would participate in the adaptation of the Curriculum Guide for multi-disciplinary use. We welcome this opportunity to collaborate with another WHO programme.

In practice, our interaction with students of all disciplines and at all levels has reinforced a very strong conviction that as part of their education students must be exposed to, and develop for themselves, an appreciation of the value of the patient experience. When that is coupled with fostering an awareness of what constitutes truly patient-centred care they will then invariably combine heart, intellect and skills to the benefit of patients and patient outcomes.

Formally embedding the patient perspective into health-care education is key to patient safety, sustainable culture change and health-care improvement. Research conducted at the University of British Columbia in Canada highlights that "Students remember what they learn from patients. The authentic and autonomous patient's voice promotes the learning of patient-centred care".

The new WHO Curriculum Guide will bring long-awaited changes which will further ensure safe care that is inclusive of patient and family. It is a very real fact that the students of today will be the health-care professionals of tomorrow – men and women who will hold our lives in their hands and whom we patients want to hold in high regard.

Mrs Margaret Murphy
External Lead
Patients for Patient Safety Programme

Meeting the needs of our future health-care professionals

With a growing recognition of the unintended harm caused by health care itself comes the need for health-care students to learn how to deliver safer care. However, education of health-care professionals has not kept up with the fast pace of different health challenges and changing workforce requirements. Just 2% of the total world expenditure on health of US$ 5.5 trillion is spent on professional education. Innovative health professional education is urgently needed to prepare health-care professionals to deliver patient-centered health care. This calls for a competency-based curriculum with a multi-professional perspective, a systems approach, and a global reach.

The Multi-professional Edition of the WHO Patient Safety Curriculum Guide is an updated edition of the Curriculum Guide for Medical Schools, published by WHO in 2009. This new edition covers the areas of dentistry, medicine, midwifery, nursing, pharmacy, and other related health-care professions. We hope that this Guide will promote and enhance the status of patient safety worldwide and ultimately prepare students for safe practice.

As a comprehensive guide to implementing patient safety education in health-care schools and universities, it contains information for all levels of faculty staff and lays the foundation for capacity-building in the essential patient safety principles and concepts. The Curriculum Guide is a rich resource for senior decision-makers involved in the development of health-care curricula.

Written with a global audience in mind and in language easily understood, the Curriculum Guide is composed of two parts: Part A: Teacher's Guide and Part B: 11 patient safety topics. The Teacher's Guide introduces patient safety concepts and principles and gives vital information on how best to teach patient safety. Part B includes 11 patient safety topics, each designed to feature a variety of ideas and methods for teaching and assessing, so that educators can tailor material according to their own needs, context, and resources.

We, therefore, commend to you this publication. What could be more important than educating health-care professionals to become competent in patient-centered care? The Multi-professional Curriculum Guide helps build capacity to achieve this goal. We look forward to its widespread use.

Professor Bruce Barraclough
External Expert Lead
Patient Safety Curriculum Guide

Professor Merrilyn Walton
Lead Author
Patient Safety Curriculum Guide

Introduction

The Multi-professional Edition of the Patient Safety Curriculum Guide is a comprehensive guide to assist effective capacity building in patient safety education by health-care academic institutions. As patient safety teaching is relatively new for most health-care educators, the Curriculum Guide provides, in a single publication, educational frameworks and features a variety of concepts and methods for teaching and assessing patient safety.

The present Curriculum Guide is designed to be easily integrated into existing health-care education curricula using a flexible approach to meet individual needs, and is applicable to different cultures and contexts. While it offers health-care schools and universities a recommended framework and resource materials, individual adaptations to local requirements, settings, student learning needs and resources are encouraged.

The development of the Multi-professional Curriculum Guide began in January 2010 and is based on the Curriculum Guide for Medical Schools, published in 2009. A core working group comprised of experts from international professional associations in dentistry, medicine, midwifery, nursing and pharmacy, as well as from the WHO regions, coordinated the work of reviewing the 2009 Curriculum Guide, assessing available scientific evidence, and rewriting sections as they would apply to dentists, midwives, nurses and pharmacists. They also provided multi-professional case studies to support interdisciplinary learning and actively fostered discussion among experts and authors. More than 50 international experts contributed to preparing this document. Authors, contributors, experts, and other professionals who actively participated and facilitated the work process are listed in the acknowledgements section at the end of the document.

Sections of the Curriculum Guide

The document comprises two parts: Part A: Teacher's Guide; and Part B: 11 Patient Safety Topics. For convenience, the figures and tables are numbered to correspond to the part and the section in which they are presented.

Part A is aimed at health-care educators. It supports them with knowledge and tools, and helps them develop the skills necessary for implementing patient safety education in their institutions. Part A provides a systematic approach to building institutional capacity. It offers background information on how to select and teach each curriculum topic, makes suggestions on how to integrate patient safety teaching, and provides techniques for exploring how this subject could fit into the institution's existing curricula. Part A also highlights the educational principles that are essential to patient safety teaching and learning and proposes approaches for student assessment, as well as evaluation of the current patient safety curricula. The importance of faculty engagement as an essential component for maintaining the sustainability of the programme is emphasized throughout the document. At the same time, clear examples on how patient safety might be taught are provided throughout Part A.

Part B addresses health-care educators and students. It contains 11 ready-to-teach, topic-based, patient safety programmes that can be used as a whole or on a per topic basis. The topics cover a wide range of contexts in which patient safety can be taught and learned.

The 11 topics are:
Topic 1: What is patient safety?
Topic 2: Why applying human factors is important for patient safety.
Topic 3: Understanding systems and the effect of complexity on patient care.

Topic 4: Being an effective team player.
Topic 5: Learning from errors to prevent harm.
Topic 6: Understanding and managing clinical risk.
Topic 7: Using quality improvement methods to improve care.
Topic 8: Engaging with patients and carers.
Topic 9: Infection prevention and control.
Topic 10: Patient safety and invasive procedures.
Topic 11: Improving medication safety.

Educators can choose which of these topics to introduce into existing curricula as guided by institutional requirements, needs, resources, and capacity. For the actual teaching of the subject, a number of different educational approaches may be used, including lectures, ward round-based teaching, small group learning, case-based discussions, independent studies, patient tracking, role-playing, simulation, and undertaking improvement projects. There are benefits and challenges to each of these approaches and educators should bear in mind that different learning goals can be achieved by selecting different approaches.

Annexes 1 and 2 give examples of the content and format of assessments /examinations. Teachers can choose the format based on the purpose of the assessment /examination and the learning outcome objectives.

The CD-Rom on the inside cover of the document contains the electronic version of the Curriculum Guide, 11 sets of slides for teaching each topic, as well as information and tools for its promotion.

Part A
Teacher's Guide

Patient Safety Curriculum Guide: Multi-professional Edition

1. Background

Why do health-care students need patient safety education?

Health-care outcomes have significantly improved with the scientific discoveries of modern medicine. However, studies from a multitude of countries show that with these benefits come significant risks to patient safety. We have learnt that hospitalized patients are at risk of suffering an adverse event, and patients on medication have the risk of medication errors and adverse reactions. A major consequence of this knowledge has been the development of patient safety as a specialized discipline to assist health-care professionals, managers, health-care organizations, governments (worldwide) and consumers who must become familiar with patient safety concepts and principles. Everyone is affected. The tasks ahead of health care are immense and require all those involved in care to understand the extent of harm to patients and why health care must move to adopt a safety culture. Patient safety education and training is only beginning to occur at all levels. Health-care students, as future providers of health care and health-care leaders, must prepare themselves to practise safe care. Though the curricula of the different health-care professions are continually changing to accommodate the latest discoveries and new knowledge, patient safety knowledge is different because it applies to all areas of practice and to all professions.

Health-care students will need to know how systems impact on the quality and safety of health care, how poor communication can lead to adverse events and much more. Students need to learn how to manage these challenges. Patient safety is not a traditional stand-alone discipline; rather, it is one that integrates into all areas of health care. The World Health Organization's (WHO) Patient Safety programme, and other projects such as this one, aims to implement patient safety worldwide. Patient safety is everyone's business and ranges from patients to politicians. As health-care students are among the future leaders in health care, it is vital that they are knowledgeable and skilful in their application of patient safety principles and concepts. The multi-professional edition of the WHO Patient Safety Curriculum Guide sets the stage for students, irrespective of their chosen profession, to begin to understand and practise patient safety in all their professional activities.

Building students' patient safety knowledge needs to occur throughout the entire education and training of health-care students. Patient safety skills and behaviours should begin as soon as a student enters a hospital, clinic or health service. By getting students to focus on each individual patient, having them treat each patient as a unique human being, and using their knowledge and skills carefully, students themselves can be role models for others in the health-care system. Most health-care students have high aspirations when they enter into their chosen field, but the reality of health-care systems sometimes deflates their optimism. We want students to be able to maintain their optimism and believe that they can make a difference, both to the individual lives of patients and the health-care system.

How to use this Curriculum

The Curriculum has been designed for health-care educational institutions to implement patient safety learning for students prior to becoming qualified health-care professionals. Faculties can introduce all the topics as a whole or they can start more slowly by introducing one or more at a time. Each topic has all the underpinning knowledge required to teach the subject including suggestions for assessment. We have inserted case studies to facilitate learning and encourage teachers and instructors to include them in their teaching activities. We have also provided different ideas about how to teach a particular

topic. Many of the topics are best delivered once the student has experienced their professional work environment as so much of patient safety learning requires a team approach and observation of the health service as a whole, not just the area where the student happens to be placed.
The topics have been designed so that students can be responsible for much of their own learning through reading online material that provides them with the underpinning knowledge required, followed by tasks that can be performed to put the acquired knowledge into practice.

We encourage the different faculties and health professions to add relevant professional literature and data to the topics that directly concern their profession. For example, we would expect that relevant pharmacy articles and data collections be included for pharmacy students. Because this is a Multi-professional Curriculum Guide we were unable to provide examples for all professions, but we have included as many as possible where available and relevant.

What is the Curriculum Guide?

The Curriculum Guide is a comprehensive programme for the implementation of patient safety education in health-care educational institutions worldwide. It comprises two parts. Part A is a teacher's guide, which has been designed to assist teachers to implement the Curriculum Guide. As we are aware that patient safety is a new discipline and many health-care professionals and faculty staff will be unfamiliar with many of the concepts and principles, this part lays the foundations for capacity-building in patient safety education. Part B provides a comprehensive, ready-to-teach, topic-based patient safety programme that can be implemented either as a whole or on a per topic basis.

Why was the Curriculum Guide developed?

Since the Harvard study [1] in 1991 first described the extent of harm to patients, other countries have reported similar results, notwithstanding the differences in their cultures and health systems. The realization that health care actually harms patients has increased scrutiny of patient care in the context of an increasingly complex health system. This complexity has been intensified by rapidly changing medical technology and service demands [2,3]. Doctors, nurses, midwives, dentists, pharmacists, and other health-care professionals are expected to manage this complexity in their daily work, provide evidence-based health-care services, and maintain a safe environment for patients. However, unless they are properly educated and trained in patient safety concepts and principles they will struggle to do this.

Patient safety education for health-care professionals in the higher education sector has not kept up with workforce requirements [3-7]. For example, incident reporting systems for medication errors or surgical mistakes have been in use for many years in several countries, but accounts of specific curricula related to health-care errors or patient safety courses embedded in undergraduate education have started to be described only recently in the published literature [5,8].

A number of factors have impeded patient safety education. First, the lack of recognition by health-care educators that teaching and learning patient safety should be an essential part of the undergraduate curricula for health-care students, and that patient safety skills can be taught [9,10]. Many educators are unfamiliar with the literature and are unsure how to integrate patient safety learning into existing curricula [11,12]. Second, educators need to be open to new areas of knowledge [3]. One of the difficulties in introducing new curricula is a reluctance to address knowledge that originates from outside one's profession, such as systems thinking and quality-improvement methods [10]. It has also been suggested that the historical emphasis on treatment of disease rather than prevention of illness creates a culture that finds it difficult to give merit to a "non-event", i.e. a preventable adverse event [3]. A third factor relates to entrenched attitudes regarding the traditional teacher-student relationship - one that may be hierarchical and competitive [9] and where an "expert" disseminates information to the student [3,4].

This Curriculum Guide seeks to fill the gap in patient safety education by providing a comprehensive curriculum designed to build foundation knowledge and skills for all health-care students that will better prepare them for clinical practice in a range of environments.

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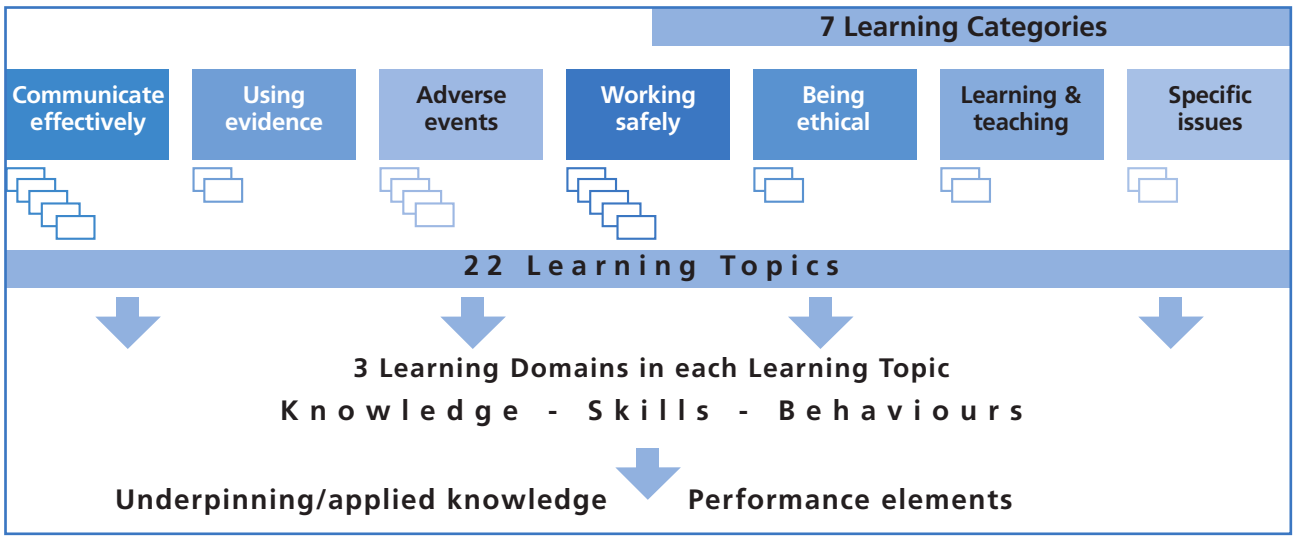
2. How were the Curriculum Guide topics selected?

The Curriculum Guide covers 11 topics, including 16 of a total of 22 learning topics that were selected from the evidence-based Australian Patient Safety Education Framework (APSEF). An additional topic not in APSEF was selected to support learning in infection control targeted by the WHO programme to reduce infections through better prevention and control. Figure A.2.1 illustrates the structure of APSEF. Table A.2.1 lists the topics selected for inclusion from APSEF and and the topics in which learning occurs. Table A.2.2 sets out the levels of learning required from the novice learner to the experienced health-care professional.

What is the Australian Patient Safety Education Framework?

APSEF [1] was developed using a four-stage approach: literature review; development of learning areas and learning topics; classification into learning domains; and conversion into a performance-based format. An extensive consultation and validation process was undertaken in Australia and internationally. Published in 2005, the Framework is a simple, flexible and accessible template describing the knowledge, skills and behaviours that all health-care workers need to ensure safe patient care. It is divided into four levels of knowledge, skills and behaviours depending on a person's position and clinical responsibility in a health service or organization. The Framework is designed to assist organizations and health-care professionals to develop educational curricula and training programmes. The Curriculum Guide was developed using the Framework.

Figure A.2.1. Structure of the Australian Patient Safety Education Framework



Source: *National Patient Safety Education Framework*, Commonwealth of Australia, 2005 [1].

Australian Patient Safety Education Framework learning areas and topics

There are seven learning areas (categories) and 22 learning topics in APSEF.
Table A.2.1 describes the Curriculum Guide topics and their relationship with APSEF.

Table A.2.1. APSEF and the WHO Curriculum Guide topics

APSEF topic	Included in curriculum	WHO topic
Communicating effectively		
Involving patients and carers as partners in health care	Yes	Topic 8
Communicating risk	Yes	Topic 6
Communicating honestly with patients after an adverse event (open disclosure)	Yes	Topic 8
Obtaining consent	Yes	Topic 8
Being culturally respectful and knowledgeable	Yes	Topic 8
Identifying, preventing and managing adverse events and near misses		
Recognizing, reporting and managing adverse events and near misses	Yes	Topics 6 & 7
Managing risk	Yes	Topic 6
Understanding health-care errors	Yes	Topics 1 & 5
Managing complaints	Yes	Topics 6 & 8
Using evidence and information		
Employing best available evidence-based practice	Yes	Covered in Topics 9, 10 & 11 (Use of guidelines).
Using information technology to enhance safety	Yes	Topic 2
Working safely		
Being a team player and showing leadership	Yes	Topic 4
Understanding human factors	Yes	Topic 2
Understanding complex organizations	Yes	Topic 3
Providing continuity of care	Yes	Topics 1 & 8
Managing fatigue and stress	Yes	Topics 2 & 6
Being ethical		
Maintaining fitness to work or practise	Yes	Topic 6
Ethical behaviour and practice	Yes	Topics 1 & 6
Continuing learning		
Being a workplace learner	Yes	Indirectly covered in Topics 4 & 8
Being a workplace teacher	Yes	Indirectly covered in Topic 4
Specific issues		
Preventing wrong site, wrong procedure, and wrong patient treatment	Yes	Topic 10
Medication safety	Yes	Topic11
Infection control (not part of APSEF)	Yes	Topic 9

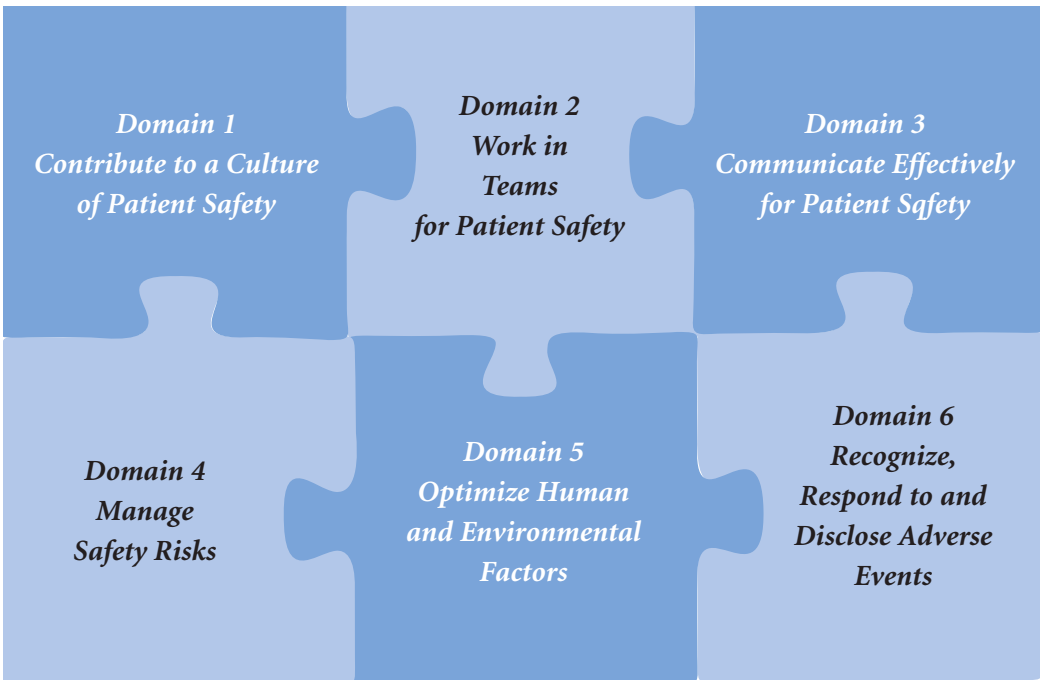
The three main stages in the development of the Framework content and structure were:

1. initial review of knowledge and development of framework outline;

2. additional searching for content and assignment of knowledge, skills, behaviours and attitudes;
3. development of performance-based format.

Since the publication of the Australian Patient Safety Education Framework in 2005, Canada released a framework entitled '*The Safety Competencies- Enhancing patient safety across the health professions*' in 2009 [2]. Similar to the Australian approach, it provides an interprofessional, practical and useful patient safety framework that identifies the knowledge, skills, and attitudes required by all health-care professionals.

Figure A.2.2. The Canadian Framework
The Safety Competencies – Enhancing patient safety across the health professions



Source: *The Safety Competencies*, Canadian Patient Safety Institute, 2009 [2].

Stage 1–Review of knowledge and development of the Australian Framework outline

A search was conducted to identify the current body of knowledge relating to patient safety (as described in the next section). The literature, books, reports, curricula and web sites collected were then reviewed to identify the major activities associated with patient safety that had a positive effect on quality and safety. These activities were then grouped into categories termed "learning areas". Each learning area was analysed and further broken down into major subject areas, termed "learning topics". See below for details of the literature review process and the Framework content structure.

The rationale for the inclusion of each learning area and topic has been articulated in the body of the Framework and is summarized below.

Stage 2–Additional searching for content and assignment of knowledge, skills, behaviours and attitudes

Each learning topic formed the basis for a more extensive search, including additional terms such as education, programmes, training, adverse events, errors, mistakes, and organization /institution/health facility/health service.
All the activities (knowledge, skills, behaviours and attitudes) for each topic were listed until no more activities were forthcoming and the sources exhausted. This list was then culled for duplication, practicality and redundancy. The activities were then categorized into the domains of knowledge, skills or behaviours.

The final step in this stage was to allocate each activity to the appropriate level corresponding

to the degree of responsibility of health-care workers.

Level 1 (Foundation) identifies the knowledge, skills, behaviours and attitudes that every health-care worker needs to have.

Level 2 is designed for health-care professionals who provide direct clinical care to patients and work under supervision, and for those with managerial, supervisory and/or advanced clinical responsibilities.

Level 3 is for health-care professionals who have managerial or supervisory responsibilities or are senior clinicians with advanced clinical responsibilities.

Level 4 (Organizational) identifies the knowledge, skills, behaviours and attitudes required for clinical and administrative leaders with organizational responsibilities. Level 4 is not part of the progressive learning that underpins the first three levels.

The learning areas and topics were endorsed by the APSEF Project Reference Group and Steering Committee. Extensive consultation with the wider health system and community within Australia, as well as internationally, completed the review and endorsement process for the learning areas and topics and their content.

The outcome of this stage is shown in Table A.2.2. This example is taken from Topic 8: *Engaging with patients and carers.*

Table A.2.2. APSEF content matrix

	Level 1 (Foundation) *For categories 1–4 health-care workers*	Level 2 *For categories 2 and 3 health-care workers*	Level 3 *For category 3 health-care workers*	Level 4 (Organizational) *For category 4 health-care leaders*
Learning objectives	Provide patients and carers with the information they need when they need it	Use good communication and know its role in effective health-care relationships	Maximize opportunities for staff to involve patients and carers in their care and treatment	Develop strategies for staff to include patients and carers in planning and delivering health-care services
Knowledge				
Skills				
Behaviours and attitudes				

Stage 3–Development of performance-based format

Once the knowledge, skills and behaviours had been described for each level of health professional, the activities were translated into a performance-based format, which takes full advantage of the modular nature of the Framework. The most extensive consultation occurred at this stage of the Framework's development. Individual health-care workers (nurses, doctors, pharmacists, physiotherapists, social workers, occupational therapists, dentists, and others) were interviewed about aspects of every performance element in the Framework and the entire document was distributed across the Australian health-care sector for feedback. International experts were also engaged in the validation process.

The WHO Curriculum Guide topics

1. What is patient safety?
2. Why applying human factors is important for patient safety
3. Understanding systems and the effect of complexity on patient care
4. Being an effective team player
5. Learning from errors to prevent harm
6. Understanding and managing clinical risk
7. Using quality-improvement methods to improve care
8. Engaging with patients and carers
9. Infection prevention and control
10. Patient safety and invasive procedures
11. Improving medication safety.

Rationale for each Curriculum Guide topic

Health-care professionals who teach students may not immediately appreciate why certain topics are included in this Curriculum. They may already be teaching a particular topic, but have not categorized it as patient safety. Teachers may also discover that many of the principles and concepts addressed in this Curriculum are similar to existing educational material, but with a different emphasis. The significance of each topic in the learning of health-care students is clarified below.

Topic 1: What is patient safety?

Given that health-care professionals are increasingly being required to incorporate patient safety principles and concepts into everyday practice, this topic presents the case for patient safety. In 2002, WHO Member States agreed on a World Health Assembly resolution on patient safety in recognition of the need to reduce the harm and suffering of patients and their families, as well as the compelling evidence of the economic benefits of improving patient safety. Studies show that additional hospitalization, litigation costs, health care-associated infections, lost income, disability, and medical expenses cost some countries between US$ 6 billion and US$ 29 billion a year [3, 4].

A number of countries have published studies highlighting the overwhelming evidence showing that significant numbers of patients are harmed due to their health care, either resulting in permanent injury, increased length of stay (LOS) in health-care facilities, or even death. We have learnt over the last decade that adverse events occur not because people intentionally hurt patients. They are, rather, due to the complexity of today's health-care systems, especially in developed countries, where the successful treatment and outcome for each patient depend on a range of factors and not just the competence of one individual health-care provider. When so many different types of health-care providers (doctors, nurses, pharmacists and allied health-care workers) are involved, it is very difficult to ensure safe care unless the system of care is designed to facilitate timely and complete information and understanding by all the health professionals.

Similarly, in developing countries, a combination of numerous unfavourable factors such as understaffing, inadequate structures and overcrowding, lack of health-care commodities and shortage of basic equipment, poor hygiene and sanitation, all of which can be attributed to limited financial resources, contribute to unsafe patient care.

Topic 2: Why applying human factors is important for patient safety

Human factors is an area of expertise of engineers and cognitive psychologists. This topic may provide some challenges for health professional faculty as well as students. We recommend that you invite an appropriate person with human factors expertise to give a lecture to the students. Human factors, engineering or ergonomics is the science of the interrelationship between humans, their tools and the environment in which they live and work [4]. Human factors engineering will help students understand how people perform under different circumstances so that systems and products can be built to enhance performance. It covers the human-machine and human-to-human interactions such as communication, teamwork and organizational culture.

Other industries such as aviation, manufacturing and the military have successfully applied knowledge of human factors to improve systems and services. Students need to understand how human factors can be used to reduce adverse events and errors by identifying how and why systems break down and how and why human beings miscommunicate. Using a human factors approach, the human-system interface can be improved by providing better-designed systems and processes. This often involves simplifying processes, standardizing procedures, providing backup when humans fail, improving communication, redesigning equipment and engendering a consciousness of behavioural, organizational and technological limitations that lead to error.

Topic 3: Understanding systems and the effect of complexity on patient care

Students are introduced to the concept that a health-care system is not one, but many systems made up of organizations, departments, units, services and practices. The huge number of relationships between patients, carers, health-care providers, support staff, administrators, economists and community members, as well as the relationships between the various health-care and non-health-care services, add to this complexity. This topic gives students a basic understanding of complex organizations using a systems approach. Lessons from other industries are used to show students the benefits of a systems approach.

When students think in terms of *'systems'*, they will be better able to understand why things break down and so will have a context for thinking about *'solutions'*. Health-care students need to appreciate how, as a provider of health care, working in a hospital or rural health clinic, they will be doing their best to treat and care for their patients, but that alone they will not be able to provide a safe and quality service. This is because patients depend on a number of people doing the right thing, at the right time for them. In other words, they depend on a system of care.

Topic 4: Being an effective team player

Students' understanding of teamwork involves more than identification with the team comprising their own profession. It requires students knowing the benefits of multidisciplinary teams and how effective multidisciplinary teams improve care and reduce errors. An effective team is one where the team members, including the patient, communicate with one another as well as combining their observations, expertise and decision-making responsibilities to optimize patient care [5].

The task of communication and flow of information between health providers and patients can be complicated due to the spread of clinical and professional responsibility among different members of the health-care team [6,7]. This can result in patients being required to repeat the same information to multiple health providers. More importantly, miscommunication has also been associated with delays in diagnosis, treatment and discharge, as well as failures to follow up on test results [8–12].

Students need to know how effective health-care teams work, as well as techniques for including patients and their families as part of the team. There is some evidence that multidisciplinary teams improve the quality of services and lower costs [13–15]. Good teamwork has also been shown to reduce errors and improve care for patients, particularly those with chronic illnesses [16–18]. This topic presents the underlying knowledge required to become an effective team member. However, knowledge alone will not make a student a good team player. They need to understand the culture of their workplace and how it impacts on team dynamics and functioning.

Topic 5: Learning from errors to prevent harm

Understanding why health-care professionals make errors is necessary to appreciate how poorly-designed systems and other factors contribute to errors in the health-care system. While errors are a fact of life, the consequences of errors on patient welfare and staff can be devastating. Health-care professionals and students alike need to understand how and why systems break down and why mistakes happen, so they can act to prevent and learn from them. An understanding of health-care errors also provides the basis for making improvements and implementing effective reporting systems [3]. Students will learn that a systems approach to errors, which seeks to understand all the underlying factors involved, is significantly better than a person approach, which seeks to blame people for individual mistakes. Lucian Leape's seminal article in 1994 showed a way to examine errors in health care that focused on learning and fixing errors instead of blaming those involved [19]. Although his message has had a profound impact on many health-care practitioners, many are still stuck in a blame culture. It is crucial that students begin their vocation by understanding the difference between blame and systems approaches.

Topic 6: Understanding and managing clinical risk

Clinical risk management is primarily concerned with maintaining safe systems of care. It usually involves a number of organizational systems or processes that are designed to identify, manage and prevent adverse outcomes. Clinical risk management focuses on improving the quality and safety of health-care services, by identifying the circumstances that put patients at risk of harm and acting to prevent or control those risks. Risk management involves every level of the organization, so it is essential that students understand the objectives and relevance of clinical risk management strategies in their workplace. Managing complaints and making improvements, understanding the main types of incidents in the hospital or clinic that are known to lead to adverse events, knowing how to use the information from complaints, incident reports, litigation, coroners' reports and quality-improvement reports to control risks [20] are all examples of clinical risk management strategies.

Topic 7: Using quality-improvement methods to improve care

Over the last decade, health care has successfully adopted a variety of quality-improvement methods used by other industries. These methods provide health-care professionals with the tools to: (i) identify a problem; (ii) measure the problem; (iii) develop a range of interventions designed to fix the problem; and (iv) test whether the

interventions worked. Health-care leaders, such as Tom Nolan, Brent James, Don Berwick and others, have applied quality-improvement principles to develop quality-improvement methods for health clinicians and managers. The identification and examination of each step in the process of health-care delivery is the bedrock of this methodology. When students examine each step in the process of care, they begin to see how the pieces of care are connected and measurable. Measurement is critical for safety improvement. This topic introduces the student to the principles of improvement theory and the tools, activities and techniques that can be incorporated into their practice.

Topic 8: Engaging with patients and carers

Students are introduced to the concept that the health-care team includes the patient and/or their carer, and that patients and carers play a key role in ensuring safe health care by: (i) helping with the diagnosis; (ii) deciding about appropriate treatments; (iii) choosing an experienced and safe provider; (iv) ensuring that treatments are appropriately administered; and (v) identifying adverse events and taking appropriate action [21, 22]. The health-care system underutilizes the expertise patients can bring, such as their knowledge about their symptoms, pain, preferences and attitudes to risk. They are a second pair of eyes if something unexpected happens. They can alert a nurse, doctor, pharmacist or other health-care worker if the medication they are about to receive is not what they usually take, which acts as a warning to the team that checks should be made.

Research has shown that there are fewer errors and better treatment outcomes when there is good communication between patients and their health-care providers, and when patients are fully informed and educated about their medications [23–30]. Poor communication between health-care professionals, patients and their carers has also emerged as a common reason for patients taking legal action against health-care providers [31, 32].

Topic 9: Infection prevention and control

Because of the worldwide problem of infection prevention and control and the efforts by WHO to reduce health care-associated infections, it was considered important that this area be included in the Curriculum Guide, not only for consistency, but also because together with surgical care and medication, it constitutes a significant percentage of adverse events suffered by patients. The problem of infection control in health-care settings is now well established, with health care-associated infections being a major cause of death and disability worldwide. There are numerous guidelines available to help doctors, nurses, dentists and others minimize the risks of cross-infection. Patients who have surgery or an invasive procedure are known to be particularly prone to infections and account for about 40% of all health care-associated infections. This topic sets out the main causes and types of infections, to enable health-care students to identify the activities that put patients at risk of infection and to prepare students to take the appropriate action to prevent transmission.

Topic 10: Patient safety and invasive procedures

By recognizing the unacceptable harm caused by surgery, WHO has successfully campaigned to reduce surgical adverse events. One of the main causes of errors involving wrong patients, sites and procedures is the failure of health-care providers to communicate effectively (inadequate processes and checks) in preoperative procedures. Some examples of wrong site/procedure/patient are: (i) the wrong patient in the operating room (OR); (ii) surgery performed on the wrong side or site; (iii) wrong procedure performed; (iv) failure to communicate changes in the patient's condition; (v) disagreements about stopping procedures; and (vi) failure to report errors.

Minimizing errors caused by misidentification involves developing best practice guidelines for ensuring that the correct patient receives the right treatment [7, 33]. Students can learn to understand the value of all patients being treated in accordance with the correct site/procedure/patient policies and protocols. Such learning would include the benefits of using checklists or protocols, as well as knowledge of the underlying principles supporting a uniform approach to treating and caring for patients.

One study of hand surgeons found that 21% of surgeons surveyed (n=1050) reported performing wrong site surgery at least once during their careers [34].

Topic 11: Improving medication safety

An adverse drug reaction has been defined by WHO [35] as any response to a medication that is noxious, unintended and occurs at doses used for prophylaxis, diagnosis or therapy. Patients are vulnerable to mistakes being made in any one of the many steps involved in ordering, dispensing and administering medication.

Medication errors have been highlighted in studies

undertaken in many countries, which show that about 1% of all hospital admissions suffer an adverse event related to the administration of medications [36]. The causes of medication errors include a wide range of factors including: (i) inadequate knowledge of patients and their clinical conditions; (ii) inadequate knowledge of the medications; (iii) calculation errors; (iv) illegible handwriting on the prescriptions; (v) confusion regarding the name of the medication; and (vi) poor history taking [37].

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3. Aims of the Curriculum Guide

The speed with which new technology, including drugs, is introduced into health-care treatments well demonstrates the constant change in health care which, in turn, is changing the nature of the work or tasks undertaken by the different health professionals. In some countries, nurses prescribe medication and non-medical personnel perform minor procedures. Regardless of the wealth of a country, patient safety principles and concepts apply irrespective of the type of health-care worker, the place where the health care is delivered and the type of patients. Some developing countries may lack adequate health-care resources and while staff shortages may make the environment more susceptible to poor quality and unsafe care, it does not mean that health-care professionals cannot make health care safer. While very important, more staff and resources are not the main remedies for minimizing harm to patients. This Curriculum Guide is relevant to all health-care professional students irrespective of the resources available at their facility. But the context of the environment in which the health-care student will be placed and working when qualified is important for teaching. Taking account of the workplace context is necessary to bring authenticity to the learning experience and prepares students for the work environment they will be entering.

The aims of the Curriculum Guide are to:

- prepare health-care students for safe practice in the workplace;
- inform health-care educational institutions of the key topics in patient safety;
- enhance patient safety as a theme throughout all health-care professional curricula;
- provide a comprehensive curriculum to assist teaching and integrating patient safety learning;
- further develop capacity for patient safety educators in health-care professional education;
- promote a safe and supportive environment for teaching students about patient safety;
- introduce or strengthen patient safety education in all health-care professional educational settings worldwide;
- raise the international profile of patient safety teaching and learning;
- foster international collaboration on patient safety education research in the higher education sector.

Underpinning principles

Capacity-building is integral to curriculum change

The main reason that WHO embarked on this project was to assist the development of patient safety education in health care. The requirement of health professional education to develop and integrate patient safety learning into the curricula of the different professions is a challenge for many institutions because of the limited education and training of faculty staff in patient safety concepts and principles. Health-care faculties cannot be expected to develop new curricula or review existing curricula if they are unfamiliar with the requirements of the discipline of patient safety.

Health-care educators come from many backgrounds (clinicians, clinician educators, non-clinician educators, managers, health professionals) and their collective experience is necessary to deliver a rigorous programme in any particular profession. Many are experts in their particular disciplines and usually keep up-to-date using the accepted professional pathways for their area. Patient safety knowledge requires additional learning that falls outside these traditional routes. To be an effective patient safety teacher, health professionals need to be provided with the knowledge, tools and skills necessary for implementing patient safety education in their institutions. This is why a Teacher's Guide (Part A) has been developed

to accompany the Curriculum Guide. It provides practical advice and information for each stage of curriculum development and renewal, from assessing capacity to staff development to programme design and implementation.

A flexible curriculum to meet individual needs

We recognize that the curriculum of most health-care programmes is already filled beyond capacity. This is why we have designed each topic as a stand-alone unit, thus allowing for wide variations in patient safety education implementation. The topics are also designed so they can be integrated into existing curricula, particularly in the doctor–patient stream. The topics in the Curriculum Guide have each been designed with enough content for a 60–90 minute educational session and feature a variety of ideas and methods for teaching and assessing so that educators can tailor material according to their own unique needs, context and available resources. There is no requirement to absolutely follow the outline provided. Teachers need to pay attention to the local environment, culture and student learning experiences and then select the most appropriate teaching method for the content selected.

Easily understood language for a targeted yet global audience

The Teacher's Guide (Part A) of the Curriculum Guide is written for educators (those with the capacity to introduce or enhance patient safety education at various levels), while the Curriculum Guide (Part B: Topics) is written for teachers and students. The Curriculum Guide was written with a global audience in mind and in language easily understood by those with English as both a first and second language.

A curriculum guide for all countries, cultures and contexts

Every attempt has been made to ensure that the content in this curriculum takes into account the wide variety of contexts in which health-care educators and students teach and learn. An Expert Group, representing all WHO regions, has assessed the curriculum to ensure cultural appropriateness. Although some of the teaching activities and suggestions for students may not be culturally appropriate in every country, we are mindful that in all countries we need to change many of the aspects of clinical care. Much professional behaviour once thought appropriate is no longer acceptable today when taking patient safety considerations into account. For example, staff, such as nurses, pharmacists and junior doctors, are now envcouraged to speak up when they see a more senior person, such as a doctor, about to make an error; this is universal and applies to all cultures to varying degrees. Patient safety principles require that everyone is responsible for patient safety and should speak up, even when they are lower in the clinic or hospital hierarchy. Teachers will need to make a judgement about the health-care environment and whether it is ready and prepared for some of the challenges that will accompany the introduction of patient safety.

Teaching and assessment strategies are designed to take into account both diversity in available resources and environmental differences, considerations that may be in terms of a developed versus developing country, or a classroom versus a simulation centre.

A curriculum guide that is based on learning in a safe and supportive environment

We are mindful that students respond best when the learning environment is one that is safe, supportive, challenging and engaging. Patient safety learning occurs in many places–beside the bed or chair, in the clinics and community, in the pharmacy, in simulated environments, and in the classroom. It is essential that students are supported in their learning and not made to feel humiliated or inadequate. The activities in the Curriculum Guide are designed to be implemented in a supportive learning environment where students feel comfortable asking questions, volunteer what they do not understand, and share their understanding in an honest and open way.

4. Structure of the Curriculum Guide

Teacher's Guide (Part A)

The Teacher's Guide (Part A) relates to building capacity for patient safety education, programme planning and design. Suggestions are provided regarding how patient safety education might be approached and implemented using the material presented in Part B. In Part A, we try to guide the reader through some important steps designed to support and achieve the implementation phase of curriculum development.

Curriculum Guide topics (Part B)

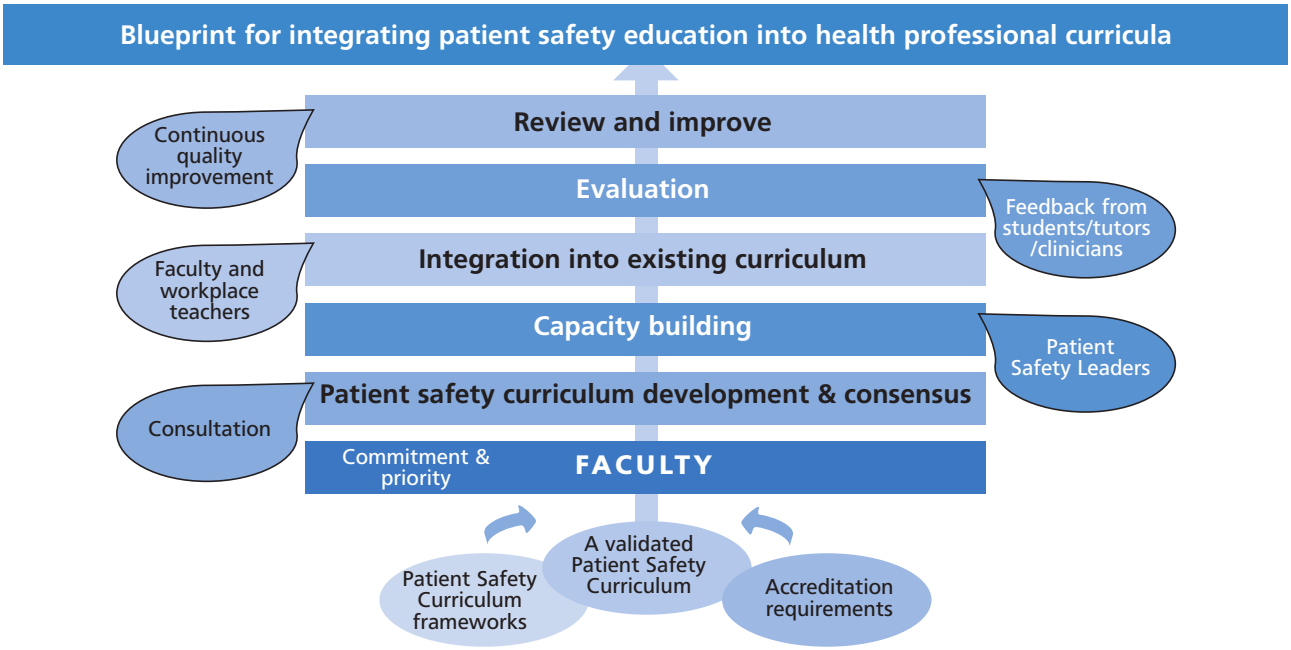
The topics represent the actual patient safety education curriculum.

5. Implementing the Curriculum Guide

How to use this Curriculum Guide

This Curriculum Guide provides the resources for teaching health-care students about patient safety. It identifies the topics to be taught, how to teach them, and how you can assess the different topics in the curriculum. Patient narratives and case studies are available at the beginning and end of each topic. These cases can be used to demonstrate a particular aspect of the topic under discussion. We recognize that the best learning occurs when the case study reflects local experiences; therefore, we encourage teachers to modify the cases so that they reflect the experiences of the health-care providers and locally available resources. This Curriculum Guide is designed for all health professional students and, therefore, teachers in specific professions should include relevant professional literature where possible to reinforce student learning. Part A of this Curriculum Guide aims to assist faculty staff to become familiar with patient safety concepts and principles so they can begin to integrate patient safety learning in all educational activities. Building capacity of faculty and teaching staff takes time and commitment. Figure A.5.1 depicts the key stages.

Figure A.5.1. Integrating patient safety education into health professional curricula



Source: supplied by Merrilyn Walton, Professor, Sydney School of Public Health, University of Sydney, Sydney, Australia, 2010.

How to review your curriculum for patient safety learning

Identify the learning outcomes
To start the process of curriculum development or renewal, it is important to first identify the learning outcomes for patient safety. Part B contains the topics that have been chosen for this Curriculum Guide, including the learning outcomes; learning outcomes are further discussed in this section (Part A).

Know what is already in the curriculum
We use the word "curriculum" to refer to the broad spectrum of teaching and learning practices, including the strategies for developing skills and behaviours, as well as using appropriate assessment methods to test whether the learning outcomes have been achieved. Students are guided in their learning by a curriculum that sets out the requisite knowledge, skills and behaviours required to demonstrate competency upon completion of their chosen health professional degree.

Before new material is introduced into a curriculum, it is important to know the content of the existing curriculum, as well as students' experiences in the hospitals and/or different work environments. It may be that students are already experiencing some patient safety education in the hospitals and clinics that is not written down. The curriculum may already cover some aspects of this patient safety curriculum, such as the importance of protocols for hand hygiene to avoid infection transmission or checking systems to ensure correct patient identification. Getting a picture of existing material in the relevant curriculum is necessary to identify the opportunities for enhancing patient safety teaching.

The patient safety curriculum is described in Part B of this document. We have identified the topics, resources, teaching strategies and assessment methods that will make patient safety teaching easier to introduce and integrate into the curriculum.

Build on what is already in the curriculum
A good approach to patient safety education is to enhance existing parts of a curriculum rather than viewing patient safety as a new subject to teach. There are elements of patient safety that are new and will be additional to the existing curriculum, but there are many aspects of patient safety that can be added onto or achieved with further development of a subject or topic that already exists.

We have found that mapping topics or learning areas in the existing curriculum will help identify opportunities to include patient safety concepts and principles. Areas such as skills development, professional and personal development, health law, ethics and communication are all suitable areas for including patient safety concepts and principles. Table A.5.1 is a template developed by the University of Sydney Medical School (Australia) to review where patient safety learning could occur in the medical school curriculum and offer it as an example that can be followed.

Table A.5.1. Mapping exercise: identification of patient safety content in the existing medical programme

Session/ area of the curriculum	Year	Where is the patient safety content?	Potential patient safety learning	How is patient safety being taught?	How is patient safety being assessed?	Comments
Ethics	1	Respect for patient autonomy	Honesty after an adverse event	Lecture	Ethics essay, multiple choice questions (MCQ), objective structured clinical examination (OSCE)	Many patient safety principles have an ethical basis that can be used to make explicit the patient safety lesson

Mapping your curriculum will also help identify the opportunities for including patient safety concepts in an integrated fashion.

How to assess the capacity of faculty to integrate patient safety teaching into the existing curriculum

One of the biggest challenges facing all health professions is the growing shortage of workplace teachers generally. There are few who know how to integrate patient safety principles and concepts into structured teaching in a new area and many will find the content unfamilar. Many health professionals intuitively adopt patient safety methods into their everyday practice, but may not know how to articulate what they do. This may be because they view any discussions about "systems" as the province of administrators and managers. Others may not think patient safety teaching important or relevant to their area of practice but patient safety concerns everybody. Most health-care professionals today would be conscious of the need for patient safety, but because this area is so new to curriculum, engaging health-care professionals will be the first challenge for you. Building capacity of the faculty can take time, but there are a number of steps that can be taken to engage clinicians in patient safety teaching.

Survey

One way to find out who is interested in teaching patient safety is to conduct a survey of those who teach students. In some institutions there may be hundreds of teachers and in others not so many. Identify the persons who are in the best position to incorporate patient safety teaching and ensure that they are included in the survey. The mapping exercise described above will help identify faculty staff who currently teach and are in a position to integrate patient safety concepts. The survey could include questions related to an interest or knowledge of patient safety and practice in patient safety methods. This process could also identify persons interested in forming a group or committee to oversee the development of the patient safety curriculum in your particular profession.

Focus group

Run a focus group of health professionals from your particular profession to find out what the current state of knowledge is about patient safety. This will also provide information about their attitudes towards patient safety learning in the curriculum.

Face-to-face meetings

Individual meetings with faculty staff and workplace teachers from your profession will help to convey a clear message about patient safety education. This provides an opportunity to explain the basis and urgency for patient safety education as well as to establish a relationship for later work.

Convene a round table

Invite a select group of people from your profession who you think may be interested and might be possible role models or "champions" to participate to a round table discussion about patient safety education for students. (The benefit of a round table format is that there is no one expert obviously in charge and the group seeks to discuss and resolve the issues together in a collegial fashion.)

Conduct a seminar on patient safety

Seminars are typical venues for building new knowledge. Seminars are useful for exposing practitioners new to the area as, well as to experts or respected practitioners who are knowledgeable about patient safety. Seminars can either be a half-day or a full day. Topics could include: (i) what is patient safety?; (ii) the evidence of why patient safety is important; (iii) how to develop a curriculum for patient safety; (iv) how to teach patient safety; and (v) how to assess patient safety. It is important to remember to maintain the aim of the programme, which is to build capacity for faculty staff and professionals to teach patient safety to students.

How to identify like-minded colleagues or associates

If you undertake the activities set out above in relation to building capacity, this will help identify like-minded people interested in teaching patient safety. Another way is to convene a meeting and send an open invitation to faculty staff and teachers. Make sure to schedule the meeting at a time convenient for as many people as possible in order to attract maximum attendance (e.g. some professions who see patients during the day may want to come, but cannot because of work demands). Another way is to put an article in the faculty or university newsletter. This will let people know about patient safety, and even if they are not interested in getting involved, the article will raise awareness of the need to include patient safety education in the curriculum.

Patient safety teaching requires the person responsible for implementing the programme to engage interested and knowledgeable health professionals who have identified themselves or have been appointed or nominated as a result of previous contacts or meetings about patient safety. It is also a good idea to check the availability of experts from other faculties and disciplines, such as engineering (human factors

knowledge), psychology (behavioural psychology, process and improvement theories), pharmacy (medication safety), and nursing and medicine (infection control).

Techniques to fit patient safety learning into the curriculum

Brainstorming is a technique that requires and encourages everyone to suggest ideas for solving a problem. The problem being how to best introduce patient safety learning into the curriculum. Each health-care faculty is different with varying resources, capacity and interest in patient safety. In some countries, patient safety may not yet be a community or government concern and the urgency to include patient safety education may not be perceived as a priority.

Convening introductory workshops on this multi-professional edition of the WHO Patient Safety Curriculum Guide will provide an opportunity for members of the faculty to become familiar with the core topics in patient safety. It will also allow them to express any reservations, ask questions and clarify any concerns they have about the programme.

Patient safety is best considered in the context of multidisciplinary learning. Staff should be encouraged to reflect on the feasibility of combining some of the patient safety sessions with other health professionals. This Curriculum Guide has been designed for all health-care students. Most health-care professions and disciplines have much to contribute, particularly in teaching some of these topics. Engineers may be able to teach about human factors systems and safety cultures. Psychologists and behavioural scientists, nursing, medicine and pharmacy faculties can teach how their disciplines have made safety improvements. Striving for diversity gives the maximum chance to enable students to learn from other disciplines, particularly in the context of a team approach to patient safety.

Reaching agreement

As in all discussions about curriculum content, there will be different views about what should be included and what should be left out. The important point is to start and build up from the discussion. This means that compromise may be better in the long run–getting something started rather than debating and discussing the issues for lengthy periods of time. Another technique is to introduce new topics into the curriculum using a pilot, which could identify any problems and be used as a guide for future topics. It also allows faculty staff members who are unsure of the value of patient safety learning to get used to the idea.

The next section gives more details about developing and integrating the Curriculum Guide into existing curricula.

6. How to integrate patient safety learning into your curriculum

General comments

Patient safety is a relatively new discipline and introducing any new material into an existing curriculum is always challenging. What should be taught? Who should teach it? Where and how will it fit in with the rest of the curriculum? What does it replace?

If your professional school is in the process of renewing an existing curriculum or if you belong to a new health professional facility, this is an ideal time to make a case for allocating space for patient safety education. However, most health-care professional school curricula are well established and already full. It is unusual to find a block of free time waiting for a new area of study.

This section provides ideas on how to integrate patient safety teaching and learning into an existing curriculum. The benefits and challenges of different approaches will be covered to help you determine the likely best fit for your school and to help you anticipate and plan what is required.

The nature of patient safety education:

- it is new;
- it spans a number of fields not traditionally taught to health-care students, such as human factors, systems thinking, effective teamwork behaviours and managing error;
- it links with many existing and traditional subjects (applied sciences and clinical sciences) (see Box A.6.1 for some examples);
- it contains new knowledge and performance elements (see Box A.6.2 for examples);
- it is highly contextual.

Box A.6.1. Linking patient safety education with traditional medical and nursing school subjects

An example of how a patient safety topic, such as correct patient identification, has specific applications in numerous disciplines in medicine.

Discipline	Patient safety application
Obstetrics	How are newborn babies identified as belonging to their mother so that babies are not accidentally mixed up and leave hospital with the wrong parent(s)?
Surgery	If a patient needs a blood transfusion, what checking processes are in place to ensure they receive the correct blood type?
Ethics	How are patients encouraged to speak up if they do not understand why the doctor is doing something to them that they were not expecting?

Box A.6.2. Linking patient safety education with new knowledge and performance elements

Patient safety competencies for a particular topic can be divided into knowledge and performance requirements. Ideally, learning will occur in both categories, e.g. correct patient identification.

Domain	Patient safety example
Broad knowledge	Understanding that patient identification mix-ups can and do occur, especially when care is delivered by a team. Learning what situations increase the likelihood of a patient mix-up, such as having two patients with the same condition, patients who cannot communicate, and staff being interrupted mid-task.
Applied knowledge	Understanding the importance of correct patient identification when taking blood for cross-matching. Understanding how errors can occur during this task and learning about the strategies used to prevent error in this situation.
Performance	Demonstrating how to correctly identify a patient by asking the patient their name as an open-ended question, such as "what is your name?" rather than as a closed question, such as "are you John Smith?"

The field of patient safety is also very broad. Given this breadth and the need for contextualizing patient safety principles, there are likely to be many opportunities in your curriculum to incorporate effective patient safety education into existing sessions. However, some areas of patient safety are relatively new to health-care professions and may not be so easy to graft onto an existing session and hence are likely to need their own time slot in the curriculum. Topic 2, *Why applying human factors is important for patient safety*, may be difficult to integrate or incorporate into an existing subject. One approach to this topic would be to create a time and invite an expert from either the faculty of engineering or psychology to give a lecture followed by a small group discussion.

How to establish best fit using generic curriculum structures

Once you have reviewed your existing curriculum, determined what patient safety areas are already taught and decided what patient safety topics you want to teach, it is time to think about how to incorporate the new content into your curriculum.

When thinking about your curriculum consider the following questions:

- How is your overall curriculum structured?
- When and where in the curriculum are particular subjects and topics taught that might lend themselves to inclusion of patient safety content?
- How are individual topics structured in terms of learning objectives, delivery methods and assessment methods?
- How is your curriculum delivered?
- Who is responsible for the delivery of the teaching?

Once you have answered these questions, it will become more apparent where and how patient safety can be included in your curriculum.

How is your overall curriculum structured?

- Is it a traditional curriculum delivered by lectures to large groups of students? Students first learn about the basic and behavioural sciences and once these are complete, they concentrate on particular areas relevant to the profession. Education tends to be discipline-specific rather than integrated.

In this setting, the application and performance elements of patient safety may be best introduced in the later years of the course. However, broad knowledge of patient safety principles can still be effectively introduced in the early years.

- Is it an integrated curriculum? Basic, behavioural, and clinical sciences and skills are covered in parallel throughout the course and learning is integrated.

In this setting, there are advantages to the vertical integration of knowledge, application and performance elements of patient safety education throughout the course.

Knowledge and performance requirements of patient safety

- Student learning is ideally experienced in the workplace setting; relevance is more apparent

once students understand how health care is delivered and they are more familiar with the workplace environment.
- Students will be more likely to change practices if they have the opportunity to use what they have learnt shortly after it is covered in the curriculum.

When teaching a patient safety topic, there are advantages if the knowledge and performance requirements are covered together. A clear understanding of the scope of a problem in patient safety will provide motivation and insight when learning about performance requirements.

Students are also less likely to feel demoralized about the risks facing patients from the health-care system they will soon be a part of. If they explore solutions (applications) and learn practical strategies (performance elements) to make them safer providers of health care at the same time, they will be more positive. For logistical reasons, it may not be possible to cover the knowledge and performance requirements of a patient safety topic at the same time.

If your curriculum is traditional, then knowledge and performance requirements of patient safety are best taught in later years when students have more knowledge of professional practice and exposure to patients and workplace skills' training. The context for the knowledge and performance requirements should match the students' ability to put into practice their new knowledge. Introductory patient safety knowledge can still be included in the early years in subjects such as public health, epidemiology, ethics, or other behavioural science-based subjects. Suitable topics for early introduction include: (i) what is patient safety?; and (ii) systems and complexity in health care. If your curriculum is integrated and students are taught clinical skills from the first year, then patient safety topics are best introduced early and vertically integrated throughout the entire course. This makes patient safety a constant theme and provides opportunities to reinforce and build upon earlier learning. Ideally, students should be exposed to patient safety education prior to and upon entering the workplace.

When and where in the curriculum are particular subjects and topics taught that might lend themselves to inclusion of patient safety teaching?

Any area of learning relevant to a particular profession can potentially house a patient safety topic if a sample case is part of the session and is relevant to that discipline. For example, a case involving a medication error in a child could be used as the starting point for teaching nurses about understanding and learning from errors while studying paediatrics. Similarly, during learning about managing patients after hip or knee replacements, a physiotherapy student could learn about the topic "patient safety and invasive procedures". Many areas could house the topic of "understanding and learning from errors" if the case was relevant to that particular discipline. The learning, however, is generic and relevant for all disciplines and all students. Box A.6.3 sets out opportunities for examining the integration of patient safety topics.

Box A.6.3. Integration of patient safety topics

Patient safety topic	Subjects that could house patient safety topics
Minimizing infection through improved infection control	Microbiology Procedural skills' training Infectious diseases Clinical placements
Improving medication safety	Pharmacology Therapeutics
Being an effective team player	Orientation programmes Communication skills' training (interprofessional) Emergency disaster training
What is patient safety?	Ethics Introduction to the clinical environment Clinical and procedural skills' training

How are individual curriculum topics structured in the following areas?
- learning objectives;
- delivery methods;
- assessment methods.

Implementation of new patient safety content into your curriculum will be more efficient if the associated learning objectives and delivery and assessment methods are consistent with the structure of objectives, and delivery and assessment methods of existing subjects.

How is your curriculum delivered?
- lectures;
- work placements, online activities on the wards, in pharmacies, in delivery suites;
- small group tutorial teaching;
- problem-based learning (PBL);
- simulation/skills laboratories;
- traditional tutorials.

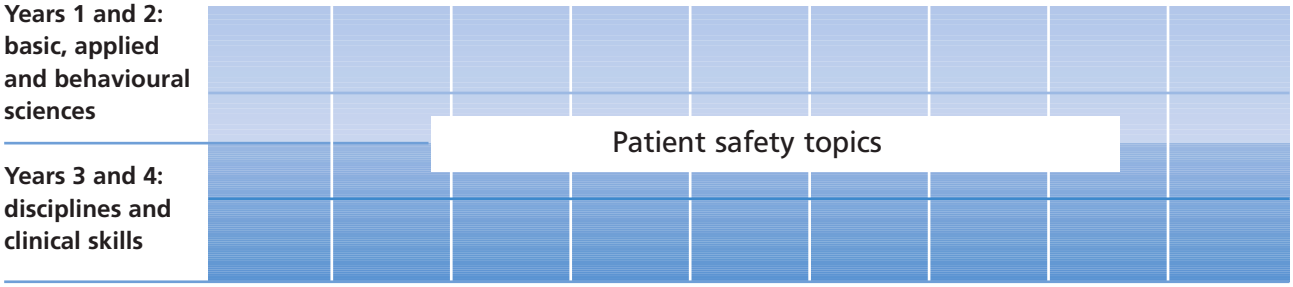
It will probably be easier to incorporate patient safety topics into pre-existing educational delivery methods familiar to students and staff.

Examples of models for implementation

Example 1: Patient safety as a stand-alone subject in a traditional curriculum occurring in the final years. See chart A.6.1.

- educational methods could consist of a combination of lectures, small group discussions, project work, practical workshops, or simulation based exercises;
- adding a layer of patient safety to prior knowledge before entering the workforce.

Chart A.6.1. Patient safety as a stand-alone subject in a traditional curriculum occurring in the final year



Example 2: Patient safety as a stand-alone subject in an integrated curriculum. See chart A.6.2.

Patient safety could be a stand-alone subject with links to other subjects, e.g. lectures at the start of term that relate to topics that will come up in tutorials or on placement over the course of the year.

Chart A.6.2. Patient safety as a stand-alone subject in an integrated curriculum

Year 1	Topic 1: what is patient safety?	PBL/other delivery format
Year 2	Topics 2, 3 and 5: why applying human factors is important for patient safety; understanding systems and the effect of complexity on patient care; learning from errors to prevent harm	Clinical skills workshops and clinical placements
Year 3	Topics 4, 7, 9 and 10: being an effective team player; using quality-improvement methods to improve care; infection prevention and control; patient safety and invasive procedures	
Year 4	Topics 6, 8 and 11: understanding and managing clinical risk; engaging with patients and carers; improving medication safety	

Example 3: Integrating patient safety into pre-existing subjects–example A. See chart A.6.3.

A number of subjects could set aside some sessions where the main objective of the tutorial or lecture is to cover a patient safety topic.

In the fourth year there could be a lecture on medication safety as part of therapeutics, a workshop on safe drug administration, and a PBL or small group learning format where a case is discussed that demonstrates the multifactorial nature of error using a case or medication error.

Chart A.6.3. Implementation of patient safety as a stand-alone subject into pre-existing subjects (A)

Year 1	PBL					Patient safety case					
	Clinical skills		Patient safety activity								
	Lecture	Patient safety topic									
Year 2	PBL					Patient safety case					
	Clinical skills		Patient safety activity								
	Lecture	Patient safety topic									
Year 3	PBL					Patient safety case					
	Clinical skills		Patient safety activity								
	Lecture	Patient safety topic									
Year 4	PBL					Patient safety case					
	Clinical skills		Patient safety activity								
	Lecture	Patient safety topic									

Example 4: Integrating patient safety into pre-existing subjects–example B. See Chart A.6.4.

Work together with subject leaders to incorporate elements of patient safety into selected educational sessions. Although the main focus of the session is not a patient safety topic, elements of patient safety education are weaved into the session. For this to occur, session objectives should include an element of patient safety. See Box A.6.4 for examples.

The more patient safety topics are integrated into the established curriculum, the easier it will be to incorporate the performance requirements in a meaningful way, and provide context for patient safety concepts.

Chart A.6.4. Implementation of patient safety as a stand-alone subject in pre-existing subjects (B)

Year 1	PBL		Patient safety case		Patient safety case		
	Clinical skills	Patient safety activity	Patient safety activity	Patient safety activity	Patient safety activity	Patient safety activity	Patient safety activity
	Lecture	Patient safety topic					
Year 2	PBL			Patient safety case			Patient safety case
	Clinical skills	Patient safety activity	Patient safety activity	Patient safety activity	Patient safety activity	Patient safety activity	Patient safety activity
	Lecture	Patient safety topic					
Year 3	PBL	Patient safety case		Patient safety case			
	Clinical skills	Patient safety activity	Patient safety activity	Patient safety activity	Patient safety activity	Patient safety activity	Patient safety activity
	Lecture	Patient safety topic					
Year 4	PBL		Patient safety case			Patient safety case	
	Clinical skills	Patient safety activity	Patient safety activity	Patient safety activity	Patient safety activity	Patient safety activity	Patient safety activity
	Lecture	Patient safety topic					

Box A.6.4. Examples of how patient safety topics can be weaved in with pre-existing sessions

Pre-existing session	Patient safety education component
Clinical skills tutorial at the bedside/chairside or clinic	Patients are always provided with an explanation and consent to being part of the educational process at the start of the session. Tutors role model respecting patients wishes. Patients are always included as part of the team. Tutors invite patient to join case discussion as they have information important to their care.
Procedural skills session on intravenous cannulation	Sterile technique and sharps' disposal are included. Involve patient in risk discussion about infection. Practise consent.
Lecture on blood transfusion	Patient risk and ways to minimize risk are included as part of the lecture. Verification protocols to ensure correct patient. Include consent training.
PBL on pulmonary embolism where the index case is commenced on an oral anticoagulant	Students are encouraged to discuss the importance of patient education when prescribing potentially dangerous medication.

A cautionary note

The more that patient safety is integrated into the existing curriculum, the more it is dispersed, dependent on a greater number of teachers, and the more it becomes harder to coordinate effective delivery. You will need to find the balance between integration of the new material and the ability to coordinate its delivery. It is a good idea to keep a detailed record of what patient safety element is integrated into the existing curriculum, how it is being taught and how it is being assessed. From an educational perspective, integration of patient safety is ideal; however, this aim needs to be balanced by the practicalities of implementation.

When asked by a university or accrediting body where and how patient safety is taught to students, the relevant faculty needs to have information that is sufficiently detailed to allow an observer to attend such a session and see patient safety education being delivered. It may be that a combination of the above approaches is more appropriate for your setting.

Once you have an overall plan of what, where and how you want to incorporate patient safety into your curriculum, it will be easier to add to the curriculum in a piecemeal fashion, topic by topic over time, rather than trying to add every aspect of your plan at once. In this way you can learn as you go, and start achieving small goals early.

Suggestions for including patient safety learning in problem-based learning sessions.

Some health-care programmes use PBL as the preferred educational delivery method. PBL programmes, originally pioneered at McMaster University in Canada, requires students to collaboratively work together on a particular topic; tasks are allocated and the students solve problems together and reflect on their effort. The following suggestions show how patient safety topics can be integrated into PBL cases.

- Include information in the case that relates to a patient safety issue. To achieve this, include aspects of the realities of the health-care delivery system, which will provide opportunities to explore issues relating to patient safety.
- Make the case relevant to your local health-care environment.
- The case may include a near miss or adverse event.
- The case may include a threat to patient safety, thus helping students to recognize where the hazards in the system lie.

A case may include a nurse, pharmacist, midwife, dentist or doctor. The case can include a professional being assertive (speaking up) with the more senior persons being receptive to the intervention by the junior staff member, thus resulting in improved patient care. The patient safety issue may be a major or minor component of the PBL case.

Example of a PBL case

Jeremy So is a 15-year-old boy who arrives at the local medical clinic with noisy breathing and itch. His father says he was fine 30 minutes ago and that he just became unwell quite suddenly. On examination, Jeremy looks distressed and nervous. He has a puffy face, his lips are huge, and he can hardly open his eyes as they are so swollen. He has red blotches on his skin and he is scratching his body. Every time he breathes in he makes a noise.

Case example: the same case written to elicit discussion of medical error as well as answers to the above questions

Jeremy is a 15-year-old boy who arrives at the local medical clinic with noisy breathing and itch. His father says he was fine 30 minutes ago and that he just became unwell quite suddenly. On examination, Jeremy looks distressed and nervous. He has a puffy face, his lips are huge, and he can hardly open his eyes as they are so swollen. He has red blotches on his skin and he is scratching his body. Every time he breathes in he makes a noise.

Jeremy's father says his son was like this once before after taking a medicine called penicillin and he was told never to have penicillin again because it could kill him. Jeremy saw a doctor this morning because of a runny nose, sore throat and fever. The doctor prescribed amoxicillin, which Jeremy started earlier today. Jeremy's father wonders if his son might also be allergic to this new medicine amoxicillin.

Case example: the case may include examples of how to enhance patient safety.

A nurse, pharmacist or medical student noticing some important information that the doctor has overlooked. The case can describe the nurse (or other health professional) being assertive (speaking up), the doctor being receptive to the nurse, and the patient's care being improved as a result.

Integration of patient safety into a procedural skills training programme

Many procedures and treatments have the potential to harm patients. This is especially so when learners who are still lacking in experience are involved. Procedures can cause harm through complications, pain and emotional distress, and by not being effective or necessary in the first place. The knowledge, skill and behaviour of the person performing the procedure can help to minimize some of the potential risks for patients. Integrating patient safety education with procedural skills training at an undergraduate level will help students to be mindful of their responsibilities to patients when embarking on procedures. This section provides some suggestions on how to integrate patient safety education with procedural skills training in your school. As a starting point, consider the following questions:

1. When, where and how are procedural skills taught in your programme?
2. What are the skills taught?
3. When do students start to perform procedures on patients? Ideally, the patient safety messages should precede or coincide with this.

Patient safety topics to consider including in a procedural skills training programme

Broad patient safety topics that are relevant for all procedures:

- the learning curve. Understand that an inexperienced learner is more likely to cause harm and/or fail a procedure compared to an experienced practitioner. What strategies can be used to help minimize harm while still allowing for learning to take place? For example, the role of careful preparation, planning, background knowledge, observation of others performing the procedure, simulation, supervision, feedback and follow-up of patients (Topics 2, 5 and 6);
- the required background knowledge a health professional needs to acquire about a procedure before undertaking that procedure (Topics 6 and 10);
- sterile precautions (Topic 11);
- communicating risk (Topics 6 and 9);
- correct patient identification, correct site, correct patient (Topic 10);
- follow-up (Topics 2, 6, 9 and 10).

Patient safety learning and application to the performance of specific procedures:

- common problems, hazards/traps, troubleshooting (Topics 2 and 5);
- common and serious complications and how to minimize them (Topics 1 and 5);
- advice for patients regarding follow-up (Topics 6 and 9);
- equipment familiarity (Topic 2);
- specific applications of broad patient safety topics (all topics).

Example. Correct patient identification when taking a blood sample.

How to label sample tubes to minimize chance of misidentification:

- label at the bedside;
- check the patient's name with an open-ended question;
- ensure that the patient's name matches the label on the sample tube and the label on the request form, i.e. perform a "three-way check".

A variety of educational methods can be used to introduce the broad patient safety topics as they apply to performing procedures, e.g. lectures, reading material, group discussion, tutorials and online activities.

The best time to learn the knowledge and performance requirements of a patient safety topic is when learning the steps of the procedure. This may occur in a practical tutorial at the bedside, using simulation in a skills laboratory, or as a tutorial without a "hands-on" component. Students could be asked to read a particular article or guidelines prior to attending the teaching session.

Tutorials on particular procedures provide an excellent opportunity to reinforce generic principles, to detail patient safety applications for a particular procedure, and for students to practise performance elements of patient safety.

For example, if your school utilizes immersive scenario-based simulation training to learn disaster management or a particular procedure or treatment, there is an opportunity to

incorporate team training into that programme. The advantages of this type of training for incorporating patient safety messages are the realistic situations that mirror many real life challenges that can emerge from the scenario. As an example, knowing what to do in an emergency situation is different from actually doing it, especially when working as part of a team. The real elements introduced are time pressure, stress, teamwork, communication, equipment familiarity, decision making in action and knowing the environment. Similar to other forms of experiential learning, there are opportunities to practise the performance requirements demonstrating safe practice.

Note: Immersive scenario-based teaching using simulation can be a highly effective way for students to learn, but can also be quite confronting for students and not always a comfortable way to learn. Attention to creating a safe and supportive learning environment is very important if this educational method is used. See the section on underpinning educational principles for more details on creating a safe and supportive learning environment.

Skills training programme

Skills training includes learning how to take a patient history, how to perform an appropriate examination, clinical reasoning, interpretation of test results, preparation of medications, and procedural and communication skills, such as providing information, counselling and obtaining informed consent.

A range of methods are used to teach health professionals the relevant skills, such as bedside or chairside tutorials, medication preparation in pharmacies, practising with simulated patients, practising with peers, observing videos of expert performance, participation in the clinical environment and presenting cases.

Consider when and how your school delivers its skills programme.

A number of patient safety topics will be appropriate for inclusion in any skills programme. And since the programme may offer opportunities to practise performance elements of patient safety, it is important that good habits be developed early. Note that bedside/chairside/benchside tutorials offer rich opportunities for tutors to role model safe practice–for example, patient-centred communication, hand hygiene, the use of checklists and protocols.

Skills training may provide opportunities for students to learn about and practise the following patient safety performance elements:

- communicating risk;
- asking permission;
- accepting refusal;
- being honest with patients;
- empowering patients–helping patients be active participants in their own care;
- keeping patients and relatives informed;
- hand hygiene;
- patient-centred focus during history taking and appropriate examinations;
- clinical reasoning–diagnostic error, consideration of risk benefit ratio of procedures, investigations and management plans.

How to collaborate with ward/clinic/community-based teachers and teachers of professional skills

For patient safety principles to be integrated broadly throughout the curriculum, the cooperation of many individual teachers will need to occur, particularly if patient safety education is to be delivered in small group settings and skills tutorials.

We mentioned in the beginning of this section that many teachers will not be familiar with patient safety concepts and specific knowledge and performance requirements will be new. For example, students may see health-care professionals in the workplace asking patients their name in a hurried and disrespectful manner, taking shortcuts that may compromise patient safety, or displaying a "blame and shame" attitude when things go wrong. Tutors will need to reflect on their own practice if they are to be effective patient safety teachers and role models.

The following strategies may assist to engage teachers in patient safety teaching:

- conduct a patient safety workshop or lecture series for teachers;
- invite guest speakers to promote patient safety;
- engage/excite teachers about the inclusion of patient safety in the curriculum;
- parallel patient safety education in the postgraduate setting;
- clearly state patient safety learning objectives in tutor notes;
- provide tutors' notes on patient safety topics;
- assess patient safety content in examinations.

Using case studies

We provide a number of case studies for each topic that can be used to demonstrate why the

topic is relevant to patient safety. The best way to use case studies is to have the students/ instructor read the case and then either discuss in small groups a range of discussion points or answer a number of questions relating to the case. Alternatively, an interactive session with a large group can also work. We have included suggested questions or discussion points after each case study. The focus of the questions is to get the students to focus on the underlying factors rather than just focus on the people who were involved.

Build local case studies

Case studies can either demonstrate how not to do something (learning from negative experience) or how to do something right (learning from positive experience). For example, if a case study is being developed for the topic "being an effective team player", then the local case study would have elements of teams that are familiar to the local institutions, clinics or hospitals.

The following steps will assist in building local cases relevant to the topic being taught.
Review the sections of each topic in this Curriculum Guide outlining:

- the relevance of the topic to the workplace;
- the learning objectives for the topic.

Write down the activities that are captured in the objectives.
Obtain case studies from:

- the Curriculum Guide; or
- ask nurses, midwives, dentists, pharmacists, doctors and other health professionals in the hospital or clinic to provide identified cases.

Develop a realistic story that contains the elements set out in the objectives.

The context of the case study should be familiar to the students and health-care professionals. For example, if there are no pharmacy services locally available, then the case studies should take this into account.

How to modify the case studies in the Curriculum Guide

Most of the case studies are written to illustrate a behaviour or process. Many of the cases we have selected and those supplied by members and affiliates of the WHO Expert Group relate to more than one topic, such as understanding errors, communication, teamwork and engaging with patients. We have listed all of the cases under each topic that we think could be used to demonstrate an appropriate learning objective.

Different types of cases have been used, ranging from health services that rely heavily on technology to ones with limited access. This means that many of the case studies will apply to most health-care programmes; if not, the case studies can be modified by changing the environment in which the case takes place. The case can also have another type of health provider involved when the one identified in the case study does not exist. For example, patients can be changed from male to female or female to male (if culturally appropriate), can have family members present or absent, or come from a rural area or a city. After a case study has been modified to take into account local elements, give the case study to a colleague to see if it makes sense and is relevant to the topic, local environment and context.

7. Educational principles essential for patient safety teaching and learning

For patient safety education to result in safe practice and improved patient outcomes it needs to be meaningful to students. As with any teaching, one of the major challenges is to ensure transfer of the learning to the workplace. What can educators do to encourage students to apply their learning in a practical way in the real life work setting?

The following strategies can help.

Context is highly relevant in teaching patient safety

Contextualize patient safety principles
Patient safety principles need to be made relevant to the daily activities of health-care workers. Aim to show students when and how patient safety knowledge can be applied in practice. This means using examples that students can relate to.

Use examples that are realistic for your setting
Think about the sort of work most of your students will be doing after they graduate and have this in mind when choosing clinical contexts in which to incorporate patient safety education. Including a case about malnutrition, morbid obesity or malaria is not particularly useful if these conditions are extremely uncommon in your practice setting. Use situations and settings that are common and relevant for the majority of your graduates.

Identify practical applications
Help students identify the situations in which they can apply their patient safety knowledge and skills. In this way they are more likely to recognize opportunities for safe practice in the workplace as they arise. For example, correct patient identification is important in:

- sending off blood samples;
- administering medication;
- putting labels on imaging request forms;
- writing in patients' files;
- writing on patients' medication charts;
- performing procedures;
- working with patients who have difficulty with communication;
- communicating with family and relatives of the patient;
- referral to other health-care professionals.

Use examples that are of interest or soon will be relevant to students
Draw on situations that the students may find themselves in when they are novice health-care professionals and/or as students on placement. For example, if the educational session is about being a patient advocate, it is far better to use an example of a student being assertive with a senior practitioner, rather than the senior practitioner needing to be assertive with hospital management. In this way, the relevance of the material will be more apparent to students, thus resulting in better motivation for learning. See the following example

Case example

While observing a surgical operation, a nursing student notices that the surgeon is closing the wound and there is still a pack inside the patient. The student is not sure if the surgeon is aware of the pack and is wondering whether to speak up.

Give students the opportunity to apply their patient safety knowledge and skills

By giving students the opportunity to practise "safe practice", such behaviours will hopefully become habitual and students will be more inclined to approach clinical situations with a patient safety mindset.

Practising safely can occur as soon as students commence their training–for example, in:

- tutorials or private study, e.g. brainstorming solutions for hazardous situations;
- a simulation setting, e.g. skills laboratory, simulation laboratory, role play;
- the clinical environment, e.g. hand hygiene when seeing patients, correct patient identification when drawing blood from a patient;
- patient interactions–when advising, students can practise encouraging patients to be informed, ask questions, and be proactive in ensuring care progresses as planned.

Create an effective learning environment

Aspects of the learning environment can also have a bearing on the effectiveness of teaching and learning. An ideal learning environment is one that is safe, supportive, challenging and engaging.

Safe and supportive learning environments

A safe and supportive learning environment is one in which:

- students feel comfortable to ask "stupid" questions;
- volunteer what they do not understand;
- share what they do understand in an honest and open way.

Students who feel safe and supported tend to be more open to learning, enjoy being challenged, and are more prepared to actively participate in learning activities.

If students feel unsafe and not supported, they will tend to be reluctant to disclose knowledge deficits and less likely to engage actively for fear of feeling embarrassed or being humiliated in front of their teachers and peers. The student's primary aim becomes self-preservation rather than learning. Attention to creating a safe and supportive learning environment not only makes learning more enjoyable, but also, importantly, makes learning more effective. The teacher has a significant role in making the learning environment a comfortable place for students.

Suggestions for helping to create a safe and supportive learning environment:

- Introduce yourself to students and ask the students to introduce themselves. Show an interest in them as individuals as well as showing an interest in their learning.
- At the start of your teaching session, explain how the session will run. This will let the students know what to expect, and also what is expected of them.
- Orient learners to the environment you are teaching in. This is especially important if you are in the workplace, clinical environment, or a simulation environment. Students need to know what is expected of them if they are in a new setting.

Simulation

Simulation environments can be confusing as some aspects are real, some aspects are not, and the learner is asked to pretend that some aspects are real. Make sure that the learners know the level of immersion required for the role play and how realistically you expect them to treat the situation. It may be embarrassing for a nursing student to talk to an intravenous (IV) cannulation insertion practice arm as if it were a real patient when the teacher's intention was just to use the IV insertion practice arm for practising the manual aspects of the task.

- Invite students to ask questions and speak up if there is anything they do not understand. This sends the message that not knowing is okay.
- Never criticize or humiliate a student for lack of knowledge or poor performance. Rather, this should be viewed as a learning opportunity.
- If active participation is required, ask for volunteers rather than singling people out yourself.
- Consider demonstrating how to do something yourself before asking students to have a turn. For example, when teaching about how to create a sterile field before administering an injection, it is much more efficient to demonstrate how to do it correctly at the outset, rather than have a student do it in front of their peers before having been taught how and making mistakes that need to be corrected.
- When asking questions of a group of students, it is best to ask the question first, give students time to think about the question, and then look for someone to provide a response. Avoid

choosing a student before asking the question. Some students will find this unnerving and may have trouble thinking clearly if a whole class is waiting for their response.
- If, as the teacher, you are asked a question you do not know the answer to, do not try to hide this fact or apologize for not knowing. To respond in such a way would send a message to the students that not knowing is unacceptable. A useful quote to remember is, "the three most important words in health professional education are "I don't know"" [1].
- When providing feedback on performances in the practice (or simulation) setting, make it a two-way conversation. Ask students for their opinion before giving your own and include aspects of performance that were done well and areas that need more work. Help students develop a plan for addressing the areas that need more attention.

Challenging and engaging learning environments

Students who are challenged by the teacher are likely to progress their learning more rapidly. A challenging learning environment is one where students are encouraged to think about and do things in new ways. Assumptions are challenged and new skills are developed. Students value these kinds of learning activities. It is important to emphasize the difference between a challenging learning environment and an intimidating learning environment. A safe and supportive learning environment is a prerequisite for challenging students. When students feel safe and supported they are open to being challenged, when they are challenged they will be more inclined to engage in the process.

Another important facet to effective teaching is to engage students by using learning activities, which require them to exercise their brain, mouth or hands, not just their ears. Try to avoid activities where students are simply passive recipients of information. The more active the activity, the more likely it is to impact on the students' learning.

Experiential learning activities such as interviewing a patient, practising a procedural skill in a workshop and role play are usually very engaging simply by virtue of the fact that they require students to do things. Small group work also tends to be engaging because of the collaborative nature of the activity, the tendency of the case to generate questions in the minds of the learners, and the need to solve problems.

It can be challenging to deliver lectures that are engaging. The following strategies may help:
- try to be interactive;
- pose questions to the students;
- have students discuss an issue or share their experience in pairs;
- tell a story to illustrate a point;
- use case examples or problems that students can easily relate to as the starting point for the lecture;
- relate theoretical concepts to concrete examples;
- have students critique a video, case, statement, solution or problem.

Activities such as observing a hospital or clinic activity, reading an article or observing a procedure can be made more engaging if students have a task to complete as part of the process. Ideally, the task would help develop critical reflection skills. For example, if students are required to attend peer review meetings, they could have some preset questions to address based on their observations.

Teaching styles

Individual educators tend to adopt a preferred style of teaching if the option exists [2]. The preferred style is likely to be determined by a combination of the teacher's beliefs about what works best, their aptitudes, and what they feel most comfortable with.

Styles can range from teacher-led where the teacher adopts the expert role and presents information to the learners via a lecture or demonstrates how to do something via role modelling, to student-centred where the teacher may simply facilitate students to learn for themselves and from peers–for example, small group project work. Teachers who adopt the student-centred approach may see their role as a motivator and guide for students as they work through a learning activity. The teacher's skills may be in formulating engaging learning activities, facilitating group discussion, asking thought-provoking questions, and/or providing effective feedback.

Each teaching style has advantages and disadvantages, which will vary with the content to be taught, the number of students, the students' preferred learning styles (if known), the teacher's abilities, and the time and resources available for the teaching session. Advantages of student-centred styles include the encouragement of collaboration, communication and proactive group problem-solving skills among students–all useful experiences for being an effective team

member in the workplace. It is helpful to be aware not only of your preferred teaching style, but also to be aware of other ways of teaching that may be equally or more effective in particular circumstances. The ability to be flexible is encouraged. It may be that you will need to adjust your usual methods to fit in with the overall curriculum delivery design of your programme.

Harden identifies six important roles of the teacher [3] :
- information provider;
- role model;
- facilitator;
- assessor;
- planner;
- resource producer.

As an information provider in the field of patient safety, it is important to be well informed about it. This requires knowledge of basic patient safety principles, why it is important in the workplace or clinical setting, and what staff can do to promote patient safety in the workplace. Spending time reflecting on one's own practice and approaches to hazards in the workplace will help identify relevant teaching points for your students.
There are many ways a teacher can demonstrate safe practice. When you are in the practice setting with patients, students will notice how you:
- interact with patients and families;
- respect the wishes of patients and families;
- inform patients and families of risks;
- consider risk–benefit ratios in determining management plans;
- respond to and invite questions from patients and families;
- cleanse your hands between patients;
- adopt a team approach;
- welcome advice from colleagues;
- adhere to workplace protocols;
- acknowledge uncertainty;
- acknowledge and learn from your own and others' errors [4];
- problem-solve system issues;
- look after yourself and your colleagues.

You can be a very effective patient safety teacher simply by being a safe practitioner yourself in the presence of students who are eager to learn.

Considering the patient in patient safety learning
Patient safety education can be incorporated into many different educational settings from the practice environment to the lecture theatre and tutorial room simply by being mindful of where the learning opportunities occur.

The following half questions may give you ideas about how to create a patient safety learning moment:
- what are the hazards for the patient here...
- what do we need to be mindful of in this situation...
- how can we minimize the risks...
- what would make this situation more risky for the patient...
- what should we do if X should occur...
- what will be our plan B...
- what would we say to the patient if X occurred...
- what are our responsibilities...
- who else can help with this situation... other health-care staff? Patient?
- what happened? How can we prevent this in the future…
- what can we learn from this situation...
- let's look at the risk–benefit ratio of your suggested plan...

Some of the best teaching students will experience comes from patients themselves. Their role in health-care education has a long history, usually in relation to describing their experience of a disease or illness. However, they can also teach students about communication, risk communication, ethics, responses to adverse events, and more.

A cautionary note
Remember that students may become demoralized if there is undue emphasis on risk, errors, and patient harm. An effective patient safety teacher will be able to balance this by addressing the positive aspects of the area, such as solutions to problems, progress in patient safety, and equipping students with concrete strategies to improve their practice. It is also important to remind students of the success of the majority of patient care episodes. Patient safety is about making care even better.

Tools and resource material

The *Teaching on the run* series was developed by Australian clinicians and is relevant to health professional education in the workplace where there are many demands on teachers who are also service providers (http://www.meddent.uwa.edu.au/teaching/on-the-run/tips; accessed 4 January 2011).

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3. Harden RM, Crosby J. Association for Medical Education in Europe Guide No 20: The good teacher is more than a lecturer: the twelve roles of the teacher. *Medical Teacher*, 2000, 22:334–347.
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8. Activities to assist patient safety understanding

Introduction

Health-care students are accustomed to learning new information by studying and then working hard to apply their new knowledge and skills in patient care. In the case of patient safety, just "trying harder" will not work [1]. Hence, a great deal of thought needs to be given to the timing and format of educational delivery.

The purpose of this chapter is to outline the various strategies that can be used to assist patient safety understanding. These are the same as the variety of teaching strategies that are used for teaching other aspects of health care. The challenge for the educator is to see if patient safety elements can be incorporated into existing teaching and learning activities. If so, it avoids patient safety topics being seen as an "add on"–and hence extra work–rather than simply being part of a holistic approach to health-care education.

A fundamental principle, in keeping with the principles of effective teaching, is that opportunities for "active learning" should be maximized, during which the learners engage with the learning process in a meaningful fashion, rather than being passive recipients of information.

Active learning can be summarized with the following statement [2]:

Don't tell students when you can show them, and don't show them when they can do it themselves

Lowman has outlined some teaching strategies for increasing the effectiveness of active learning, including [3]:

- use information that is of interest to learners and involves real life events;
- present dramatic or provocative material;
- reward learners;
- tie themes together with as many topics as possible;
- activate prior knowledge using pre-tests and concept maps and gathering background information;
- challenge learners by presenting topics that are more difficult from time to time;
- demonstrate the behaviours you are seeking to promote.

Lectures

In a lecture [4], the teacher presents a topic to a large group of students. This traditionally occurs in a face-to-face setting; however, recently, some universities give students the option of viewing the lecture online via podcasting.

Lectures should have both:

- aims–indicating the general theme of the lecture, e.g. the aim of this lecture is to introduce you to the topic of patient safety;
- objectives–relating directly to the learning and that should be achievable by the end of the lecture, e.g. by the end of this lecture you will be able to list three major studies that highlight the extent of harm caused by health-care delivery.

Lectures should last about 45 minutes as concentration falls after this time. Therefore, it is important that they do not contain too much material–aim for four or five key points at the most.

Lectures are often structured as follows with three principal elements (set, body, close):

- the set, or introduction, is the initial period of the lecture when the lecturer explains why the topic is important and outlines the objectives of the session;
- the body is the main content part of the lecture;
- the conclusion should revisit the objectives and the key points of the presentation.

Benefits:
- able to convey information to large numbers of students at one time;
- useful for providing an overview of broad topics, to impart factual information and introduce theoretical concepts;
- provide up-to-date information and ideas that are not easily accessible in texts or papers;
- can explain or elaborate on difficult concepts and ideas and how these should be addressed.

Challenges:
- keeping large numbers of students actively engaged;
- senior students and junior staff generally prefer more experiential techniques;
- presentation skills;
- usually there is some dependence on technology;
- content (health-care harm) can be discouraging.

Examples:
- Topic 1: What is patient safety?
- Topic 2: Why applying human factors is important for patient safety.

Learning on the run during work and clinical placements

Teaching that occurs in the context of ward rounds, clinics or in bedside/chairside teaching sessions.

Benefits:
- ward-based, clinics, benchside and chairside teaching provides ideal opportunities to teach and observe history taking and examination skills, as well as communication and interpersonal skills–the teacher can also role model safe, ethical, professional practice;
- patient safety issues are everywhere in the work environment;
- contextualized;
- real–hence highly relevant;
- interesting and often challenging.

Challenges:
- lack of time due to work pressure;
- lack of knowledge of how to incorporate patient safety topics into bedside teaching;
- opportunistic—not possible to prepare and difficult to deliver a uniform curriculum.

Examples:
- Topic 9: Infection prevention and control (hand hygiene issues in the workplace).
- Topic 10: Patient safety and invasive procedures (including patient identification processes).

Tools and resource material

The *Teaching on the run* series was developed by clinicians and is relevant to health professional education in the workplace where there are many demands on teachers who are also service providers (http://www.meddent.uwa.edu.au/teaching/on-the-run/tips; accessed 4 January 2011).

Small group activities–learning with others

This occurs when students learn in the setting of a small group, usually with a tutor, but also with a patient. The main feature is student participation and interactivity used in relation to a particular problem, but with more onus on students to be responsible for their own learning, e.g. project work.

Benefits:
- sharing own stories;
- listening to patient stories;
- learning from peers;
- multiple perspectives;
- learning teamwork and communication skills.

Challenges:
- group dynamics;
- resource implications in terms of tutor time;
- expertise of the tutor.

Examples:
- Topic 2: Why applying human factors is important for patient safety (human factors considerations of commonly used equipment).
- Topic 4: Being an effective team player (teamwork in the work setting or clinical environment).

Tools and resource material

Learning to use patient stories. NHS Evidence - innovation and improvement (http://www.library.nhs.uk/improvement/viewResource.aspx?resID=384118; accessed 4 January 2011).

Beyea SC, Killen A, Knox GE. Learning from stories–a pathway to patient safety. *Association of periOperative Registered Nurses Journal*, 2004, 79, 224-226.

This Curriculum Guide:
- enables health-care organizations and their teams to successfully implement a series of interventions to improve the safety and quality of care that their patients receive;
- is based around the collection and use of patient stories;
- shows a method for collecting effective stories

from all members of society–patients, carers, guardians and members of staff;
- shows that everyone has a different, equally valuable perception of their health-care experience.

Case discussion
This occurs when a group of students–often with a tutor–discuss a clinical case.

Benefits:
- can use an actual or invented case to illustrate patient safety principles;
- contextualized–makes concepts real and relevant;
- learn to solve problems as they arise in the workplace;
- enables linking of abstract concepts to the real life situation.

Challenges:
- choosing/developing realistic cases that encourages students to become actively engaged in the discussion;
- using the case effectively to challenge thinking and generate thoughtful learning;
- encouraging students to generate problem-solving themselves.

Tools and resource material
Incident analyses from parent hospital, clinics or workplace.

Agency for Healthcare Research and Quality weekly morbidity and mortality cases (http://webmm.ahrq.gov/; accessed 4 January 2011).

Games
Games are fun and encompass a spectrum from computer games to situational role play.

Benefits:
- fun, enjoyable;
- challenging;
- can illustrate teamwork, communication.

Challenges:
- relating the game to the workplace;
- clearly defining the purpose of the game upfront.

Tools and resource material
http://www.businessballs.com/teambuildinggames.htm; accessed 4 January 2011.

Independent study
Study undertaken by the student, e.g. assignment work, essays.

Benefits:
- student can proceed at own pace;
- student can focus on own knowledge gaps;
- opportunity for reflection;
- cheap, easy to schedule;
- flexible for learner.

Challenges:
- motivation;
- lack of exposure to multiple inputs;
- may be less engaging;
- marking the work and providing the feedback is time-consuming for the teacher.

Buddying a patient who uses a health service (hospital, clinic, private consulting rooms, formulary): patient tracking
A student follows an individual patient throughout their journey through the health service or hospital. The exercise includes the student accompanying the patient for all investigations, tests, and procedures.

Benefits:
- includes the opportunity to learn about the health-care system;
- see things from the patient perspective;
- see how different health-care areas interact together.

Challenges:
- timetabling;
- shaping the experience into a learning exercise;
- limited opportunity for students to share their learning, obtain feedback from peers, and get assessed.

Role plays (docudrama)
A well-known educational method that allow students to act out roles of health-care professionals in particular situations. These fall into two types:
- students improvise the dialogue and actions to fit a predetermined scenario;
- students "act out" the roles and dialogue of a case study situation.

Benefits:
- cheap;
- requires little training;
- always available;
- interactive–enables learners to try "what if" scenarios;
- experiential–introduces and sensitizes learners to the roles that patients, their families, and health-care practitioners and administrators play in patient safety situations;

- allows the learner to adopt a more senior role or the role of a patient;
- can demonstrate different perspectives;
- ideal for exploring factors in association with interprofessional teamwork and communication in the prevention of patient safety errors.

Challenges:
- writing the scenarios or scripts;
- developing sufficiently meaningful situations that allow for choices, decisions, conflicts;
- time-consuming;
- not all students are involved (some are only passive spectators);
- students can get off the topic and the role play fizzles out.

Tools and resource material

Kirkegaard M, Fish J. Doc-U-drama: using drama to teach about patient safety. *Family Medicine*, 2004, 36:628–630.

Simulation

In the context of health care, simulation is defined as *"an educational technique that allows interactive, and at times immersive activity by recreating all or part of a clinical experience without exposing patients to the associated risks"* [5]. It is likely that in the future increased access to various forms of simulation training will emerge because of the increasing ethical imperative to avoid patient harm [6].

A number of different simulation modalities are available, including:
- screen-based computer simulators;
- low-tech models or mannequins used to practise simple physical manoeuvres;
- standardized patients (patient actors);
- sophisticated computerized ("realistic") full-body patient mannequin simulators;
- virtual reality devices.

Benefits:
- no risk to patients;
- many scenarios can be presented, including uncommon but critical situations in which a rapid response is needed;
- participants can see the results of their decisions and actions; errors can be allowed to occur and reach their conclusion (in real life a more capable clinician would have to intervene);
- identical scenarios can be presented to different clinicians or teams;
- the underlying causes of the situation are known;
- with mannequin-based simulators clinicians can use actual equipment, exposing limitations in the human–machine interface;
- full recreations of actual clinical environments allow to explore complete interpersonal interactions with other clinical staff and provide training on teamwork, leadership and communication;
- intensive and intrusive recording of the simulation session is feasible, including audio taping and videotaping; there are no issues of patient confidentiality–the recordings can be preserved for research, performance assessment or accreditation. [7]

Challenges:
- some modalities are very expensive;
- specialized expertise required for teaching and for upkeep of some of the training devices.

Improvement projects

Quality improvement is a continuous cycle of planning, implementing strategies, evaluating the effectiveness of these strategies, and reflection to see what further improvements can be made. Quality-improvement projects are typically described in terms of the plan-do-study-act (PDSA) cycle [8] as follows:
- plan–the change, based on perceived ability to improve a current process;
- do–implement the change;
- study–analyse the results of the change;
- act–what needs to happen next to continue the improvement process.

The PDSA cycle approach encourages health professionals to develop and be actively engaged in strategies they hope will lead to improvements. It also promotes evaluation of these changes once the strategies have been implemented. Therefore, this can be a very useful approach to have students involved at a ward or clinic level, ideally as part of a multidisciplinary team approach to patient safety. Most quality-improvement projects by their very nature have an inherent patient safety element.

Benefits:
- motivating;
- empowering;
- learn about change management;
- learn to be proactive;
- learn to problem solve.

Challenges:
- sustaining momentum and motivation;
- time commitment.

Example:
Hand hygiene issues in a clinical environment.

Tools and resource material

Bingham JW. Using a healthcare matrix to assess patient care in terms of aims for improvement and core competencies. *Joint Commission Journal on Quality and Patient Safety*, 2005, 31:98–105.

US Agency for Healthcare Research and Quality mortality and morbidity web site (http://www.webmm.ahrq.gov/; accessed 17 February 2011).

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9. How to assess patient safety

The purposes of assessment

Assessment is an integral part of any curriculum. The content and format of assessment procedures strongly influence the study behaviour and learning outcomes of the students. It is essential that assessments support the exit learning outcome objectives, as well as providing appropriate motivation and direction for the students. Assessments should be meaningful and give confidence to teachers, course planners and external stakeholders, such as accreditation bodies, standards boards and the future employers of students. Newble and Cannon [1] emphasise that clarity about the purpose of assessment is extremely important. They list a range of assessment purposes. The two in bold are key for patient safety learning:

- judging mastery of essential skills and knowledge;
- rank ordering students;
- measuring improvement over time;
- diagnosing student difficulties;
- **providing feedback to students;**
- evaluating the effectiveness of a course;
- **motivating students to study;**
- setting standards;
- quality control for the public.

In patient safety, getting the students to actually perform the tasks and practise doing them is often more difficult than designing an assessment instrument to demonstrate how well they performed the activity. Bearing in mind that many health professionals are not yet competent in patient safety, the focus on assessment should be supportive of the continued development of the students' knowledge and skills in patient safety. No student should be prevented from continuing their course by a failure in a patient safety area unless it is egregious and intentionally dangerous. Patient safety is not an area that lends itself to students studying alone. Patient safety depends on a complex set of factors–working with the right team, practising in a health service that is designed to minimize failures, and active support for patient safety initiatives from the organization and management. Students as novices are expected to have rudimentary knowledge and skills and with time and exposure to the appropriate role models and mentors, as well as experience of working in well-functioning teams, they will become more astute and responsive to the many environmental factors that make patient care unsafe. Given this context for student learning about patient safety, the purpose of assessment in patient safety should be to provide feedback and motivate the students to engage with patient safety. Any assessment process should reflect this.

Engaging students in the assessment process

One of the biggest challenges facing educational institutions is finding appropriate instructors or health professionals to teach patient safety in the workplace. One way to address this difficulty is to implement a student-driven curriculum. But the main reason for getting students to perform patient safety tasks is that learning by doing is a most effective teaching method. At the University of Sydney Medical School (Australia), students are required to undertake patient safety activities in their final two years and while on their placements in the hospitals. They are provided with web-based, underpinning knowledge designed to give them just-in-time learning. The WHO topics can be appropriately edited and made available on the web for just-in-time reading before students practise the activities associated with the learning topic. Students record their experiences and answer the questions posed for a particular activity on a one-page template. At the end of the block/term, students meet in small groups with their tutor to discuss their experiences and observations. Tutors or supervisors are required to verify by way of signature

the students' accounts completing the mandatory formative assessment for the particular topic. Below is an example of a Topic (3) from this curriculum and the required activities the students are to perform, as well as the assessment requirement.

Figure A.9.1. Content of topic 3: The University of Sydney, Australia

Topic 3	Activities	Assessment
Understanding systems and the impact of complexity on patient care	Read Learning topic on line Follow a patient from the time they enter hospital until discharge or a clear outcome Use the template to make notes on the above activity	Tutor sign-off of satisfactory student participation and performance in face-to-face session (or clinician sign-off of activity completion in the event of no face-to-face session).

Figure A.9.2 is the template the students use to make notes while they observe the patient on their journey through the hospital or clinic.

Figure A.9.2. Example of student report form for topic 3: The University of Sydney, Australia

Stage 3 (Year 3 of postgraduate medical programme):
Topic 3: Understanding systems

.....

Student name .....

Student number .....

Date of activity .....

Summary of the patient journey:

3 main observations:

3 most important things you learned:

Position of person signing-off on completion of activity

Name (print) .....

Signature .....

Position .....

Date signed .....

For other activities such as medication safety or invasive procedures, students are required to have a health professional observe them participating in an activity (e.g. medication reconciliation, preparation of medications in the pharmacy, ward round with a pharmacist, observation of the time-out process prior to a procedure). The person who observed them must sign a form confirming the student's completion of the task.

There are more examples of student assessment in Part B, Annex 1.

One of the benefits of student-led activities is the potential to change the workplace culture. When students request staff if they can observe or participate in a particular activity and the reasons why, they open up discussion about the patient safety programme. Many of the topics can be delivered using a student-led delivery.

The role of measurement in assessment

There are four components to reliable assessment measures: *validity* (is the assessment method valid?); *reliability* (does the assessment always produce consistent results?); *practical* (what time and resources does it require?); and *positive impact on learning* (does it work from the perspective of the learner?) [1].

For further reading about measurement in assessment, the following resources may be useful.

Brown S, Glasner A, eds. *Assessment matters in higher education: choosing and using diverse approaches*. Buckingham, Society for Research into Higher Education and Open University Press, 1999.

Miller A, Imrie B, Cox K. *Student assessment in higher education: a handbook for assessing performance*. London, Kogan Page Ltd, 1998.

Formative assessments

Formative assessments are a vital and inherent part of the learning process for students. Patient safety learning lends itself to formative assessment. A wide range of such activities is possible within all components of any health-care programme. Self-assessment is the ability of students to assess their own learning needs and choose educational activities that meet these needs. (The preponderance of evidence suggests that students have a limited ability to accurately self-assess and may need to focus more on external assessment.)

Formative assessments should be continuous and provide feedback to students about their performance. The aim of this type of assessment is to get the students to open up about their observations and experience working in health care. We want them to feel free to reveal their vulnerabilities and weaknesses. A punitive approach will do the opposite and force students to hide their true level of knowledge and skills. They may also be reluctant to talk about their observations, particularly when they relate to unsafe care or practices.

Summative assessment

All components of assessment that the students have to pass, or have to complete before progression from one part of the course to another may occur, are regarded as summative. In general terms, they fall into two types of assessment: end-of-course examinations and in-course assessments.

The above example from the University of Sydney is an example of mandatory summative assessment. The students are required to perform the activities and are assessed through face-to-face discussion or observation. Students have a semester to complete the assignments of course summative assessments. Such assessments can typically be at the end of an eight-week block, end of term, end of year, or end of programme. The bulk of this chapter covers the requirements of end-of-course assessments.

In-course summative assessments

There is a range of course assessments that can easily be introduced in the patient safety curriculum. Many health educational programmes could incorporate these elements into existing portfolios or the "record of achievement".

Some features of "best assessment" practices in patient safety

The following assessment principles will apply to achieving the aims of a patient safety curriculum. The assessments should:

- drive learning in the intended direction of meeting the exit learning outcomes of a newly-graduated health professional capable of safe patient care;
- have a strong formative element, with regular opportunities for remediation and counselling throughout the course;
- be integrated with, for example, clinical competence and not be discipline-based;
- be included in examinations of clinical competence and professional behaviours in all stages of the course;
- be included in examinations of basic sciences, e.g. integrated in population health sciences at all stages of the course;
- be progressive and ensure that proportions of material from previous stages will be included in all subsequent exams;
- be developed with the expectation that they will meet quality assurance standards;
- claim fairness by engaging students and staff in the process of development;
- be motivating and provide direction for what students need to learn to practise safely;
- be feasible and acceptable to both faculty and students.

Defining what is to be tested

Defining the range of competencies to be tested (a blueprint)

Students internationally are concerned about the amount of material in the curriculum that they have to learn, and are made anxious by not

knowing what might be assessed. Faculty should describe the range of competencies (or knowledge) to be tested, which would normally be drawn directly from the learning outcomes of the curriculum. It is important to ensure that the planned assessment adequately samples the range of competencies by the end of the health-care professional degree.

Some competencies need to be systematically assessed to ensure that students build on their knowledge and integrate these into their area of practice. Table A.9.1 shows different components of patient safety that could be used for end-of-course assessments throughout a four-year health professional degree course.

Table A.9.1. A blueprint showing end-of-course assessments for components of the patient safety curriculum

Assessable learning outcomes	Year that curriculum modules are first assessed in a typical programme			
	Year 1	Year 2	Year 3	Year 4
What is patient safety?	X			
Health-care systems		X		
Communication		X		
Safe patient care			X	
Engaging with patients			X	
Team work			X	
Quality Improvement				X
Health-care errors				X
Medication safety				X

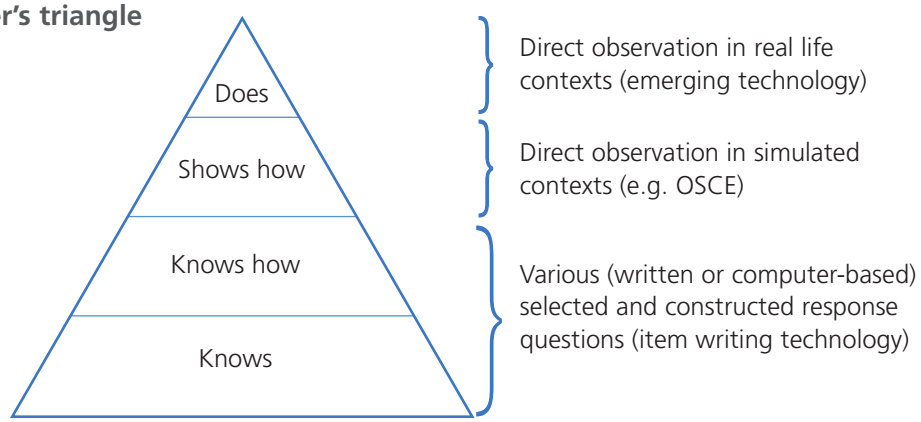
Select appropriate test methods

It is important to emphasize that assessment in patient safety is aligned with the agreed learning outcomes. It is unlikely that any particular assessment format is suitable to assess everything required. It is best to be aware of the range of assessment methods and make a decision based on an understanding of their strengths and limitations. Let the purpose of the assessment, for example, "to assess knowledge of adverse event reporting", drive the choice of format, in this case a modified essay question (MEQ) or a multiple choice question (MCQ).

Quality-improvement methods may be best assessed via a student project. There are a number of basic concepts in assessment to help decide the most appropriate type of assessment format. One of the most well known is Miller's triangle, which suggests that a student's performance is made up of four levels (see Figure A.9.3):

- knows;
- knows how;
- shows how;
- does.

Figure A.9.3. Miller's triangle



Source: Miller GE. The assessment of clinical skills/competence/performance. *Academic Medicine*, 1990 [2].

For example, "showing how" is related to specific competencies that are appropriate for the level of expertise of the student. These can be examined by, for example, an objective structured clinical examination (OSCE) station.

Again, looking at Figure 3, one can see that knowledge (knows) can be tested by MCQs, for example.

Typical assessment formats within a health professional school might include:

Written:
- essay;
- multiple choice items (1 from 4/5);
- extended matching questions (EMQ);
- structured short answer questions;
- modified essay question (MEQ);
- extended written work (e.g. project reports, posters);
- portfolio or log books.

Workplace performance (practical):
- multiple station exams;
- direct observation of performance (e.g. observed long cases, mini clinical evaluation exercise [mini CEX]);
- 360 degree or multisource feedback (MSF);
- structured reports (e.g. attachment assessments);
- oral presentations (e.g. projects, case-based discussion);
- self-assessment;
- structured oral exams.

There are some strengths and weaknesses with all of these formats and these need to be considered when choosing the right assessment for a particular learning outcome within a patient safety curriculum.

Written

Essay
The traditional essay is used in some places. There is great advantage in allowing students to demonstrate their critical thinking, reasoning and problem-solving skills. While it is tempting to set essays, which allow learners to express their thoughts, as an assessment method they are very time-consuming to mark and subject to much variability in judges' marks. The key to successful marking of essays is the quality of the feedback to students. Just being given a mark without any comments is discouraging to students who wish to know what the marker thought of their responses to the set questions. Some of the topics do lend themselves to essay-type assessments, but unless the faculty has the resources available to provide quality feedback, this method should be avoided.

Multiple choice question/extended matching question
MCQ and EMQ are very attractive formats in that they can test a wide sample of the curriculum, can be machine-marked, and give reliable scores of a student's ability. However, their main drawback in testing patient safety is that they tend to test knowledge only. For example, this method could be used to test whether a student knows the characteristics of successful teams, but this assessment cannot test whether the student applies any of this knowledge in practice. The EMQ has been designed to address the issue of guessing in multiple-choice examinations. See Part B, Annex 2, for an example of an MCQ.

Modified essay questions/key feature
MEQs or key feature formats are designed to be answered in 5–10 minutes, and encourage short note responses to appropriate scenarios. Providing a model answer and marking scheme helps examiners maintain some standardization. Several MEQs on a range of different subjects can be asked in the time it takes to write one essay sampling just one area of the curriculum. See Part B, Annex 2, for a nursing example.

Portfolio/logbook
A spectrum of assessment methods that can be easily linked to key learning outcomes range from a log of professional activities through to a record of achievements throughout a segment of the programme, to documentation supporting an annual appraisal complete with learning plans. A particularly useful component of the portfolio is the critical incident. Students can be asked to reflect in a structured way on situations they have observed where patient safety was an issue. The students hand in their portfolios or logbooks for marking by an appropriate tutor.

Clinical/practical
There is a wealth of research evidence to suggest that having more than one observer improves the accuracy of competency assessments. It is very important that considerations of patient safety are incorporated within the marking rubrics and examiner training and feedback sessions of each of the assessments used in the health professional school context. If the topic is assessed separately, it will drive students to learn patient safety as something extra to be added on, rather than as an integral part of safe patient care.

Objective structured clinical examination
OSCE comprises of a circuit of short simulated clinical cases assessed either by a standardized patient or the instructor/clinical teacher. Patient safety can be incorporated as at least one item within the checklist for each simulated scenario. Alternatively, a single case can be entirely dedicated to a patient safety case, for example, communicating an adverse event to a simulated patient who has been given the wrong medication. Cases in which the student is required to look at treatment charts, test results, X-rays or investigations are sometimes called static stations as they do not require the student to be observed. This allows, for example, prescribing errors to be simulated and the students' actions recorded. See Part B, Annex 2, for an example of an OSCE.

Multisource feedback
MSF are collated views from a range of health-care workers or peers about the student in the learning environment. Ideally, checklist items about safe patient care and good communication would be included in the rating form.

Mini clinical evaluation exercise
A mini-CEX is where the supervisor or instructor observes a student performing history taking, an examination, or communication exercise on a real patient and rates the student on several domains. Aggregated scores of several encounters are used to determine the competency of the student. Once again, it is important to ensure that elements of patient safety are included on the rating form. It is particularly important in a mini-CEX to have a good preparation of raters and ensure that trainers of instructors/supervisors include references to patient safety in the training sessions.

End of clinical placement assessments/ global rating scales
This assessment aims to give a credible view of a student's progress and is usually completed by the instructor or supervisor, based on personal knowledge or after consultation with colleagues. Patient safety criteria need to be included.

Case-based discussion (CBD)
The CBD is a structured discussion of cases by the instructor/supervisor focusing on professional/clinical reasoning and decision making. It takes real cases in which the student has been involved. This is a relatively underexplored technique for examining the understanding of patient safety issues as related to real cases.

Matching assessment to expected learning outcomes
It is always important to match assessments to intended learning outcomes. Most curricula will have learning outcomes, some more detailed than others. In Table A.9.2, the complete list of learning outcomes for patient safety can be easily matched with appropriate assessments.

Table A.9.2. Sample of typical end of a professional educational programme learning outcomes for patient safety showing typical assessment formats

Competencies	Assessment formats
Safe patient care: systems	
Understand the complex interaction between the health-care environment, health professional and patient	Essay, Formative assessment sign-off that student accompanied a patient on their journey through the service, followed by small group discussion.
Aware of mechanisms that minimize error, e.g. checklists, clinical pathways	Formative assessment sign-off by instructor or supervisor that student participated in a time out or other activity.
Safe patient care: risk and prevention	MCQ/MEQ
Know the main sources of error and risk in the workplace	Essay/MEQ
Understand how personal limitations contribute to risk	Viva/Portfolio

Promote risk awareness in the workplace by identifying and reporting potential risks to patients and staff	Portfolio
Safe patient care: adverse events and near misses	
Understand the harm caused by errors and system failures	Essay/MEQ
Aware of principles of reporting adverse events in accordance with local incident reporting systems	MEQ
Understand principles of the management of adverse events and near misses	MEQ
Understand the key health issues of your community	MCQ
Aware of procedures for informing authorities of "notifiable diseases"	MCQ
Understand the principles of disease outbreak management	MEQ
Safe patient care: infection control	
Understand prudent antibiotic/antiviral selection	MCQ
Practise correct hand hygiene and aseptic techniques	OSCE
Always use methods to minimize transmission of infection between patients	OSCE
Know the risks associated with exposure to radiological investigations and procedures	MCQ/MEQ
Know how to order radiological investigations and procedures appropriately	MEQ
Safe patient care: medication safety	
Know the medications most commonly involved in prescribing and administration errors	MCQ
Know how to prescribe and administer medications safely	OSCE
Know the procedures for reporting medication errors/ near misses in accordance with local requirements	Portfolio
Communication	
Patient interaction: context	
Understand the impact of the environment on communication, e.g. privacy, location	MEQ
Use good communication and know its role in effective health-care relationships	OSCE
Develop strategies to deal with the difficult or vulnerable patient	OSCE
Patient interaction: respect	
Treat patients courteously and respectfully, showing awareness and sensitivity to different cultures and backgrounds	OSCE/mini-CEX
Maintain privacy and confidentiality	
Provide clear and honest information to patients and respect their treatment choices	OSCE/mini-CEX
Patient interaction: providing information	
Understand the principles of good communication	OSCE/mini-CEX/MSF
Communicate with patients and carers in ways they understand	OSCE
Involve patients in discussions about their care	Portfolio
Patient interaction: meetings with families or carers	
Understand the impact of family dynamics on effective communication	Portfolio
Ensure relevant family/carers are included appropriately in meetings and decision making	Portfolio
Respect the role of families in patient health care	MEQ/portfolio
Patient interaction: breaking bad news	
Understand loss and bereavement	MEQ
Participate in breaking bad news to patients and carers	OSCE
Show empathy and compassion	OSCE
Patient interaction: open disclosure	
Understand the principles of open disclosure	MEQ
Ensure patients are supported and cared for after an adverse event	OSCE
Show understanding to patients following adverse events	OSCE
Patient interaction: complaints	
Understand the factors likely to lead to complaints	MEQ/portfolio
Respond appropriately to complaints using the local procedures	OSCE
Adopt behaviours to prevent complaints	OSCE

Tools and resource material

Newble M et al. Guidelines for assessing clinical competence. *Teaching and Learning in Medicine*, 1994, 6:213–220.

Roberts C et al. Assuring the quality of high stakes undergraduate assessments of clinical competence. *Medical Teacher*, 2006, 28:535–543.

Walton M et al. Developing a national patient safety education framework for Australia. *Quality and Safety in Health Care* 2006 15:437-42.

Van Der Vleuten CP. The assessment of professional competence: developments, research and practical implications. *Advances in Health Science Education*, 1996, 1:41–67.

Case-based discussion

Southgate L et al. The General Medical Council's performance procedures: peer review of performance in the workplace. *Medical Education*, 2001, 35 (Suppl. 1):S9–S19.

Miller GE. The assessment of clinical skills/competence/performance. *Academic Medicine*, 1990, 65 (Suppl.):S63–S67.

Mini clinical evaluation exercise

Norcini J. The mini clinical evaluation exercise (mini-CEX). *The Clinical Teacher*, 2005, 2:25–30.

Norcini J. The mini-CEX: a method for assessing clinical skills. *Annals of Internal Medicine*, 2003, 138:476–481.

Multisource feedback

Archer J, Norcini J, Davies H. Use of SPRAT for peer review of paediatricians in training. *British Medical Journal*, 2005, 330:1251–1253.

Violato C, Lockyer J, Fidler H. Multisource feedback: a method of assessing surgical practice. *British Medical Journal*, 2003, 326:546–548.

Multiple choice questions

Case SM, Swanson DB. *Constructing written test questions for the basic and clinical sciences*. Philadelphia, National Board of Medical Examiners, 2001.

Objective structured clinical examination

Newble DI. Techniques for measuring clinical competence: objective structured clinical examinations. *Medical Education*, 2004, 35:199–203.

Portfolios

Wilkinson T et al. The use of portfolios for assessment of the competence and performance of doctors in practice. *Medical Education*, 2002, 36:918–924.

References

1. Newble D, Cannon R. *A handbook for medical teachers*, 4th ed. Dordrecht, Kluwer Academic Publishers, 2001.
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10. How to evaluate patient safety curricula

Introduction

In this section we have summarised some general principles of evaluation. Following the publication of this document, WHO plans to make available standard evaluation tools for this curriculum.

As individuals, we engage in evaluation every day: what to eat, what clothes to wear, how good that movie was. Evaluation is an important component of any curriculum and should be included in your strategy for implementing patient safety curricula at your institution or in your hospital/classroom. It can be as simple as having students complete a questionnaire after exposure to a patient safety session to see what they thought, or as complex as a faculty-wide review of the entire curriculum, which may involve surveys and focus groups with students and staff, observation of teaching sessions, and other evaluation methods.

Evaluation involves three main steps:

- developing an evaluation plan;
- collecting and analysing information;
- disseminating the findings to appropriate stakeholders for action.

How evaluation differs from assessment

Information on assessment and evaluation can be confusing due to the fact that some countries use the two terms interchangeably. The easiest way to remember the difference between assessment and evaluation is that assessment is about measuring student performance, while evaluation is about examining how and what we teach. In assessment, data are collected from a single source (the student), whereas in evaluation, data may be collected from a number of sources (students, patients, teachers, and/or other stakeholders).

> Assessment = student performance
> Evaluation = quality of courses/ programmes, quality of teaching

Step 1: Developing an evaluation plan

What is being evaluated?

A fundamental first step in developing an evaluation plan is identifying the evaluation object: is it a single patient safety session? Is it the entire curriculum? Are we evaluating the faculty's capacity for implementation? Are we evaluating teacher performance/effectiveness? Objects for evaluation can be classified either as policy, programme, product or individual [1]–and all can be applied in the educational setting.

Who are the stakeholders?

There are often many stakeholders involved in the evaluation of patient safety education. However, it is important to identify a primary audience as this will impact on the question(s) you want your evaluation to answer. The primary audience may be the university, the relevant professional faculty, hospital administration, teachers, students or patients/the public. For example, you may be the primary stakeholder if you are a teacher wanting to know how your students are responding to the introduction of patient safety education in your course.

What is the purpose of the evaluation?

After identifying the primary audience/ stakeholder(s), the next step is to decide what you are trying to achieve from the evaluation. What question(s) are you trying to answer? These may differ depending on your role in patient safety education. Table A.10.1 gives examples of the kinds of questions that might be asked depending on the primary stakeholder.

Table A.10.1. Examples of stakeholder questions

Stakeholder	Possible questions for evaluation
Hospital administrators/clinical staff	Does teaching patient safety to health professionals result in a decreased number of adverse events?
University faculty	How can this patient safety curriculum best be implemented in our institution?
Individual teachers	Am I delivering the curriculum effectively? Are students engaged in learning about patient safety? Are they applying patient safety principles in their placements?

What form(s) of evaluation is/are most appropriate?
Evaluation types or forms can be categorized as follows: proactive, clarificative, interactive, monitoring and impact [2]. The forms differ in terms of the primary purpose of the evaluation, the stages of programme/curriculum implementation you are at, the kinds of questions you are asking, and the key approaches required. Table A.10.2 provides a summary of each form of evaluation.

Table A.10.2. Forms of evaluation

Purpose	Proactive	Clarificative	Interactive	Monitoring	Impact
Orientation	Synthesis	Clarification	Improvement	Justification	Justification
				Fine tuning	Accountability
Major focus	Context for curriculum	All elements	Delivery	Delivery	Delivery
				Outcomes	Outcomes
State of programme/ curriculum	None (not yet implemented)	Development phase	Development phase	Settled	Settled
				Implemented	Implemented
Timing relative to implementation	Before	During	During	During	After
Key approaches	Needs assessment	Evaluation assessment	Responsiveness	Component analysis	Objectives-based
	Review of the literature	Logic development	Action research		Needs-based
		Accreditation	Developmental	Devolved performance assessment	Goal-free
			Empowerment		Process-outcome
			Quality review	Systems analysis	Realistic
					Performance audit
Gathering evidence	Review of documents, data-bases	Combination of document analysis, interview and observation	On-site observation	A systems approach requires availability of management information systems	Pre-ordinate research designs
	Site visits Focus groups, nominal group technique	Findings include programme plan and implications for organization. Can lead to improved morale	Questionnaires		Treatment and control groups where possible
			Interviews		Observation
	Delphi technique for needs assess-ment		Focus groups		Tests and other quantitative data
			Degree of data structure depends on approach.	the use of indicators, and	Determining all the outcomes requires use of more exploratory methods and qualitative evidence
			May involve providers (teachers) and programme participants (students)	the meaningful use of performance information	

Types of questions					
	Is there a need for the programme?	What are the intended outcomes and how is the programme designed to achieve them?	What is the programme trying to achieve?	Is the programme reaching the target population?	Has the programme been implemented as planned?
	What do we know about the problem that the programme will address?	What is the underlying rationale for the programme?	How is it going?	Is implementation meeting stated objectives and benchmarks?	Have the stated goals been achieved?
	What is recognized as best practice?	What elements need to be modified to maximize intended outcomes?	Is the delivery working?	How is implementation going between sites?	Have the needs of students, teachers and others served by the programme been achieved?
		Is the programme plausible?	Is delivery consistent with the programme plan?	How is implementation now compared to a month/6 months/ 1 year ago?	What are the unintended outcomes?
		Which aspects of the programme are amenable to subsequent monitoring for impact evaluation?	How could delivery be changed to make it more effective?	Are our costs rising or falling?	How do differences in implementation affect programme outcomes?
			How could this organization be changed to make it more effective?	How can we fine tune the programme to make it more efficient? More effective?	Is the programme more effective for some participants than for others?
				Are there any programme sites that need attention to ensure more effective delivery?	Has the programme been cost-effective?

Source: Adapted from Owen J. *Program evaluation: forms and approaches,* 2006 [1].

Step 2: Collecting and analysing information

Collection

There are a number of data sources and collection methods to consider in an evaluation of patient safety curricula or any other evaluation object. How many and which ones you use depends on your evaluation's purpose, form, scope and scale. Potential data sources include:

- students (prospective, current, past, withdrawn);
- self (engaging in self-reflection);
- colleagues (teaching partners, tutors, teachers external to the course);
- discipline/instructional design experts;
- professional development staff;
- graduates and employers (e.g. hospitals);
- documents and records (e.g. teaching materials, assessment records).

Data may be collected from the above-listed sources in a variety of ways, including self-reflection, questionnaires, focus groups, individual interviews, observation, and documents/records.

Self-reflection

Self-reflection is an important activity for all educators and has an important role in evaluation. An effective method for reflection involves:

- writing down your experience of teaching (in this case, patient safety education) or feedback received from others;
- describing how you felt and whether you were surprised by those feelings;
- re-evaluating your experience in the context of assumptions made [3]:
  - Were they good assumptions? Why, or why not?

Engaging in self-reflection will allow for the development of new perspectives and a greater commitment to action in terms of improving or enhancing curriculum and/or teaching.

Questionnaires

Questionnaires are easily the most common method of data collection, providing information on people's knowledge, beliefs, attitudes, and

behaviour [4]. If you are interested in research and publishing the evaluation results, it may be important to use a previously validated and published questionnaire. This will save you both time and resources and will allow you to compare your results with those from other studies using the same instrument. It is always useful as a first step to search the literature for any such tools that may already be in existence.

More often than not, however, teachers/faculties/universities choose to develop questionnaires for their own individual use. Questionnaires may be comprised of open- and/or closed-ended questions and can take a variety of formats, such as tick-box categories, rating scales, or free text. Good questionnaire design is integral to the collection of quality data and much has been written about the importance of layout and how to construct appropriate items [5]. You may wish to consult one of the references or resources provided prior to developing your questionnaire for evaluation of patient safety teaching or curricula.

Focus groups

Focus groups are useful as an exploratory method and means of eliciting student or tutor perspectives [6]. They often provide more in-depth information than questionnaires and allow for more flexible, interactive exploration of attitudes towards and experiences of curriculum change. They can be used in conjunction with questionnaires or other data collection methods as a means of checking or triangulating data, and can vary in terms of structure and delivery from the conversational and flexible to the strictly regimented and formal. Depending on resources available and the level of analysis sought, you may wish to audio or video record focus groups in addition to, or in place of, taking notes.

Individual interviews

Individual interviews provide the opportunity for more in-depth exploration of attitudes towards potential curriculum change and experiences with the curriculum once it has been implemented. As with focus groups, they can be unstructured, semi-structured, or structured in format. Although individual interviews provide information on a narrower range of experience than focus groups, they also allow the interviewer to explore more deeply the views and experiences of a particular individual. One-to-one interviews may be a useful method for obtaining evaluation data from colleagues, instructors or supervisors, or faculty leaders/administrators.

Observation

For some forms of evaluation it may be useful to conduct observations of patient safety educational sessions to obtain an in-depth understanding of how material is being delivered and/or received. Observations should involve the use of a schedule to provide a framework for observations. The schedule can be relatively unstructured (e.g. a simple notes sheet) or highly structured (e.g. the observer rates the object of evaluation on a variety of predetermined dimensions and makes comments on each).

Documents/records

As part of your evaluation, you may also wish to examine documental or statistical information, such as teaching materials used or student performance data gathered. Other information such as hospital data on adverse events may also be useful, depending on your evaluation question(s).

Analysis

Your data collection may involve just one of the above or other methods, or it may involve several. In either case, there are three interconnected elements to consider in terms of data analysis [1]:

- data display–organizing and assembling information collected in a meaningful way;
- data reduction–simplifying and transforming the raw information into a more workable or usable form;
- conclusion drawing–constructing meaning from the data with respect to your evaluation question(s).

Step 3: Disseminating findings and taking action

All too often the conclusions and recommendations of evaluations are not acted upon–the first step in avoiding this is by ensuring that this valuable information is fed back in a meaningful way to all relevant stakeholders. If the evaluation is on the quality of patient safety teaching, then results (e.g. from student questionnaires, peer-observed teaching sessions) must be relayed to and discussed not only with the administration, but also with the teachers. Brinko [7] provided an excellent review of best practice on the process of giving feedback both for students or colleagues. It is important that any feedback is received in a way that encourages growth or improvement. If the evaluation focuses on the effectiveness of the patient safety curriculum, any conclusions and recommendations for improvement must be communicated to all who participated in implementing the curriculum

(e.g. at the institution, faculty, teacher and student levels). The format for dissemination must be meaningful and relevant. Effective communication of evaluation outcomes, findings and recommendations is a key catalyst for improvements in patient safety teaching and curriculum design.

Tools and resource material

You may find the following resources useful for various stages of your evaluation planning and implementation:

DiCicco-Bloom B, Crabtree BF. The qualitative research interview. *Medical Education*, 2006, 40:314–321.

Neuman WL. *Social research methods: qualitative and quantitative approaches*, 6th ed. Boston, Pearson Educational Inc, Allyn and Bacon, 2006.

Payne DA. *Designing educational project and program evaluations: a practical overview based on research and experience*. Boston, Kluwer Academic Publishers, 1994.

University of Wisconsin-Extension. *Program development and evaluation*, 2008 (http://www.uwex.edu/ces/pdande/evaluation/; accessed 17 February 2010).

Wilkes M, Bligh J. Evaluating educational interventions. *British Medical Journal*, 1999, 318:1269–1272.

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3. Boynton PM, Greenhalgh T. Selecting, designing and developing your questionnaire. *British Medical Journal*, 2004, 328:1312–1315.
4. Leung WC. How to design a questionnaire. *Student British Medical Journal*, 2001, 9:187–189.
5. Taylor-Powell E. *Questionnaire design: asking questions with a purpose*. University of Wisconsin-Extension, 1998 (http://learningstore.uwex.edu/pdf/G36582.pdf; accessed 17 February 2011).
6. Barbour RS. Making sense of focus groups. *Medical Education*, 2005, 39:742–750.
7. Brinko K. The practice of giving feedback to improve teaching: what is effective? *Journal of Higher Education*, 1993, 64:574–593.

11. Web-based tools and resources

Each topic has a set of tools that have been selected from the World Wide Web and designed to assist health professionals and students to improve the care they deliver to patients. We have only included tools that are freely available on the Internet. All of the sites were accessible as of January 2011.

Included in the list are examples of guidelines, checklists, web sites, databases, reports and fact sheets. Very few of the tools have been through a rigorous validation process. Most measures in quality tend to be about processes of care and quality that apply to small groups of patients in highly contextualized environments [1], such as a ward, a rehabilitation unit or a clinic.

Most patient safety initiatives require health professionals to measure the steps they take in the delivery care process. By doing this, you will be able to tell if the planned changes have made any difference to patient care or the outcome. Focusing on measurement has been a necessary and important step in teaching patient safety; if you do not measure, how do you know that an improvement has been made? Even though students will not be expected to measure their outcomes by the time they graduate, they should be familiar with the PDSA cycle that forms the basis of measurement. Many of the tools on the Internet incorporate the PDSA cycle.

Reference

1. Pronovost PJ, Miller MR, Wacher RM. Tracking progress in patient safety: an elusive target. *Journal of the American Medical Association*, 2006, 6:696–699.

12. How to foster an international approach to patient safety education

Patient safety impacts on all countries

In 2002, WHO Member States agreed on a World Health Assembly Resolution on patient safety in recognition of the compelling evidence of the need to reduce the harm and suffering of patients and their families, and the economic benefits of improving patient safety. The extent of patient harm from their health care had been exposed by the publication of international studies from a number of countries including Australia, Canada, Denmark, New Zealand, the United Kingdom (UK) and the United States of America (USA). The concerns of patient safety are international and it is widely recognized that adverse events are considerably underreported. While most patient safety research has been conducted in Australia, the UK and the USA and a number of other European countries, patient safety advocates wish to see patient safety adopted in all countries around the world, not just in those that have had the resources to study and publish their patient safety initiatives. This internationalization of patient safety requires novel approaches to the education of future doctors and health-care practitioners.

Globalization

The global movements of nurses, doctors and other health professionals have produced many opportunities for enhancing postgraduate health-care education and training. The mobility of students and teachers, and the interconnectedness of international experts in curriculum design, instructional methods and assessment, married with local campus and clinical environments, have led to a concordance in what constitutes good health-care education [1].

WHO has noted a global shortage of 4.3 million health-care workers. The 'brain drain' of health-care workers deepens the crisis in developing countries. There is evidence that developing countries which have invested in the education of future generations of health-care workers have seen their assets stripped by the predations from health-care systems of countries with transitional or advanced economies, during times of workforce shortages there [2].

The globalization of health-care delivery has forced health-care educators to recognize the challenges of preparing all health-care students not only to work in their country of training, but also to work in other health-care systems. Harden [3] described a three-dimensional model of medical education, relevant to all health-care professional education, based on the:

- student (local or international);
- teacher (local or international);
- curriculum (local, imported or international).

In the traditional approach to teaching and learning patient safety, local students and local teachers use a local curriculum. In the international graduate or overseas student model, students from one country pursue a curriculum taught in another country and developed by teachers in a third. In the branch-campus model, students, usually local, have an imported curriculum taught jointly by international and local teachers.

A second important consideration in the internationalization of health-care education is the affordability of e-learning technologies that allow a global interconnectivity where the provider of a teaching resource, the teacher of that resource, and the student do not all have to be on campus, in a hospital or out in a community at the same time.

The old style of curriculum emphasizes the mobility of students, teachers and the curriculum across the boundaries of two countries by mutual agreement, with a high expectation that the country of practice will provide much of the training when the student graduates.

The new way involving the internationalization of patient safety education is integrated and embedded within a curriculum and involves collaboration between a number of schools in different countries. In this approach, the principles of patient safety are taught in a global context rather than the context of a single country.

This model offers a considerable range of challenges and opportunities for international collaboration in patient safety education. This Curriculum Guide serves as an excellent base in this regard. It is important that the standards of international health-care education institutions are reviewed to ensure that the principles of patient safety are included. At a more local level, it is important for countries to customize and adapt materials. A good example of an international approach to health-care education is the experience with virtual medical schools [4]. Here, a number of international universities have collaborated to form a virtual medical school dedicated to enhanced learning and teaching. This model could be adaptable to patient safety. People's Open Access Education Initiative: Peoples-uni (http://www.peoples-uni.org/; accessed 17 February 2011) has established a web-based curriculum on patient safety for health professionals who are unable to access more expensive postgraduate courses.

Common components of a virtual patient safety curriculum could be:

- a virtual library that would provide access to up-to-date resources, tools and learning activities, and access to international patient safety literature (for example, the topics);
- an "ask-the-expert" facility with online access to patient safety experts from different countries;
- a bank of virtual patient safety cases with emphasis on ethical hazards, disclosure and apology;
- an approach to patient safety which is culturally aware and respects competences;
- an assessment bank of patient safety items for sharing (for example, the Hong Kong International Consortium for Sharing Student Assessment Banks is a group of international medical schools that maintains a formative and summative bank of assessment items across all aspects of medical courses).

Content experts in patient safety and educational developers are few and far between, and often work in isolation. This impedes the sharing of information, innovation and development and often results in unnecessary duplication of resources and learning activities. An international approach to patient safety education would ensure that there is true capacity-building in patient safety education and training worldwide. This is one way that developed countries can share their curriculum resources with developing countries.

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2. World Health Organization, *Working together for Health*, The World Health Report 2006 (http://www.who.int/whr/2006/whr06_en.pdf; accessed 15 June 2011).
3. Harden RM. International medical education and future directions: a global perspective. *Academic Medicine*, 2006, 81 (Suppl.):S22–S29.
4. Harden RM, Hart IR. An international virtual medical school (IVIMEDS): the future for medical education? *Medical Teacher*.

Part B
Curriculum Guide Topics

Patient Safety Curriculum Guide: Multi-professional Edition

Definitions of Key Concepts

The WHO Conceptual Framework for the International Classification for Patient Safety (v.1.1). Final Technical Report 2009

1. **Adverse reaction**: unexpected harm resulting from a justified action where the correct process was followed for the context in which the event occurred.

2. **Agent**: a substance, object or system which acts to produce change.

3. **Attributes**: qualities, properties or features of someone or something.

4. **Circumstance**: a situation or factor that may influence an **event**, **agent** or person(s).

5. **Class**: a group or set of like things.

6. **Classification**: an arrangement of **concepts** into **classes** and their subdivisions, linked so as to express the **semantic relationships** between them.

7. **Concept**: a bearer or embodiment of meaning.

8. **Contributing factor**: a **circumstance**, action or influence that is thought to have played a part in the origin or development of an **incident** or to increase the **risk** of an **incident**.

9. **Degree of harm**: the severity and duration of harm, and any treatment implications, that result from an **incident**.

10. **Detection**: an action or **circumstance** that results in the discovery of an **incident**.

11. **Disability**: any type of impairment of body structure or function, activity limitation and/or restriction of participation in society, associated with past or present **harm**.

12. **Disease**: a physiological or psychological dysfunction.

13. **Error**: failure to carry out a planned action as intended or application of an incorrect plan.

14. **Event**: something that happens to or involves a **patient**.

15. **Harm**: impairment of structure or function of the body and/or any deleterious effect arising there from. Harm includes **disease**, **injury**, **suffering**, **disability** and death.

16. **Harmful incident (adverse event)**: an **incident** that resulted in **harm** to a patient.

17. **Hazard**: a **circumstance, agent** or action with the potential to cause harm.

18. **Health**: a state of complete physical, mental and social well-being and not merely the absence of **disease** or infirmity.

19. **Health care**: services received by individuals or communities to promote, maintain, monitor or restore **health**.

20. **Health care-associated harm**: **harm** arising from or associated with plans or actions taken during the provision of health care, rather than an underlying **disease** or **injury**.

21. **Incident characteristics**: selected **attributes** of an **incident**.

22. **Incident type**: a descriptive term for a category made up of incidents of a common nature, grouped because of shared, agreed features.

23. **Injury**: damage to tissues caused by an **agent** or **event.**

24. **Mitigating factor**: an action or **circumstance** that prevents or moderates the progression of an **incident** towards harming a **patient**.

25. **Near miss**: an **incident** that did not reach the patient.

26. **No harm incident:** an **incident** that reached a patient, but no discernable harm resulted.

27. **Patient**: a person who is a recipient of **health care**.

28. **Patient characteristics**: selected **attributes** of a **patient**.

29. **Patient outcome**: the impact upon a patient that is wholly or partially attributable to an **incident.**

30. **Patient safety**: the reduction of risk of unnecessary **harm** associated with **health care** to an acceptable minimum.

31. **Patient safety incident**: an **event** or **circumstance** that could have resulted, or did result, in unnecessary **harm** to a **patient**.

32. **Preventable**: accepted by the community as avoidable in the particular set of circumstances.

33. **Reportable circumstance**: a situation in which there was significant potential for harm, but no incident occurred.

34. **Risk**: the probability that an **incident** will occur.

35. **Safety**: the reduction of risk of unnecessary **harm** to an acceptable minimum.

36. **Semantic relationship**: the way in which things (such as **classes** or **concepts**) are associated with each other on the basis of their meaning.

37. **Side-effect**: a known effect, other than that primarily intended, related to the pharmacological properties of a medication.

38. **Suffering**: the experience of anything subjectively unpleasant.

39. **Violation**: deliberate deviation from an operating procedure, standard or rule.

Source: *WHO conceptual framework for the international classification for patient safety*. Geneva, World Health Organization, 2009 (http://www.who.int/patientsafety/en/; accessed 11 March 2011).

Definitions from other sources

1. **Health care-associated infection**: an infection that was neither present nor incubating at the time of patient's admission, which normally manifests itself more than three nights after the patient's admission to hospital [1].

2. **Patient safety culture**: a culture that exhibits the following five high-level attributes that health-care professionals strive to operationalize through the implementation of strong safety management systems; (1) a culture where all health-care workers (including front-line staff, physicians, and administrators) accept responsibility for the safety of themselves, their coworkers, patients, and visitors; (2) a culture that prioritizes safety above financial and operational goals; (3) a culture that encourages and rewards the identification, communication, and resolution of safety issues; (4) a culture that provides for organizational learning from accidents; (5) a culture that provides appropriate resources, structure, and accountability to maintain effective safety systems [2].

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Key to Icons

Slide number 

Topic number 

Groups 

Lecture 

Simulation exercises 

DVD 

Book 

Introduction to the Curriculum Guide topics

Being patient-centred

This patient-centred Curriculum is designed specifically for the health professional student and places patients, clients and carers at the centre of health-care learning and service delivery. The underpinning and applied knowledge and the required demonstration of performance set out in these topics calls for students and health-care workers to think about how to incorporate patient safety concepts and principles into everyday practice.

Patients and the wider community in all countries are predominantly passive observers to the significant changes occurring in health care. Many patients still do not fully participate in decisions about their health care, nor are they involved in discussions about the best way to deliver health services. Most health services today continue to place the health professionals at the centre of care. The disease-focused models of care emphasize the role of the health professional and management by organizations without appropriate consideration of the patients who are at the receiving end of health care. Patients need to be at the centre of care and not at the receiving end of care.

There is strong evidence that patients effectively self-manage their conditions with appropriate support. Decreased attention to the acute setting and increased attention to treating patients in multiple sites requires health-care workers to put patient interests first–to seek and provide full information, to be respectful of their cultural and religious differences, to seek permission to treat and work with them, to be honest when things go wrong or the care is suboptimal, and to focus health-care services on prevention and minimization of risk or harm.

The community perspective

Community perspectives on health care reflect the changing needs for care over an individual's entire lifecycle and are associated with staying healthy, getting better, living with illness or disability, and coping with the end of life. The changing health-care environment (new models of care for treating chronic and acute conditions, the continuously expanding evidence base and technological innovations, complex care delivered by teams of health-care professionals, and engaged relationships with patients and carers) has created new demands for the health-care workforce. This Curriculum recognizes this changing environment and aims to cover a wide variety of patients in multiple situations and locations being treated by multiple health-care workers.

Why do students in the health professions need to learn about patient safety?

The scientific discoveries of modern health care have led to markedly improved patient outcomes. However, studies conducted in many different countries have shown that significant risks to patient safety have accompanied these benefits. A major consequence of this knowledge has been the development of patient safety as a specialized discipline. Patient safety is not a traditional stand-alone discipline; rather, it is one that can and should be integrated into all areas of health care.

As future clinicians and leaders in health care, students need to know about patient safety, including how systems impact on the quality and safety of health care and how poor communication can lead to adverse events. Students need to learn how to manage these challenges and how to develop strategies to prevent and respond to errors and complications, as well as how to evaluate results to improve performance in the long term.

The WHO Patient Safety programme aims to improve patient safety worldwide. Patient safety is everyone's business–health professionals,

managers, cleaners and catering staff, administrators, consumers and politicians. As students are the health-care leaders of the future, it is vital that they be knowledgeable and skilful in their application of patient safety principles and concepts. This Curriculum Guide equips students with essential knowledge of patient safety, as well as describing the necessary skills and behaviours to help them perform all their professional activities safely.

The time to build students' knowledge of patient safety is right at the beginning of their training programmes. Students need to be ready to practise patient safety skills and behaviours as soon as they enter a hospital, clinic or patient's home. Students also need the opportunity, whenever possible, to consider safety issues in a simulated environment prior to actual practice in the real world.

By getting students to focus on each individual patient, having them treat each patient as a unique human being, and practising applying their knowledge and skills to benefit patients, students themselves can be role models for others in the health-care system. Most health-care students enter their training programmes with high aspirations. Nevertheless, the reality of the system of health care sometimes deflates their optimism. We want students to be able to maintain their optimism and believe that they can make a difference in both the individual lives of patients and to the health-care system.

How to teach patient safety: managing the barriers

Effective student learning depends on instructors using a range of educational methods, such as explaining technical concepts, demonstrating skills and instilling attitudes–all of which are essential for patient safety education. Teachers of patient safety use problem-based teaching (facilitated group learning), simulation-based learning (role play and games) and lecture-based teaching (interactive/didactic), as well as mentoring and coaching (role models).

Patients judge their health-care providers not by how much they know, but by how they perform. As students progress in the clinical and work environment, the challenge is to apply their general scientific knowledge to specific patients. In doing so, students go beyond "what" they have learned in class to knowing "how" to apply their knowledge. The best way for students to learn is by doing. Patient safety practices require students to act safely–to check names, to seek information about medications and to ask questions. The best ways for students to learn about patient safety are through hands-on experience or practise in a simulated environment. Students need expert clinical coaching even more than lectures on underpinning theories. When instructors observe students' performance and provide feedback, students will continuously improve and eventually master many skills important to patient safety.

Mentoring and coaching are also particularly relevant to patient safety education. Students naturally try to copy and model the behaviour of their instructors and senior practitioners. The ways in which role models behave will have a great influence on how students behave and how they will eventually practice when they finish their training. Most students come to health care with high ideals–wanting to be a healer, to show compassion, and to be a competent and ethical health professional. However, what they frequently see is rushed care, rudeness to colleagues, and professional self-interest. Slowly, their high ideals are compromised as they try to fit in with the surrounding work culture.

Patient safety education and this Curriculum Guide recognize these strong influences and factors exist in some settings. We believe that these negative influences can be moderated and their impact minimized by talking with students about the prevailing work culture and the impact of such a culture on the quality and safety of patients. Recognizing the barriers to patient safety and talking about them will give students a sense of the system as a problem (as opposed to the people in the system being the problem) and allow them to see that changing the system for the better is possible and a goal worth striving for. The barriers are not the same in every country and culture or even across different clinical settings within one region. Country-specific barriers might include laws and regulations governing the health system. These laws may prevent the implementation of certain patient.safety practices. Different cultures have their own approaches to hierarchies, errors and the resolution of conflicts. The extent to which students are encouraged to be assertive in the presence of instructors and/or senior clinicians, particularly in circumstances in which a patient might be at risk of harm, will depend on the situation and the readiness of the local professional culture for change. In some societies, patient safety concepts might not easily fit in with cultural norms. These barriers are explored in more depth later in this topic (see the section

Confronting the real world: helping students to become patient safety leaders).

The barriers most evident to students are those that surface during their professional placements and treatment settings and relate mainly to senior instructors/ supervisors or health professionals who are unable to adapt to the new health-care challenges or who actively discourage any change in response to them. Their behaviour can transform a student from an advocate for patient safety into a passive textbook learner. The way that different health professionals (nurses, pharmacists, dentists, doctors, etc.) maintain their own professional cultures, which results in a silo approach to health care, is also another significant barrier. Failure to communicate across disciplines can lead to health-care errors. An interdisciplinary team approach is much more effective in reducing errors, improving staff communication, and promoting a healthier work environment.

As instructors and supervisors become familiar with this Curriculum, they will quickly realize that student learning may not be practised in the real life setting. Some health professionals may feel that teaching patient safety to health-care students is an unachievable goal because of the many barriers involved. Yet, once barriers are named and discussed, they are not so daunting. Even discussions among groups of students about the realities and the barriers can inform and teach. At the very least, they can allow a constructive critique of the system and time for reflection on how things are done.

How the topics in this Curriculum Guide relate to health-care practice

Table B.I.1 shows how the topics in this Curriculum Guide are integrated into health care, using hand hygiene as an example. Many patient safety principles apply across health care, such as teamwork, medication safety, and engaging with patients. We use this example because minimizing the transmission of infection can be achieved by health-care workers cleansing their hands in the right way at the right time. Using correct hand hygiene practices seems to be such an obvious and easy thing to achieve. But, despite hundreds of campaigns to educate health professionals, faculty, students and other staff about standard and universal precautions, we do not appear to have fixed this problem and rates of health care-associated infections (HCAI) are climbing worldwide. Each curriculum topic contains important learning for health-care students in a particular area. Taken together, the topics provide the underpinning knowledge and prepare health-care students to maintain correct hand hygiene techniques, as well as to identify how to make system-wide improvements.

The Curriculum Guide topics and their relation to patient safety

While the topics are stand alone, Table B.I.1 demonstrates how all the topics are necessary for the development of appropriate behaviour by health professionals. Using hand hygiene as an example, we show how the learning from each of the topics is necessary to achieve and sustain safe health care.

Table B. I. 1. How the topics are interrelated: the example of hand hygiene

Problem area: minimizing the spread of infection	Curriculum Guide topic and relevance to practice
Problem caused by poor infection control.	**Topic 1 "What is patient safety?"** describes the evidence of the harm and suffering caused by adverse events. As students learn about the discipline of patient safety and their own role in minimizing the incidence and impact of adverse events, they will be able to appreciate the importance of their own behaviours, such as using appropriate hand hygiene techniques, for the prevention and control of infection.
Health-care workers know that infection is a problem. However, just knowing this does not seem to change practice. People tend to use correct hand hygiene techniques for a while, but then they forget.	**Topic 2 "Why applying human factors is important for patient safety"** explains how and why humans work the way they do, and why they make errors. An understanding of human factors will assist the identification of opportunities for errors and help students to learn how they can be avoided or minimized. Understanding the factors involved in errors and their root causes will help students to understand the context of their actions. Telling people to try harder (cleanse their hands correctly) will not change anything. They need to see their own actions in the context of the environment they work in and the equipment they use. When health-care workers believe that a patient's infection was caused by their actions, they are more likely to change the way they work and use standard precautions.

Health-care workers want to maintain proper infection prevention and control procedures, but there are too many patients to care for and time constraints appear to preclude adequate hand hygiene.	**Topic 3 "Understanding systems and the effect of complexity on patient care"** shows how patient care includes multiple steps and multiple relationships. Patients depend on health-care professionals treating them in the right way; they depend on a system of health care. Students need to know that good health care requires a team effort. They need to understand that cleansing hands is not an optional extra, but an important step in caring for patients. Understanding how each person's actions and each component of care fit together in a continuous process that has either good outcomes (the patient gets better) or bad outcomes (the patient suffers an adverse event) is an important patient safety lesson. When they understand that the actions of one person on the team can undermine the patient's treatment goals, they quickly see their work in a different context–a patient safety context.
There are no alcohol-based hand rubs or cleaning agents on the wards because the clerk forgot to order them.	**Topic 4: "Being an effective team player"** explains the importance of teamwork among health-care professionals. If no alcohol-based hand rubs are available, it is up to every member of the team to notify the appropriate person to ensure availability. Just complaining that someone forgot to order hand rubs does not help the patients get better. Being mindful at work and looking for opportunities to assist patients and the team is part of being a professional and a team player. Adverse events are often caused by a cascade of many seemingly trivial things–not cleansing hands, no medication chart available, or the delayed attendance of a clinician. Reminding someone to order the hand rubs is not trivial, it can prevent an infection.
A surgeon left the theatre momentarily to answer a mobile phone. He returned to theatre and continued the operation wearing the same gloves. The patient experienced a postoperative wound infection.	**Topic 5: "Learning from errors to prevent harm"** shows how blaming people does not work, and that if people fear being accused of negligence or blamed, no one will report or learn from adverse events. A systems approach to errors seeks to identify the underlying causes of errors and to ensure that they are not repeated. An examination of the causes of the infection may show that the surgeon left the theatre and did not use appropriate sterile techniques upon his return. Blaming a person alone will achieve nothing. Further analysis may show that the surgeon and the rest of the team had been routinely violating infection control guidelines because they did not think infection was a problem. Without the data, they were lulled into a false sense of security.
The patient above, who was infected, made a written complaint to the hospital about his care.	**Topic 6: "Understanding and managing clinical risk"** shows students the importance of having systems in place to identify problems and fix potential problems before they occur. Complaints can tell a clinician or manager if there are particular problems. This patient's letter of complaint about his infection may be the 10th letter in a month, which could tell the hospital that there may be a problem with infection control. Reporting incidents and adverse events is also a systematic way of gathering information about the safety and quality of care.
The hospital decides that it has a problem with infection in a particular theatre and wants to know more about the problem.	**Topic 7: "Using quality-improvement methods to improve care"** provides examples of methods for measuring and making improvements in clinical care. Students need to know how to measure care processes in order to determine whether changes have led to improvements.
The hospital now knows that one of its theatres has a higher infection rate than the others. Patients are complaining and the hospital's infection problem has received media coverage.	**Topic 8: "Engaging with patients and carers"** shows students the importance of honest communication with patients after an adverse event and the importanceof giving complete information to patients about their care and treatment. Engaging with patients is necessary to maintain the trust of the community.

The hospital decides that infection is a particular problem and that everyone needs to be reminded of the mportance of complying with standard precautions.	**Topic 9: "Infection prevention and control"** describes the main types and causes of infections. It also covers relevant steps and protocols for minimizing infections.
The hospital decides to review infection control in theatres because surgical-site infections comprise a significant percentage of the adverse events being reported by staff.	**Topic 10: "Patient safety and invasive procedures"** demonstrates to students that patients having surgery or other invasive procedures are at a higher risk of infection or receiving the wrong treatment. An understanding of the failures caused by poor communication, lack of leadership, inadequate attention to processes, non-compliance with guidelines, and overwork will help students appreciate the multiple factors that are at play in surgery.
Records from the surgical ward were reviewed using a quality-improvement method (one that asks "what happened?" instead of "who did it?"), as the team searched for an intervention that might help lower the infection rate. The team learned that the appropriate administration of prophylactic antibiotics can help prevent infections. But this practice would also require that a complete medication history be available for each patient to avoid interactions with other medications they might be prescribed.	**Topic 11: "Improving medication safety"** is important because medication errors cause a significant proportion of adverse events. The scale of medication error is immense and students need to identify factors that lead to errors and know the steps to take to minimize these. Medication safety ensures that students know about the potential for adverse drug reactions and that they consider all relevant factors when prescribing, dispensing, administering, and monitoring the effects of medications.

Confronting the real world: helping students to become patient safety leaders

One of the main challenges to patient safety reform is the receptiveness of the workplace to new ways of delivering care. Change can be very difficult for organizations and health professionals who are used to treating patients in particular ways. They do not necessarily see anything wrong with how they deliver care and are not convinced that they need to change. They may feel threatened or challenged when someone, particularly a junior staff member, sees and even does things differently. In these circumstances, unless students are supported with positive coaching and given an opportunity to discuss their experiences, much of the teaching and learning about patient safety in training programmes will be undermined.

Students very quickly learn how members of their chosen health-care profession behave and what is expected of them and, because they are novices, they wish to fit in as soon as possible. Students in the health professions are often very dependent upon instructors and supervisors for information and professional support.

For students, maintaining the confidence of an instructor or supervisor is paramount. Their progression depends on favourable reports from their teachers based on informal and formal feedback and subjective and objective assessments of their competence and commitment. Patient safety requires that health-care professionals talk about their mistakes and learn from them, but students may fear that disclosing their own mistakes or the mistakes of a senior professional, instructor or supervisor may have repercussions for them or the people involved. Over-reliance on workplace-based instructors or supervisors for teaching and assessment may encourage students to conceal their mistakes and perform requested tasks, even when they know that they are not yet competent to perform those tasks. Students may be reluctant to talk about patient safety or express their concerns about ethical issues with senior staff. They may be fearful of receiving an unfavourable report or of being seen as "lacking in commitment" or "having a bad attitude". Students may hold founded or unfounded fears that speaking up for a patient or disclosing errors may lead to unfavourable reports, decreased employment opportunities and/or reduced chances for gaining access to advanced training programmes.

Discussions about health-care errors are difficult for all health-care professionals in all cultures. Openness to learning from errors will often depend on the personalities of the senior professionals involved. In some cultures and

organizations, openness about errors may be new and, therefore, very difficult for faculty. In these cases, it may be appropriate for the students to talk about errors in student teaching sessions. In some places, these discussions are held in closed meetings and, in more advanced educational settings, teams may talk about errors openly and have many policies in place to assist health-care workers navigate their way through an error. But, eventually, every culture will have to confront the human suffering caused by errors. Once the suffering is openly acknowledged by the health professionals who work in the hospitals, clinics, and community, it will be difficult to maintain the status quo. Many will adopt different approaches to hierarchies and patient-care services. Some of these newer approaches view the team as the main instrument of health-care delivery, envisaging a flatter hierarchy in which everyone caring for the patient can appropriately contribute.

It may help students if they can understand why the expectations and attitudes of some senior professionals and faculty seem to be at odds with what they have learned about patient safety. Health care has not been designed with patient safety in mind. It has evolved over time, with many aspects of care being a consequence of tradition rather than explicit concerns for safety, efficiency and efficacy within the context of contemporary health care. Many attitudes within health care are deeply rooted in a professional culture that originated at a time when hierarchical structures were commonplace in society–health care was seen as a life vocation and clinicians, particularly doctors, were considered infallible. Within that conceptual framework, good health-care professionals were thought to be incapable of making mistakes, training was through apprenticeship, and patient outcomes (good and bad) were attributed to the professional's skills, not those of the team. They were not professionally accountable to anyone other than themselves and, in some places, non-paying patients were predominantly viewed as learning material. Although much has changed, some remnants of the old culture have persisted and shaped the attitudes of health-care professionals who trained in that cultural environment.

Modern societies want safe, quality health care delivered by health professionals working in a safety culture. This safety culture has started to permeate health-care workplaces around the world and students will encounter both traditional attitudes and those that reflect a safety culture. The challenge for all students, irrespective of their culture, country or discipline is to practise safe health care, even when those around them do not.

It is helpful to be able to differentiate between certain old approaches that may negatively affect patient care and certain new practices that foster patient-centred care. It is also important to acknowledge that this cultural shift may create some tension for the student or trainee who is keen to practise with safety in mind, but whose direct senior is not aware of, or in favour of, these new approaches. It is important that students talk to their supervisors before they start implementing the suggested new techniques.

We do not expect students to put themselves or their careers at risk in the interest of changing the system. But we do encourage students to think about how they might approach their training and maintain a patient safety perspective at the same time. Table B.I.2 below provides a framework to give students some ideas for managing the conflicts they may experience while they are assigned to a workplace for training.

Table B.I.2. Managing conflicts: the old way and the new way

Area or attribute	Example	Old way	New way
Hierarchies in health care: Hand hygiene	A senior health practitioner does not cleanse his/her hands between patients.	Student says nothing and conforms to inadequate practices, imitating the senior clinician.	(1) Seek clarification on the "when and how" of hand hygiene with the clinician or other senior person. (2) Say nothing, but use safe hand hygiene techniques. (3) Say something in a respectful manner to the clinician and continue to use safe hand hygiene techniques.

Hierarchies in heath care: Surgical site	Surgeon does not participate in checking the correct site for surgery or verifying the patient's identity. The surgeon is resentful of the preoperative checking protocol, believing it to be a waste of time, and puts pressure on the rest of the team to hurry up.	Adopt the approach of the senior surgeon and do not participate in checking–decide that checking is too menial a task.	(1) Actively help the rest of the team to complete the checking protocol.
Hierarchies in health care: Medication	Student is aware that a patient has a known serious allergy to penicillin and observes a senior nurse about to administer penicillin.	Say nothing for fear of being seen to disagree with a senior person's decision. Presume that the nurse must know what he/she is doing.	(1) Immediately share concern about allergy with the nurse. Student views this as being a helpful part of the team and also his/her responsibility as a patient advocate.
Paternalism: Consent	Student asked to obtain consent from a patient for a treatment the student has never heard of before.	Accept task. Do not let senior staff know your level of ignorance about the treatment. Talk to the patient about the treatment in a vague and superficial way so as to obtain the patient's signature on the consent form.	(1) Decline the task and suggest that a clinician with some familiarity with the treatment would be more appropriate for this task. (2) Accept the task, but explain you know little about the treatment and will need some teaching about it first, and request that one of the supervisors comes along to help/supervise.
Paternalism: Role of patients in their care	The patients are ignored during the ward round and not engaged in discussions about their care. Family members are asked to leave the bedside when the doctors are doing their ward rounds.	Accept the situation and do nothing. Assume that this is the way things are done. Conform to behaviours that do not include or engage patients and their families.	(1) Take the lead in greeting each patient: "Hello Mr Ruiz, we are reviewing all of our patients this morning. How are you feeling today?". (2) If there is time pressure to keep moving, explain to the patient and his/her family, "I will come back to talk to you after the ward round". (3) Find out your patient's concerns before the round and raise them with the senior clinicians on the round at the bedside, e.g. "Mr Carlton is hoping to avoid surgery, is this an option for him?". (4) Invite and encourage patients to speak up during the ward round. (5) Ask your supervisor whether he/she thinks patients and their relatives can add value to the ward round discussions and so improve the efficiency of the unit.

Infallibility of health-care professionals: Hours of work	A junior staff member on the ward announces with pride that he has been at work for the last 36 hours.	Admire the staff member for his stamina and commitment to his work.	(1) Ask the staff member how he feels and whether it is wise or even responsible to still be working. (2) Ask when he is due to finish and how he plans to get home. Is he safe to drive a car? (3) Make some helpful suggestions: "Is there someone who can carry your pager so you can go home and get some rest?" Or, "I didn't think staff were allowed to work such long hours, you should complain about your roster".
Infallibility of health-care professionals: Attitude toward mistakes	Mistakes are only made by people who are incompetent or unethical. Good health-care professionals do not make mistakes.	Accept the culture that says health professionals who make mistakes are "bad" or "incompetent". Try harder to avoid making mistakes. Remain silent, or find someone or something else to blame when you have made a mistake. Look at the mistakes others make and tell yourself that you would not be as stupid.	(1) Understand that everyone will make mistakes at some time and that the causes of errors are multifactorial and involve latent factors not immediately obvious at the time the error was made. Look after your patients, yourself and your colleagues in the event of an error and actively promote learning from errors.
Infallibility of health-care professionals: Making mistakes	A senior health practitioner makes a mistake and tells the patient it was a complication. Staff do not talk about their mistakes in peer-review meetings.	Accept that the way to handle a mistake is to rationalize it as a problem associated with the patient, rather than the care provided. Quickly learn that senior staff do not disclose errors to patients or their colleagues and model your behaviour on them.	(1) Talk to a supervisor about open disclosure to patients and whether the hospital or clinic has a policy about providing information to patients after adverse events. (2) Ask the patient if he/she would like more information about their care and, if so, advise the doctor that the patient would like more information. (3) Tell your supervisor or team leader when you make a mistake and ask how a similar mistake can be avoided in the future. (4) Fill out an incident form, if appropriate.
Infallibility of health-care professionals: Omniscience	A health practitioner who acts "god-like" and looks down on junior health professionals and patients.	Aspire to be like this person and admire how everyone bows down to him.	(1) Recognize the arrogance in such attitudes and model behaviour on staff who work in teams and share their knowledge and responsibilities.
Blame/shame	A health practitioner who makes a mistake is ridiculed or humiliated by their supervisor. A hospital disciplines a staff member for an error.	Say nothing and model behaviour on other staff who talk negatively about a health professional involved in an incident.	(1) Offer support and understanding to a colleague who is involved in an incident. (2) Talk to colleagues and your supervisor about better ways to understand mistakes than just blaming the person involved. (3) Focus on the mistake. Ask "what happened?" rather than "who was involved?". Try to generate discussion within the team/tutorial group about the multiple factors that might have been involved.

Teamwork: My team is the nursing team (or the midwifery/ pharmacy/ dental/ medical team)	Students and junior clinicians identify only other clinicians of the same discipline as being part of their team. The clinicians in the ward do their rounds without a member of other professions present.	Change behaviour to reflect that of the rest of the clinicians and identify only with the members of your own profession.	(1) Be mindful that the team from a patient's perspective is everyone who cares and treats the patient–nurses, ward staff and allied health-care workers, as well as the patient and his/her family members. (2) Always suggest including other members of the health-care team in conversations about a patient's care and treatment. (3) Acknowledge and maximize the benefit of an interprofessional team.

Patient narratives

The use of narratives in health care as a learning tool has been effective for generations of health professionals. Stories about both gifted and difficult work colleagues, about good and bad teachers, instructors and supervisors, about tips for surviving a particular shift or rotation are just a few examples. These stories focus largely on the health-care student perspective. Missing from the usual narrative toolbox are the patients' stories. Their experiences are reminders that they too are part of the health-care team and that they too have something to offer. Patient narratives included in each learning topic, are designed to highlight the importance of the topic from a patient perspective and to bring the Curriculum to life by giving some real examples of what can go wrong in the delivery of health-care services in the absence of a patient-centred approach.

Fictitious names have been used for most of the patient narratives, except where permission has been given by the family, such as in the case of Caroline Anderson. These real patient stories are taken from the Australian Patient Safety Education Framework (APSEF) 2005.

Topic 1
What is patient safety?

Caroline's story

On 10 April 2001, Caroline, aged 37, was admitted to a city hospital and gave birth to her third child in an uncomplicated caesarean delivery. Dr A was the obstetrician and Dr B was the anaesthetist who placed the epidural catheter. On 11 April, Caroline reported that she felt a sharp pain in her spine and had accidentally bumped the epidural site the night before the epidural was removed. During this time, Caroline repeatedly complained of pain and tenderness in the lumbar region. Dr B examined her and diagnosed "muscular" pain. Still in pain and limping, Caroline was discharged from the city hospital on 17 April.

For the next seven days, Caroline remained at her home in the country. She telephoned Dr A about her fever, shaking, intense low back pain and headaches. On 24 April, the local medical officer, Dr C, examined Caroline and her baby and recommended that they both be admitted to the district hospital for back pain and jaundice, respectively.

The admitting doctor at the district hospital, Dr D, recorded that Caroline's back pain appeared to be situated at the S1 joint rather than at the epidural site. On 26 April, the baby's jaundice had improved, but Caroline had not yet been seen by the general practitioner, Dr E, who acknowledged that he had forgotten about her. The medical registrar, Dr F, examined Caroline and diagnosed sacroiliitis. He discharged her with prescriptions for oxycodone hydrochloride, paracetamol, and diclofenac sodium. He also informed Caroline's obstetrician, Dr A, of his diagnosis.

Caroline's pain was helped by the medications until 2 May when her condition deteriorated. Her husband then took her to the local country hospital in a delirious state. Shortly after arriving at the hospital on 3 May, she started convulsing and mumbling incoherently. Dr C, recorded in the medical records "? Excessive opiate usage, sacroiliitis". Her condition was critical by this stage and she was rushed by ambulance to the district hospital.

By the time she arrived at the district hospital, Caroline was unresponsive and needing intubation. Her pupils were noted to be dilated and fixed. Her condition did not improve and on 4 May she was transferred by ambulance to a second city hospital. At 1.30pm on Saturday 5 May, she was determined to have no brain function and life support was withdrawn.

A postmortem examination revealed an epidural abscess and meningitis involving the spinal cord from the lumbar region to the base of the brain, with cultures revealing a methicillin-resistant *Staphylococcus aureus* (MRSA) infection. Changes to the liver, heart and spleen were consistent with a diagnosis of septicemia.

The coronial investigation concluded that Caroline's abscess could and should have been diagnosed earlier. The following discussion of the coroner's report into the death of Caroline Anderson highlights many of the issues addressed in this multi-professional edition of the WHO Patient Safety Curriculum Guide.

Discussion

The observation that surfaced repeatedly in this story was the inadequacy in recording detailed and contemporaneous clinical notes and the regular incidence of notes being lost. The anaesthetist, Dr B, was so concerned about Caroline's unusual pain that he consulted the medical library, but he did not record this in her clinical notes. He also failed to communicate to Caroline the risk of what he now thought to be "neuropathic" pain or to ensure that she was fully investigated before discharge. There were also concerns that evidence-based guidelines were not followed with respect to Dr B scrubbing prior to the epidural insertion as it was the view of an independent expert that the bacteria that caused the abscess was most likely to have originated from the staff or environment at the city hospital.

It was clear that Caroline would be managed by others after her discharge. However, she was not involved as a partner in her health care by being given instructions about the need to seek medical attention if her back pain worsened. Similarly, no referral letter or phone call was made to her local medical officer, Dr C.

It was the coroner's opinion that each of the doctors who examined Caroline after she returned to the country was hasty in reaching a diagnosis, mistakenly believing that any major problem would be picked up by someone else down the track. Dr C made only a very cursory examination of Caroline as he knew she was being admitted to the district hospital. The admitting doctor, Dr D, thought that there was a 30% chance of Caroline having an epidural abscess, but did not record it in the notes because he believed that it would be obvious to colleagues. In a major departure from accepted medical practice, Dr E agreed to see Caroline and simply forgot about her.

The last doctor to examine Caroline at the district hospital was the medical registrar, Dr F, who discharged her with prescriptions for strong analgesics without fully investigating his provisional diagnosis of sacroiliitis, which he thought could have been postoperative or of infectious origin. With regards to medication safely, Dr F's handwritten notes to Caroline were considered vague and ambiguous in instructing her to increase the dose of oxycodone hydrochloride if the pain increased, while monitoring specific changes at the same time. The notes that Dr F made on a piece of paper detailing his examination and the possible need for magnetic resonance imaging (MRI) have never been found.

The one doctor who the coroner believed could have taken global responsibility for Caroline's care was her obstetrician, Dr A. He was phoned at least three times after her discharge from the city hospital with reports of her continuing pain and problems, but failed to realize the seriousness of her condition.

From the birth of her child to her death 25 days later, Caroline was admitted to four different hospitals. There was an obvious need for proper continuity of care in the handover of responsibilities from each set of medical and nursing staff to another. The failure to keep adequate notes with provisional/differential diagnoses and investigations and provide discharge summaries and referrals led to a delay in the diagnosis of a life-threatening abscess and, ultimately, Caroline's death.

Source: *Inquest into the death of Caroline Barbara Anderson, Coroner's Court*, Westmead, Sydney, Australia, 9 March 2004. (Professor Merrilyn Walton was given written permission by Caroline's family to use her story in teaching health-care students to help them learn about patient safety from the perspective of patients and families).

Introduction–Why is patient safety relevant to health care?

There is now overwhelming evidence that significant numbers of patients are harmed from health care, resulting in permanent injury, hospital admissions, increased lengths of stay in hospital and even death. Over the last decade, we have learned that adverse events occur not because people intentionally hurt patients, but rather due to the complexity of health-care systems today, where the successful treatment and outcome for each patient depend on a range of factors, in addition to the competence of each individual health-care provider.

When so many and varied types of health-care providers (physicians, midwives, dentists, surgeons, nurses, pharmacists, social workers, dieticians, and others) are involved, it can be very difficult to ensure safe care, unless the system of care is designed to facilitate the timely and complete exchange of information among all the health professionals involved in caring for the patient.

Patient safety is an issue in all countries that deliver health services, whether these services are privately commissioned or funded by the government. Failing to adequately check the identity of a patient or prescribing antibiotics without regard for the patient's underlying condition or administering multiple drugs without paying attention to the potential for adverse drug reactions can lead to patient injury. Patients are not only harmed by the misuse of technology. They can also be harmed by poor communication between different health-care providers, or delays in receiving treatment.

The situation of health care in developing countries merits particular attention. The poor state of infrastructure and equipment, unreliable supply and quality of drugs, shortcomings in infection control and waste management, poor performance of personnel because of low motivation or insufficient skills and severe under-financing of the health services makes the probability of adverse events much higher than in the developed world. Important patient safety issues include: health care-associated infection, injuries due to surgical and anaesthesia errors, medication safety, injuries due to medical devices, unsafe injection practices and blood products, unsafe practices for pregnant women and newborns. In many hospital settings, the challenge of health-care associated infection is widespread, with infection control measures virtually non-existent. This is the result of a combination of numerous unfavourable factors relating to poor hygiene and sanitation. In addition, an unfavourable socio-economic background and patients affected by malnutrition and other types of infection and/or diseases contribute to increasing the risk of health care-associated infection.

Several studies have shown that the risk of developing surgical site infections in developing countries is significantly higher than in developed countries, with rates ranging between 19% to 31% across different hospitals and countries [1]. WHO figures for unsafe medications demonstrate that an estimated 25% of all medicines consumed in developing countries are probably counterfeit, thus contributing to unsafe health care. A WHO survey of medication safety and counterfeit medicines reports from 20 countries found that 60% of counterfeit medicine cases occurred in developing countries and 40% in the developed world [2]. Another WHO study showed that at least half of all hospital medical equipment in developing countries is unusable or only partly usable at any given time [3]. In some countries, about 40% of hospital beds are located in structures originally built for other purposes. This makes facilities for radiation protection and infection control extremely difficult to incorporate, with the result that such facilities are often either substandard or absent [4]. Even on the basis of limited and estimated evidence from developing countries, it is likely that a combination of efforts specifically related to the education and training of health care professionals is urgently needed.

Patient safety in both developed and developing countries is a broad subject that could incorporate the latest technology, such as electronic prescribing and redesigning clinics and out-patient settings, but also washing hands correctly and knowing how to be an effective team member. Many of the features of patient safety programmes do not involve financial resources, but rather the commitment of individuals to practise safely. Individual health-care providers can improve patient safety by engaging with patients and their families in a manner that shows respect, checking procedures, learning from errors and communicating effectively with other members of the health-care team. Such activities can also help minimize costs as they minimize the harm caused to patients. The reporting and analysis of errors can help identify the main contributing factors. Understanding the factors that lead to errors is essential for thinking about the changes that will prevent errors.

Keywords
Patient safety, systems theory, blame, blame culture, system failures, person approach, violations, patient safety models, interdisciplinary and patient-centred.

Learning objectives

Students should understand the discipline of patient safety and its role in minimizing the incidence and impact of adverse events, as well as maximizing recovery from these events.

Learning outcomes: knowledge and performance

Patient safety knowledge and skills cover many areas, including effective teamwork, accurate and timely communication, medication safety, hand hygiene and procedural and surgical skills. The topics in this Curriculum Guide have been selected based on evidence of their relevance and effectiveness. In this topic, we present an overview of patient safety and set the scene for deeper learning in some of these above areas. For example, we introduce the term *sentinel event* in this topic, but we present a more thorough discussion of its meaning and relevance to patient safety in Topic 5 (*Learning from errors to prevent harm to patients*) and Topic 6 (*Understanding and managing clinical risk*).

Knowledge requirements

Students should know:

- the harm caused by health-care errors and system failures;
- lessons about error and system failure from other industries;
- the history of patient safety and the origins of the blame culture;
- the difference between system failures, violations and errors;
- a model of patient safety.

Performance requirements

Students need to apply patient safety thinking in all professional activities. They need to demonstrate the ability to recognize the role of patient safety in the delivery of safe health care.

The harm caused by health-care errors and system failures

Even though the extent of adverse events in the health system has long been recognized [5-12], the degree to which these events are acknowledged and managed varies greatly across health systems and health professions. Poor information and poor understanding of the extent of the harm caused and the fact that most errors do not cause any harm at all may explain why it has taken so long for patient safety to be seen as a priority. In addition, mistakes affect one patient at a time, and staff working in one area may only infrequently experience or observe an adverse event. Errors and system failures do not all happen at the same time or place, which can mask the extent of errors in the system.

The collection and publication of patient outcome data is not yet routine for all hospitals and clinics. However, a significant number of studies that have examined patient outcome data [11,13,14] have shown that many adverse events are preventable. In a landmark study, Leape et al. [14] found that more than two-thirds of the adverse events in their sample were preventable, 28% were due to the negligence of a health professional and 42% were caused by factors other than negligence. They concluded that many patients were injured as a result of poor medical management and substandard care.

Bates et al. [15] found that adverse drug events were common and that serious adverse drug events were often preventable. They further found that medications harmed patients at an overall rate of about 6.5 per 100 admissions in large United States teaching hospitals. Although most of these events resulted from errors at the prescribing and dispensing stages, many also occurred at the administration stage. The authors of this study suggested that prevention strategies should target both stages of the drug delivery process. Their research, based on self-reports by nurses and pharmacists and daily chart review, is a conservative figure because many doctors do not routinely self-report medication errors.

Many studies confirm that health-care errors are prevalent in our health systems and that the associated costs are substantial. In Australia [16], errors result in as many as 18 000 unnecessary deaths and more than 50 000 disabled patients. In the United States [17], health-care errors result in at least 44 000 (and perhaps as many as 98 000) unnecessary deaths each year, as well as one million excess injuries.

In 2002, WHO Member States agreed on a World Health Assembly resolution on patient safety in recognition of the need to reduce the harm and suffering of patients and their families and in acknowledgement of the compelling evidence of the economic benefits of improving patient safety. Studies show that additional hospitalization, litigation costs, infections acquired in hospitals,

lost income, disability and medical expenses have cost some countries between US$ 6 billion and US$ 29 billion a year [17, 18].

The extent of patient harm from health care has been exposed by the publication of the international studies listed in Table B.1.1. These studies confirm the large numbers of patients involved and show the adverse event rate in four countries.

Table B.1.1. Data on adverse events in acute-care hospitals in Australia, Denmark, the United Kingdom and the United States of America

	Study	Year in which data was collected	Number of hospital admissions	Number of adverse events	Adverse event rate (%)
1	USA (Harvard Medical Practice Study)	1984	30 195	1 133	3.8
2	USA (Utah–Colorado study)	1992	14 565	475	3.2
3	USA (Utah–Colorado study)[a]	1992	14 565	787	5.4
4	Australia (Quality in Australian Health Care Study)	1992	14 179	2 353	16.6
5	Australia (Quality in Australian Health Care Study)[b]	1992	14 179	1 499	10.6
6	UK	1999–2000	1 014	119	11.7
7	Denmark	1998	1 097	176	9.0

Source: World Health Organization, Executive Board 109th session, provisional agenda item 3.4, 5. 2001, EB 109/9 [19].

[a] Revised using the same methodology as the Quality in Australian Health Care Study (harmonizing the four methodological discrepancies between the two studies).

[b] Revised using the same methodology as the Utah–Colorado Study (harmonizing the four methodological discrepancies between the two studies).

Studies 3 and 5 present the most directly comparable data for the Utah–Colorado and Quality in Australian Health Care studies.

The studies listed in Table B.1.1 used retrospective medical record reviews to calculate the extent of patient injury as a result of health care [20-23]. Since then, Canada, England and New Zealand have published similar adverse event data [24]. While the rates of injury differ among the countries that publish data, there is unanimous agreement that the harm incurred is of significant concern. The catastrophic deaths that are reported in the media, while horrific for the families and health professionals involved, are not representative of the majority of adverse health-care events. Patients are more likely to suffer less serious, but nevertheless debilitating events, such as wound infections, decubitus ulcers and unsuccessful back operations [24]. Surgical patients are more at risk than others [25].

To assist the management of adverse events, many health systems categorize adverse events by level of seriousness. The most serious adverse events, which cause serious injury or death, are called *sentinel events*. In some countries, these are named the "*should never be allowed to happen*" events. Many countries now have, or are putting in place, systems to report and analyse adverse events. To further improve care over the long term, some countries have even mandated the reporting of sentinel events accompanied by root cause analyses (RCA) to determine the origin of each error. The reason for categorizing adverse events is to ensure that the most serious ones with the potential to be repeated are analysed using quality-improvement methods, and to make certain that the causes of the problem are uncovered and steps taken to prevent similar incidents. These methods are covered in Topic 7.

Table B.1.2. Some adverse events reported in Australia and the USA [19]

Type of adverse event	USA (% of 1 579 total events)	Australia (% of 175 total events)
Suicide of inpatient or within 72 hours of discharge	29	13
Surgery on wrong patient or body site	29	47
Medication error leading to death	3	7
Rape/assault/homicide in an inpatient setting	8	N/A
Incompatible blood transfusion	6	1
Maternal death (labour, delivery)	3	12
Infant abduction/wrong-family discharge	1	-
Retained instrument after surgery	1	21
Unanticipated death of a full-term infant	-	N/A
Severe neonatal hyperbilirubinaemia	-	N/A
Prolonged fluoroscopy	-	N/A
Intravascular gas embolism	N/A	-

Source: Runciman B, Merry A, Walton M. *Safety and ethics in health care: a guide to getting it right*, 2007 [24].

N/A indicates that this category is not on the official list of reportable sentinel events for that country.

Human and economic costs

There are significant economic and human costs associated with adverse events. The Australian Patient Safety Foundation estimated the costs of claims and premiums on insurance for large medical negligence suits in the state of South Australia to be about $18 million (Australian) for 1997–1998 [26]. The National Health Service in the UK pays around £400 million every year to settle clinical negligence claims every year [14]. In December 1999, the United States Agency for Healthcare Research and Quality (AHRQ) reported that preventing medical errors has the potential to save approximately US$ 8.8 billion per year. Also in 1999, the Institute of Medicine (IOM) in its seminal report *To err is human* estimated that between 44 000 and 98 000 people die each year from medical errors in hospitals alone, thus making medical errors the eighth leading cause of death in the USA. The IOM report also estimated that preventable errors cost USA about US$17 billion annually in direct and indirect costs.

The human costs in pain and suffering include loss of independence and productivity for both patients and their families and carers have not been calculated. While debates [27-31] within the medical profession about the methods used to determine the rates of injury and their costs to the health system continue, many countries have accepted that the safety of the health-care system is a priority area for review and reform.

Lessons about error and system failure from other industries

Large-scale technological disasters involving spacecraft, ferries, offshore oil platforms, railway networks, nuclear power plants a nd chemical installations in the 1980s led to the development of organizational frameworks for safer workplaces and safer work cultures. The central principle underpinning efforts to improve the safety of these industries was that accidents are caused by multiple factors, not single, isolated factors. Individual situational factors, workplace conditions and latent organizational factors and anagement decisions are commonly involved. Analyses of these disasters also showed that the more complex the organization, the greater potential for a larger number of system errors.

Turner, a sociologist who examined organizational failures in the 1970s, was the first to appreciate that tracing the "chain of events" was critical to understanding the underlying causes of an accident [32,33]. Reason's work on the cognitive theory of latent and active errors and risks associated with organizational accidents built on this research [34, 35]. Reason analysed the features of many of the large-scale disasters occurring in the 1980s and noted that latent human errors were more significant than technical failures. Even when faulty equipment or components were present, he observed that human action could have averted or mitigated the bad outcomes.

An analysis of the Chernobyl catastrophe [36] showed that organizational errors and violations of operating procedures that were typically viewed as evidence of a "poor safety culture" [37] at the Chernobyl plant were really organizational characteristics that contributed to the incident. The lesson learnt from the Chernobyl investigation was the critical importance of the extent to which a prevailing organizational culture tolerates violations of rules and procedures. This was also a feature of the events preceding the 'Challenger' shuttle crash [38]. The investigation of that crash showed how violations had become the rule rather than the exception. (The investigating commission found flaws in the shuttle design and poor communication may have also contributed to the crash.) Vaughan analysed the 'Challenger' crash findings and described how violations were the product of continued negotiations between experts searching for solutions in an imperfect environment with incomplete knowledge. Vaughan suggested that the process of identifying and negotiating risk factors leads to the normalization of risky assessments.

Table B.1.1. 'Challenger's' crash

Violations that could have led to the 'Challenger's' crash

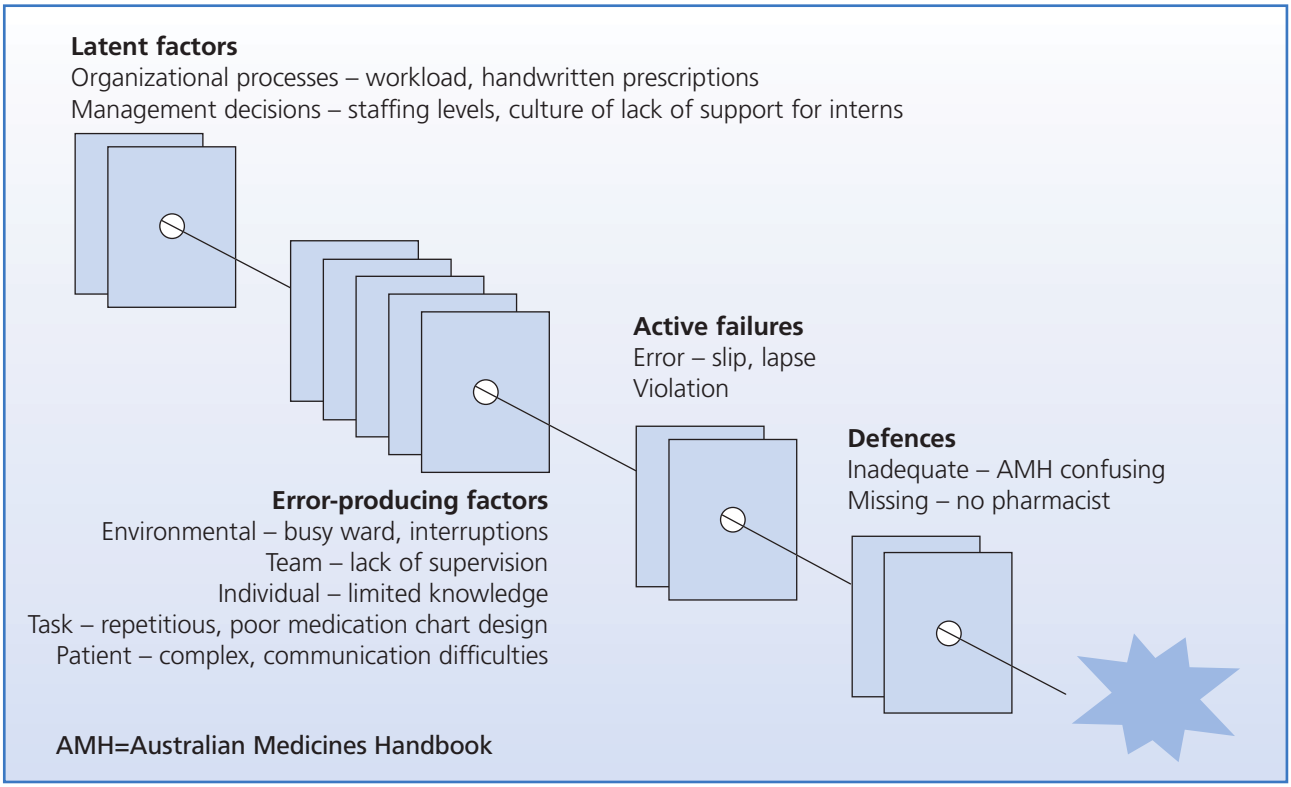
For nearly a year before the Challenger's last mission, engineers were discussing a design flaw in the field joints. Efforts were made to redesign a solution to the problem but, before each mission, officials from both NASA and Thiokol (the company that designed and built the boosters) certified that the solid rocket boosters were safe to fly. (See: McConnell M. Challenger: a major malfunction. London, Simon & Schuster, 1987:7). The Challenger completed nine previous missions before its fatal crash.

Reason [39] used these lessons from industry to make sense of the high number of adverse events in health-care environments. He stated that only a systems approach (as opposed to the more common person approach based on blaming individuals) will create a safer health-care culture, because it is easier to change the conditions people work under than it is to change human behaviour. To demonstrate a systems approach, he used industrial examples that show the benefits of built-in defences, safeguards and barriers. When a system fails, the immediate question should be why it failed rather than who caused it to fail. For example, which safeguards failed? Reason created the Swiss cheese model [40] to explain how faults in the different layers of a system can lead to accidents/mistakes/incidents.

Reason's Swiss cheese model below (Figure B.1.1) depicts the different kinds of factors (latent factors, error-producing factors, active failures and defences) associated with adverse events.

The diagram shows that a fault in one layer of the organization is usually not enough to cause an accident. Bad outcomes in the real world usually occur when a number of faults occur in a number of different layers (e.g. rule violations, inadequate resources, inadequate supervision and inexperience) and momentarily line up to permit a trajectory of accident opportunity. For example, if a junior doctor was properly supervised in a timely way, then a medication error might be avoided. To combat errors at the sharp end of the model, Reason invoked the "defence in-depth" principle [41], according to which successive layers of protection (understanding, awareness, alarms and warnings, restoration of systems, safety barriers, containment, elimination, evacuation, escape and rescue) are designed to guard against the failure of the underlying layer. The organization is designed to anticipate failure, thereby minimizing the hidden latent conditions that allow actual or "active" failures to cause harm.

Figure B.1.1. Swiss cheese model: steps and factors associated with adverse events 7



Source: Coombes ID et al. Why do interns make prescribing errors? A qualitative study. *Medical Journal of Australia*, 2008 (Adapted from Reason's model of accident causation) [41].

History of patient safety and the origins of the blame culture 8 9

The way we have traditionally managed failures and mistakes in health care has been based on the person approach–we single out the individuals directly involved in the patient care at the time of the incident and hold them accountable. This act of "blaming" in health care has been a common way for resolving problems. We refer to this as the "blame culture." Since 2000, there has been a dramatic increase in the number of references to the blame culture in the health literature [42]. This may be due to the realization that systemic improvements cannot be made as long as we focus on blaming individuals. This willingness to assign blame is thought to be one of the main constraints on the health system's ability to manage risk [40, 43-46] and improve care. For example, if a patient is found to have received the wrong medication and suffered a subsequent allergic reaction, we look for the individual student, pharmacist, nurse or doctor who ordered, dispensed or administered the wrong drug and blame that person for the patient's condition. Individuals who are identified as responsible are also shamed. The person responsible may receive remedial training, a disciplinary interview or be told never to do it again. We know that simply insisting that health-care workers try harder does not work. Policy and procedures may also be changed to help health-care workers avoid allergic reactions in patient. However, the focus is still on the individual staff member rather than on how the system failed to protect the patient and prevent the administration of the wrong medication.

Why do we blame?

A demand for answers as to why the adverse event occurred is not an uncommon response. It is human nature to want to blame someone and it is far more emotionally satisfying for everyone involved in investigating an incident if there is someone to blame. Social psychologists have studied how people make decisions about what caused a particular event, explaining it as attribution theory. The premise of this theory is that people naturally want to make sense of the world. So, when unexpected events happen, we automatically start trying to figure out their cause.

Pivotal to our need to blame is the belief that punitive action sends a strong message to others

that errors are unacceptable and that those who make them will be punished. The problem with this assumption is that it is based on a belief that the offender somehow chose to make the error rather than adopt the correct procedure: that the person intended to do the wrong thing. Because individuals are trained and/or have professional/organizational status, we think that they "should have known better" [47]. Our notions of personal responsibility play a role in the search for the guilty party. Professionals accept responsibility for their actions as part of their training and code of practice. It is easier to attribute legal responsibility for an accident to the mistakes or misconduct of those in direct control of the treatment than to those at the managerial level [47].

In 1984, Perrow [48] was one of the first to write about the need to stop "pointing the finger" at individuals when he observed that between 60% and 80% of system failures were attributed to "operator error" [5]. At that time, the prevailing cultural response to mistakes was to punish individuals rather than address any system-related problems that may have contributed to the error(s). Underpinning this practice was the belief that, since individuals are trained to perform tasks, a failure of a task must relate to a failure of individual performance deserving punishment. Perrow believed that these socio-technical breakdowns are a natural consequence of complex technological systems [31]. Others [49] have added to this theory by emphasizing the role of human factors at both the individual and institutional levels.

Reason [40], building on the earlier work of Perrow [48] and Turner [33], provided the following two-fold rationale for human error. Firstly, human actions are almost always constrained and governed by factors beyond the immediate control of the individual. For example, nursing students must follow policies and procedures developed by the nursing staff. Second, people cannot easily avoid actions that they did not intend to perform. For example, a dental student who may have intended to obtain consent from a patient for an operation might have been unaware of the rules for informed consent. A nursing student may not have understood the relevance of checking to make sure the signed consent form is on record before a procedure. Or, the patient may have indicated to a student that he/she did not understand what was signed and the student may not have mentioned this to the doctor.

Errors have multiple causes: personal, task-related, situational and organizational. For example, if a dental, medical or nursing student entered a sterile area without correctly scrubbing, it may be because the student was never shown the correct way or had seen others not comply with scrubbing guidelines. It is also possible that the cleaning agent may have run out or that the student was hurrying to respond to an emergency. Within a skilled, experienced and largely well-intentioned workforce, situations are more amenable to improvement than people. For example, if staff were prevented from entering theatres until appropriate cleansing techniques were followed, then the risk of infection would be diminished.

Reason warned against being wise after the event–so-called "hindsight bias"–because most people involved in serious accidents do not intend for anything to go wrong and generally do what seems like the right thing at the time, though they "may be blind to the consequences of their actions" [35].

Today, most complex industrial/high-technological managers realize that a blame culture will not bring safety issues to the surface [50]. While many health-care systems are beginning to recognize this, we have not yet moved away from the person approach–in which finger-pointing or cover-ups are common–toward an open culture in which processes are in place to identify failures or breaks in the "defences". Organizations that place a premium on safety routinely examine all aspects of their system in the event of an accident, including equipment design, procedures, training and other organizational features [51].

Violations

The use of a systems approach for analysing errors and failures does not imply a blame-free culture. In all cultures, individual health professionals are required to be accountable for their actions, maintain competence and practise ethically. In learning about systems thinking, students should appreciate that, as trusted health professionals, they are required to act responsibly and are accountable for their actions [44]. Part of the difficulty is that many health professionals break professional rules daily, such as using incorrect hand hygiene techniques or letting junior and inexperienced providers work without proper supervision. Students may see health-care professionals on the wards or in clinics who cut corners and think that this is the way that things are done. Such behaviours are not acceptable. Reason studied the role of violations

in systems and argued that, in addition to a systems approach to error management, we need effective regulators with the appropriate legislation, resources and tools to sanction unsafe clinician behaviour [40].

Reason defined a violation as a deviation from safe operating procedures, standards or rules [40]. He linked the categories of routine and optimizing violations to personal characteristics and necessary violations to organizational failures.

Routine violations

Professionals who fail to practise hand hygiene between patients because they feel they are too busy are an example of a routine violation. Reason stated that these violations are common and often tolerated. Other examples in health care would be inadequate information exchange between staff at the change of a shift (hand-offs or hand-overs), not following a protocol, and not attending on-call requests.

Optimizing violations

Senior professionals who let students perform a procedure without proper supervision because they are busy with their private patients are an example of an optimizing violation. This category involves violations in which a person is motivated by personal goals, such as greed or thrills from risk-taking, the performance of experimental treatments, and the performance of unnecessary procedures.

Necessary violations

Time-poor nurses and doctors who knowingly skip important steps in administering (or prescribing) medication, or a midwife who fails to record a woman's progress because of time constraints, are examples of necessary violations. A person who deliberately does something they know to be dangerous or harmful does not necessarily intend a bad outcome, but poor understanding of professional obligations and a weak infrastructure for managing unprofessional behaviour provide fertile ground for aberrant behaviour to flourish.

By applying systems thinking to errors and failures, we can ensure that when such an event occurs, we do not automatically rush to blame the people closest to the error. Using a systems approach, we can examine the entire system of care to find out what happened rather than who did it. Only after careful attention to the multiple factors associated with an incident can there be an assessment as to whether any one person was responsible.

A model of patient safety

The urgency of patient safety was raised over a decade ago, when the United States IOM convened the National Roundtable on Health Care Quality. Since then, debate and discussion about patient safety worldwide have been informed by lessons learned from other industries, the application of quality-improvement methods to measure and improve patient care, and the development of tools and strategies to minimize errors and failures. All of this knowledge has strengthened the position of the safety sciences in the context of health-care services. The need to improve health care by redesigning processes of care has been acknowledged by WHO and its representative countries, as well as by most health professions.

The emergence of patient safety as a discipline in its own right has been made possible thanks to other disciplines, such as cognitive psychology, organizational psychology, engineering and sociology. The application of theoretical knowledge from these disciplines has led to the development of postgraduate courses in quality and safety and patient safety education in prevocational and vocational programmes for health-care professions.

The application of patient safety principles and concepts in the workplace does not require health providers to have formal qualifications in quality and safety. Rather, it requires them to apply a range of skills and be aware of patient safety considerations in every situation, recognizing that things can go wrong. Health professionals should make a habit of sharing their experiences of adverse events. Today, increased emphasis is being put on being an effective team member, as we learn more about the role of accurate and timely communication in patient safety. Training to become an excellent team member starts in professional school. Learning how to substitute roles and appreciate the other's perspective is central to effective teamwork.

Leaders in patient safety have defined patient safety as follows:
"A discipline in the health-care sector that applies safety science methods towards the goal of achieving a trustworthy system of health-care delivery. Patient safety is also an attribute of health-care systems; it minimizes the incidence and impact of, and maximizes recovery from adverse events" [52].

This definition provides the scope for the conceptual model of patient safety. Emanuel et al. [47]

designed a simple model of patient safety. It divides health-care systems into the following four main domains:

1. those who work in health care;
2. those who receive health care or have a stake in its availability;
3. the infrastructure of systems for therapeutic interventions (health-care delivery processes);
4. methods for feedback and continuous improvement.

This model shares features with other quality-design models [53], including understanding the system of health care, recognizing that performance varies across services and facilities, understanding methods for improvement, including how to implement and measure change, and understanding the people who work in the system and their relationships with one another and with the organization.

How to apply patient safety thinking in all health-care activities

There are many opportunities for students to incorporate patient safety knowledge into their clinical and professional work.

Develop relationships with patients

Everyone, including health professional students, should relate and communicate with individual patients as unique human beings with their own experience of their disease or illness. The application of learned knowledge and skills alone will not necessarily result in the best outcomes for patients. Students also need to speak with patients about how they view their illness or condition and its impact on them and their families. Safe and effective care depends on patients disclosing their experiences of their illnesses, their social circumstances, their attitudes to the risks involved, and their values and preferences for how they wish to be treated.

Students and their instructors must ensure that patients understand that students are not qualified health-care professionals. When they are introduced to patients or their families, students should always be described as "students". It is important not to describe students as "junior dentists" or "junior nurses", "student doctors", "young pharmacists", "assistants" or "colleagues" as this can lead the patient to think that the student is qualified. Honesty is very important for patient safety. It is important that students advise patients of their correct status, even if that means correcting what their supervisor or instructor has said.

Sometimes instructors introduce students in a way that is designed to instil confidence in the student and the patient, without realizing that they may be stretching the truth in doing so. As it can be awkward to correct what the instructor has said at that point, it is a good idea to check with the instructor as to how he/she usually introduces students to patients beforehand, especially the first time you are working together. Students must clearly explain to patients and their families that they are in fact students.

Understand the multiple factors involved in failures

Students should look beyond a health-care mistake or failure in care and understand that there may be many factors associated with an adverse event. This will involve the students asking questions about the underlying factors and encouraging others to consider an error from a systems perspective. For example, they could be the first in a team meeting or discussion group to ask questions about possible causes of errors by using the phrase "what happened?", rather than "who was involved?". The five "whys" (keep on asking why something happened when given an answer) is a method used to keep discussions about causes focused on the system rather than the people involved.

Table B.1.2. The five "whys"

The five "whys"
Statement: The nurse gave the wrong drug.
Why?
Statement: because she misheard the name of the drug ordered by the doctor.
Why?
Statement: because the doctor was tired and it was the middle of the night and the nurse did not want to ask him to repeat the name.
Why?
Statement: because she knew that he has a temper and would shout at her.
Why?
Statement: because he was very tired and had been operating for the last 16 hours.
Why?
Because...

Avoid blaming when an error occurs
It is important that students support each other and their colleagues in the other health professions when they are involved in an adverse event. Unless students are open about errors, there will be little opportunity to learn from them. However, students are often excluded from meetings where discussions about adverse events are held. Also, some schools, hospitals and clinics may not hold such meetings. This does not necessarily mean that clinicians want to hide their errors; it may mean they are unfamiliar with patient safety strategies for learning from them. They may also have medico-legal fears and worry about possible interference from administrators. Fortunately, as patient safety concepts become more widely known and discussed in health care, more opportunities are arising for reviewing care and making the improvements necessary to minimize errors. Students can ask their supervisors if their organization conducts meetings or other peer-review forums, such as morbidity and mortality meetings in which adverse events are reviewed. Students, irrespective of their level of training and education, must appreciate the importance of reporting their own errors to their supervisors.

Practise evidence-based care
Students should learn how to apply evidence-based practices. They should be aware of the role of guidelines and appreciate how important it is to follow them. When a student is placed in a clinical setting, he/she should seek out information about the common guidelines and protocols that are used. These guidelines and protocols should be evidence-based whenever possible.

Maintain continuity of care for patients
The health system is made up of many parts that interrelate to produce a continuum of care for patients and families. Understanding the journey that patients make through the health-care system is necessary to understanding how the system can fail. Important information can be missed, outdated or incorrect. This can lead to inadequate care or errors. The continuity-of-care chain is then broken, leaving the patient vulnerable to a poor outcome.

Be aware of the importance of self-care
Students should be responsible for their own well-being and that of their peers and colleagues. Students should be encouraged to have their own doctors and be aware of their own health status. If a student is in difficulty (mental illness or drug or alcohol impairment), he/she should be encouraged to seek professional help.

Act ethically every day
Learning to be a good health-care professional requires observation of respected senior health professionals, as well as practical clinical experience involving patients. One of the privileges students have is the opportunity to learn by treating real patients. Most patients understand that students have to learn and that the future of health care depends on training. Yet, it is also important that students remember that their opportunity to interview, examine, and treat patients is a privilege that is granted by each individual. In most situations, patients cannot be examined by a student unless they have given their consent. Students should always ask permission from each patient before they physically touch or seek personal information from them. They should also be aware that patients may withdraw this privilege at any time and request that the student stop what he/she is doing.

Even in a teaching clinic, it is important that clinical instructors advise patients that their cooperation in educational activities is entirely voluntary. Clinical instructors and students must obtain verbal consent from patients before students' interview or examine them. When patients are asked to allow a student to examine them, they should be told that the examination is primarily for educational purposes. An example of appropriate wording of such a request is "would you mind if these students ask you about your illness and/or examine you so that they can learn more about your condition?"

It is important that all patients understand that their participation is voluntary and that a decision not to participate will not compromise their care. Verbal consent is sufficient for most educational activities, but there will be times when written consent is required. Students should make inquiries if they are in doubt about the type of consent required.

Particular care should be taken when involving patients in teaching activities because the benefit to the patient is secondary to the educational needs of the students. Patient care and treatment are usually not dependent on student engagement.

Explicit guidelines for health professional teachers and students provide protection for everyone. If no guidelines exist, it is a good idea to request that the faculty develop a policy on the relationship between students and

the patients they are allowed to treat. Properly designed guidelines will protect patients, promote high ethical standards and help everyone to avoid misunderstandings.

Most schools for the health-care professions are aware of the problem of the "hidden curriculum" in health-care education. Studies show that students on clinical placements have felt pressured to act unethically [54] and they report that these situations are difficult to resolve. All students and trainees potentially face similar ethical dilemmas. On the rare occasion where a clinical supervisor directs students to participate in patient management that is perceived to be unethical or misleading to the patient, faculty staff should deal with the matter. Many students may not be confident enough to raise such matters with their supervisors and are often unsure of how to act. Raising this issue in teaching about patient safety is very important. This role confusion can lead to student stress and can have a negative impact on morale and the development of the students' professionalism. It can also place patients at risk. Learning how to report concerns about unsafe or unethical care is fundamental to patient safety and relates to the capacity of the system to support reporting.

Students should be aware of their legal and ethical obligations to put the interests of patients first [12]. This may include refusal to comply with an inappropriate instruction or direction. The best way to resolve such a conflict (or at least gain a different perspective) is for the student to speak privately with the health professional or responsible staff person concerned. The patient should not be part of this discussion. The student should explain the problem(s) and why he/she is unable to comply with the instruction or direction. If the clinician or responsible staff person ignores the issues raised and continues to instruct the student to proceed, then discretion should be used as to whether to proceed or withdraw from the situation. If it is decided to continue, patient consent must be confirmed. If the patient does not consent, the student must not proceed.

If a patient is unconscious or anaesthetized and a supervisor asks a medical or nursing student to examine the patient, the student should explain why he/she cannot proceed unless the patient had given prior consent. It may be appropriate in such circumstances to discuss the situation with another person in the faculty or clinic. If students are uncertain about the propriety of the behaviour of any other person involved in patient care, they should discuss the matter with a senior faculty member of choice.

All students who feel that they have been subjected to unfair treatment because of their refusal to do something that seems to be wrong should seek advice from senior supervisors.

Recognize the role of patient safety in the delivery of safe health care

The timing of a student's entry into a clinical environment or the workplace varies across training programmes. Prior to entering a clinical environment, students should ask questions about other parts of the health system that are available to the patient and ask for information about the processes that are in place to identify adverse events.

Ask questions about other parts of the health system that are available to the patient.

The success of a patient's care and treatment depends on understanding the total health system available to the particular patient. If a patient comes from an area in which there is no refrigeration, then sending that patient home with insulin that needs refrigeration will not assist the patient. An understanding of systems (Topic 3) will help the student appreciate how different parts of the health system are connected and how continuity of care for the patient is dependent on all parts of the system communicating in an effective and timely manner. → T3

Ask for information about the processes that are in place to identify adverse events.

Most hospitals or clinics will have a reporting system to identify adverse events. It is important that students be aware of these events and understand how they are managed by the clinic. If there are no reporting requirements in place, the student can ask the appropriate people how such events are managed. At the very least, this may generate some interest in the topic. (Reporting and incident management are covered in Topics 3, 4 and 6). → T3 T4 T6

Teaching strategies and formats

The prevalence data used in this topic have been published in the literature and cover a number of different countries. Some instructors may wish to make the case for patient safety using prevalence data from their own country. If such data is not available in the professional literature, some relevant data may be available through

databases maintained by the local health service. For example, there are many trigger tools freely available on the World Wide Web for the measurement of adverse events that are designed to help health-care professionals measure their adverse event rates. If there are no general measures available for a particular country or institution, teachers may want to look for data for one area of care, such as infection rates. Infection rates in a particular country may be available and this could be used to demonstrate the extent of transmission of potentially preventable infections. There may also be literature about adverse events associated with your specific profession.
It is appropriate to use these data in teaching.

This topic can be broken up into sections to be included in existing curricula. It can be taught in small groups or as a stand-alone lecture. If the topic is being delivered as a lecture, then the slides at the end of the topic may be helpful for presenting the information.

Part A of the Curriculum Guide sets out a range of teaching methods for patient safety, since lectures are not always the best approach.

Small group discussion 

Instructors may wish to use any of the activities listed below to stimulate discussion about patient safety. Another approach is to have one or more students prepare a seminar on the topic of patient safety using the information in this topic. They could then lead a discussion about the areas covered in the topic. The students could follow the headings outlined below and use any of the activities listed below to present the material. The tutor facilitating this session should also be familiar with the content, so that information can be added about the local health system and clinical environment.

Ways to teach about harm caused by adverse health-care events and system failures:
- use examples from the media (newspapers and television);
- use de-identified case examples from your own hospitals and clinics;
- use a case study to construct a flowchart of a patient's journey;
- use a case study to brainstorm all of the things that went wrong and the times when a particular action might have prevented the adverse outcome;
- invite a patient who has experienced an adverse event to talk to students.

Ways to teach the differences between system failures, violations and errors:
- use a case study to analyse the different avenues for managing an adverse event;
- have students participate in or observe a root cause analysis;
- have students describe the effect of not using an interdisciplinary team approach.

An interactive/didactic session 

Invite a respected senior health professional from within your institution or country to talk about health-care errors in the workplace. If no one is available, then use a video of an influential and respected practitioner talking about errors and how the system of health care exposes everyone to them. Video clips of speeches that have been made by patient safety leaders are available on the Internet. Listening to someone talk about errors and how they affect patients and staff is a powerful introduction to patient safety. Students can be encouraged to respond to the presentation. The instructor can then go through the information in this topic to demonstrate to students how and why attention to patient safety is essential for safe clinical practice.

PowerPoint slides or overhead projector slides can be used. Start the session with a case study and ask the students to identify some of the issues presented in that scenario. Use the accompanying slides at the end of this topic as a guide.

Other ways to present different sections of this topic are listed below.

Lessons about error and system failure from other industries
- Invite a professional from another discipline, such as engineering or psychology, to talk about system failures, safety cultures and the role of error reporting.
- Invite someone from the aviation industry to talk about that industry's response to human errors.

History of patient safety and origins of the blame culture
- Invite a senior respected clinician to talk about the damage caused by blaming.
- Invite a quality and safety officer to discuss systems in place to minimize errors and manage adverse events.

Simulation 

Different scenarios could be developed concerning adverse events and the need to report and analyse errors. For each scenario, have students identify where the system broke down, how the problem

could have been prevented and steps that should to be taken if such an error occurs in the future.

Other teaching and learning activities
There are many other opportunities for students to learn about patient safety. The following are examples of activities that students could perform, either alone or in pairs:

- follow a patient on his/her journey through the health-care service;
- spend a day with a health professional from a different discipline and identify the main role and functions of that profession;
- routinely seek information about the illness or condition from the patients' perspective as you interact with them;
- inquire whether your school or health service has processes or teams to investigate and report on adverse events. If practical, ask students to seek permission from the relevant supervisor to observe or take part in these activities;
- find out whether your school conducts mortality and morbidity meetings or other peer-review forums in which adverse events are reviewed and/or quality-improvement meetings;
- discuss clinical errors they have observed using a no-blame approach;
- inquire about a main protocol used by the staff in a clinical setting in which they have been placed. Students should ask how the guideline was written, how staff know about it, how to use it, and when to deviate from it.

Case studies

Caroline's story is described at the beginning of this topic. This case illustrates the importance of continuity of care and how a system of care can go badly wrong.

From the birth of her child to her death 25 days later, Caroline was admitted to four different hospitals and, therefore, there was a need for proper continuity of care in the hand-over of responsibilities from each set of medical and nursing staff to another. The failure to keep adequate notes with provisional/differential diagnoses and investigations and provide discharge summaries and referrals led to a delay in the diagnosis of a life-threatening abscess and, ultimately, to Caroline's death.

Ask students to read the case and to identify some of the underlying factors that may have been present during her care and treatment.

Dental student under pressure
This case illustrates how a chain of events can lead to unintended harm. In this case, the number of fillings, the closeness of the caries to the pulp, and multiple missed opportunities by health-care staff to check the patient's blood pressure all contributed to the adverse event.

Peter, a 63-year-old man with a history of hypertension and heart attack, was scheduled to have several tooth fillings. On the morning of his appointment at the dental clinic he took his usual antihypertensive and anticoagulant medicines.

At the clinic, the dental student greeted Peter and proceeded to do the fillings. The dental student sought his supervisor's permission to give dental anaesthesia to Peter, but he failed to check his vital signs prior to administering the anaesthetic. He administered two capsules of 2% lidocaine with 1:100 000 epinephrine and proceeded to remove caries in two upper teeth. In one of these teeth, the caries turned out to be very close to the pulp. A third capsule was administered before a lunch break.

Peter returned in the afternoon to have more fillings done. The student sought permission from his supervisor to carry out mandibular anaesthesia, but again failed to check the patient's vital signs. In all, the patient received five capsule-syringe cartridges of anesthetic (1.8 mL each) for a total of 180 mg lidocaine and 0.09 mg epinephrine over six hours. At 3pm, Peter began to feel uncomfortable and was flushed and diaphoretic (perspiring). His blood pressure was 240/140 and his pulse was 88. The student contacted his supervisor and they called for an ambulance. Paramedics arrived and Peter was taken to the emergency department of the nearest hospital for treatment of his hypertensive emergency.

Questions

– What factors may have contributed to the dental student not checking Peter's vital signs at any point during the day?

– Did the student tell the supervisor about Peter's medical history? Had it become routine to skip checking vital signs in that clinic?

– What systems could be put in place to prevent this type of incident in the future?

Source: Case supplied by Shan Ellahi, Patient Safety Consultant, Ealing and Harrow Community Services, National Health Service, London, UK.

Patient safety in a midwifery context
This case deals with practice realities and the consequences of overlooking important results.

Mary was a woman in her 26th week of pregnancy and had just started antenatal classes. She was taking iron supplements for her mild anaemia which caused her occasional constipation. This was treated by Mary changing her diet. She also had several vaginal infections during her pregnancy, but nothing severe.

At the beginning of her 27th week, Mary's abdominal cramps were worsening, so she called her midwife. The midwife performed a vaginal examination and determined that the cervix was of moderate consistency, mid-position, closed and 1 cm long, but the midwife did not ask any questions beyond how long she had the cramping. She made a diagnosis and told Mary that she was experiencing Braxton-Hicks contractions. The midwife gave her another appointment to be seen in two days.

At the visit two days later, Mary said the abdominal cramping had stopped, but that she had some bleeding and was feeling very tired. The midwife told Mary that a small amount of bleeding is normal after a vaginal examination and that she should be resting more.

Four days following her last visit, Mary noticed that she had increased vaginal secretions. She had sporadic cramps and so she contacted her midwife again by telephone. The midwife again reassured Mary that the cramps were due to constipation and explained that increased vaginal secretions are normal during pregnancy. A few hours later, Mary developed stronger, more regular uterine contractions and was taken to the maternity hospital for preterm labour and gave birth to a premature baby girl.

Twelve hours after birth, the baby girl was diagnosed with pneumonia. This infection was caused by *Streptococcus agalactiae* (Group B *Streptococcus*), diagnosed from the vaginal swabs taken just prior to birth at the time of admission to hospital.

Questions
– What factors may have been present that led the midwife to maintain her original diagnosis?

– What were the underlying system factors that may have been associated with Mary having a premature baby with pneumonia?

Source: Case supplied by Teja Zaksek, Senior Lecturer and Head of Teaching and Learning, Midwifery Department, University of Ljubljana Health Faculty, Ljubljana, Slovenia.

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Assessing this topic

A range of assessment methods are suitable for this topic, including essay questions, multiple-choice questions (MCQ), short best answer questions (BAQ), case-based discussion (CBD), and self-assessment. Logs and journals can also be used. Encourage students to develop a portfolio approach to learning about patient safety. The benefit of a portfolio approach is that each student will have a collection of their patient safety activities at the end of the patient training programme that they may be able to use in job applications and in their future careers.

The assessment of knowledge of the potential harm to patients, the lessons from other industries, violations and the blame-free approach and models for thinking about patient safety can all be assessed using any of the following methods:

- portfolio
- CBD
- objective structured clinical examination (OSCE) station
- written observations about the health system and the potential for error (in general).

Students can also be asked to write reflective statements about the topics, for example:

- effects of adverse events on patients' trust in health care;
- the community response to media stories about patient harm and negligence;
- the role of health professionals in mentoring students and the role of patients in the health-care system.

The assessment can be either formative or summative; rankings can range from satisfactory/unsatisfactory to giving a mark. Please refer to the section in the Teacher's Guide (Part A) on the type of assessment suitable for patient safety topics. Examples of some of these assessment methods are also provided in Part B, Annex 2.

Evaluating the teaching of this topic

Evaluation is important in reviewing how a teaching session went and how improvements can be made. See the Teacher's Guide (Part A) for a summary of important evaluation principles.

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Slides for Topic 1: What is patient safety?

Didactic lectures are not usually the best way to teach students about patient safety. If a lecture is being considered, it is a good idea to plan for student interaction and discussion during the lecture. Using a case study is one way to generate group discussion. Another way is to ask the students questions about different aspects of health care that will bring out the issues contained in this topic, such as the blame culture, the nature of error, and how errors are managed in other industries.

The slides for Topic 1 are designed to help the teacher deliver the content of this topic. The slides can be changed to fit the local environment and culture. Instructors do not have to use all of the slides and it is best to tailor the slides to the content being covered in the teaching session.

All drug names used are according to the *WHO International Nonproprietary Names for Pharmaceutical Substances* (http://www.who.int/medicines/services/inn/en/; accessed 24 March 2011).

Topic 2
Why applying human factors is important for patient safety

An unaccounted retractor

Suzanne's medical history included four caesarean sections in a 10-year period. The second and third operations were performed at hospital B, and the fourth at hospital C. Two months after her fourth caesarean, Suzanne presented to hospital C suffering severe anal pain.

A doctor performed an anal dilation under general anaesthesia and retrieved a surgical retractor from the rectum that was 15 cm long by two cm wide, with curved ends. It was of a type commonly used by hospitals in the area and the engraved initials indicated it came from hospital B. The doctor thought that the retractor had been left inside Suzanne after one of her caesareans and it had worked its way gradually through the peritoneum into the rectum.

During her fourth caesarean, the surgeon noted the presence of gross adhesions, or scarring, to the peritoneum, whereas no scarring had been observed by the doctor who had performed the third caesarean two years earlier. While it is not known for certain what had occurred, the instrument was most likely to have been left inside Suzanne during her third caesarean and remained there for more than two years.

Source: *Health Care Complaints Commission Annual Report 1999–2000*, New South Wales Government (Australia), 2001:58.

Introduction–Why applying human factors is important 

The study of human factors examines the relationship between human beings and the systems with which they interact [1] by focusing on improving efficiency, creativity, productivity and job satisfaction, with the goal of minimizing errors. A failure to apply human-factors principles is a key aspect of most adverse events (harm to patients) in health care. Therefore, all health-care workers need to have a basic understanding of human-factors principles. Health-care workers who do not understand the basics of human factors are like infection control professionals who do not understand microbiology.

Keywords
Human factors, ergonomics, systems, human performance.

Learning objectives 

Students should understand the relationship between human factors and patient safety and apply this knowledge in the clinical/professional setting.

Learning outcomes: knowledge and performance

Knowledge requirements 

Students need to know the meaning of the term *human factors* and understand the relationship between human factors and patient safety.

Performance requirement 

Students need to apply their knowledge of human factors in their work environment.

Box B.2.1 below, published by the Australian Commission on Safety and Quality in Health Care, answers some basic questions about human factors and its relationship to health care.

Box B.2.1. Basic questions about human factors in health care

Human factors in health care

Q. What does the term "human factors" mean?
A. Human factors apply wherever humans work. Human factors acknowledges the universal nature of human fallibility. The traditional approach to human error might be called the "perfectibility" model that assumes that if workers care enough, work hard enough, and are sufficiently well trained, errors will be avoided. Our experience, and that of international experts, tells us that this attitude is counter-productive and does not work.

Q. What does the study of human factors involve?
Human factors is a discipline that seeks to optimize the relationship between technology and humans, applying information about human behaviour, abilities, limitations, and other characteristics to the design of tools, machines, systems, tasks, jobs and environments for effective, productive, safe and comfortable human use.

Q. Why is the issue of human factors in health care important?
A. Human factors issues are major contributors to adverse events in health care. In health care and other high-risk industries, such as the aviation industry, human factors can have serious and sometimes fatal consequences. However, the health-care system can be made safer by recognising the potential for error, and by developing systems and strategies to learn from mistakes so as to minimize their occurrence and effects.

Q. Is it possible to manage human factors?
A. Yes, management of human factors involves the application of proactive techniques aimed at minimizing and learning from errors or near misses. A work culture that encourages the reporting of adverse events and near misses in health care allows the health-care system and patient safety to improve.

Aviation is a good example of an industry that has embraced the study of human factors as an approach to improving safety. Since the mid-1980's, aviation has accepted human fallibility as inevitable and, rather than demand constant perfection that is not sustainable and publicly punishing error, this industry has designed systems to minimize the impact of human error. The aviation safety record is now a testament to this approach–despite an average of 10 million take-offs and landings annually, there have been fewer than 10 fatal crashes a year worldwide in commercial aviation since 1965, and many of these have occurred in developing nations.

Source: *Human factors in health care*. Australian Commission on Safety and Quality in Health Care, 2006 (http://www.health.gov.au/internet/safety/publishing.nsf/Content/6A2AB719D72945A4CA2571C5001E5610/$File/humanfact.pdf; accessed 21 February 2011).

Human factors and ergonomics

The terms *human factors* and *ergonomics* are used to describe interactions between individuals at work, the task at hand, and the workplace itself. These terms may be used interchangeably.

The study of human factors is an established science that uses many disciplines (such as anatomy, physiology, physics and biomechanics) to understand how people perform under different circumstances. We define human factors as: *the study of all the factors that make it easier to do the work in the right way.*

Another definition of human factors is the study of the interrelationship between humans, the tools and equipment they use in the workplace, and the environment in which they work [1].

Application of human factors knowledge

One can apply human factors knowledge wherever humans work. In health care, knowledge of the effects of human factors can help us to design processes that make it easier for health-care providers to do their jobs correctly. The application of human-factors principles is highly relevant to patient safety because, embedded in the discipline of human factors engineering, are the basic sciences of safety. Human factors principles can help us to make sure we use safe prescribing and dispensing practices, communicate well in teams, and effectively share information with other health-care professionals and patients. These tasks, once thought to be basic, have become quite complicated as a result of the increasing complexity of health-care systems. Much of health care is dependent on the professionals providing the care. Human factors experts believe that mistakes can be reduced by focusing on health-care providers and studying how they interact with and as part of their environments. The application of human factors principles can make it easier for health-care providers to care for patients.

Human factors principles can be applied in any environment and industries such as aviation, manufacturing, and the military have been applying knowledge of human factors to improve systems and services for many years [2].

Lessons and examples from other industries show that, by applying human-factors principles, we can improve work processes in health care. For example, the underlying causes of many adverse events relate to miscommunication between people in the system and their actions. Many people think that communication difficulties among members of health-care teams are related to the fact that each person has a number of tasks that need to be performed at one time. Human-factors engineering research shows that what is important is not the number of tasks that need to be completed, but the nature of those tasks. A professional may be able to explain the steps in a simple procedure to a student while he/she is performing that procedure but, in a complicated case, he/she may not be able to do so while concentrating on the task at hand. An understanding of human factors and adherence to human factors principles is fundamental to the discipline of patient safety [3].

Human factors experts help make it easier for the widest range of health-care providers to perform at their best while caring for patients. This is important because the goal of good human-factors design is to accommodate all the individuals who use and interact with the system. This means thinking about system-design issues not only in terms of the vulnerability of patients, anxious family members and calm, rested, experienced clinicians, but also inexperienced health-care workers who might be stressed, fatigued and rushing.

Human factors experts use evidence-based guidelines and principles to design ways to make it easier to safely and efficiently complete tasks such as: (i) prescribing and dispensing medications; (ii) handing-off (handing-over) information; (iii) moving patients, (iv) charting medications and other orders electronically; and (v) preparing medications. If these tasks were made easier for health-care practitioners, then those practitioners would be able to provide safer health care. These tasks require design solutions that include software (computer order entry systems and programmes to support dispensing), hardware (IV pumps), tools (scalpels, syringes, patient beds) and the appropriate physical layout of work areas, including proper lighting. The technological revolution in health care has increased the relevance of human factors in errors because the potential for harm is great when technology and health-care devices are mishandled [3]. Knowledge of human factors also allows better understanding of the impact of fatigue on humans. Tired health-care professionals are more prone to memory lapses and mistakes because fatigue can impair performance and produce mood swings, anxiety, depression and anger [4, 5]. If a nurse has to work an extra shift because of staff shortages, then one might predict that the nurse will be sleep-deprived and more prone to errors.

In its broadest sense, the study of human factors incorporates human–machine interactions (including equipment design) as well as human–human interactions, such as communication, teamwork and organizational culture. Human-factors engineering seeks to identify and promote the best fit between people and the environment within which they live and work, especially in relation to the technology and physical design features present in their work environment.

This field recognizes that the workplace needs to be designed and organized to minimize the likelihood of errors and the impact of errors

when they do occur. While we cannot eliminate human fallibility, we can act to moderate and limit risks.

Note that the study of human factors is not as *directly* about humans as the name might suggest. However, it is about understanding human limitations and designing the workplace and the equipment we use to allow for variability among humans and their activities.

Knowing how fatigue, stress, poor communication, disruption and inadequate knowledge and skill affect health professionals is important because it helps us to understand predisposing characteristics that may be associated with adverse events and errors. The fundamental basis of the study of human factors relates to the issue of how human beings process information. We acquire information from the world around us, interpret and make sense of it and then respond to it. Errors can occur at each step in this process (see Topic 5). → T5

Human beings are not machines; machines, when maintained properly, are on the whole very predictable and reliable. In fact, compared to machines, humans are unpredictable and unreliable, and our ability to process information is limited due to the capacity of our working memory. However, human beings are very creative, self-aware, imaginative and flexible in their thinking [6].

Human beings are also distractible, which is both a strength and a weakness. Distractibility helps us notice when something unusual is happening. We are very good at recognizing and responding to situations rapidly and adapting to new situations and new information. However, our ability to be distracted also predisposes us to error because, when we are distracted, we may not pay attention to the most important aspects of a task or situation. Consider a medical or nursing student taking a blood sample from a patient. As the student is in the process of cleaning up after taking the blood sample, a patient in a neighbouring bed calls out for assistance. The student stops what he/she is doing, goes to help that patient, and forgets that the tubes of blood are not labelled. Or consider a pharmacist who is taking a medication order over the telephone and is interrupted by a colleague asking a question. In such a situation, the pharmacist may mishear the person on the other end of the line or fail to check the medication or dosage as a result of the distraction.

Our brain can also play "tricks" on us by misperceiving the situation, thereby contributing to the occurrence of errors.

The fact that we can misperceive situations, despite the best of intentions, is one of the main reasons that our decisions and actions can be flawed, thus resulting in "silly" mistakes– regardless of experience level, intelligence, motivation or vigilance. In health-care settings, we describe these situations as errors and these errors may have consequences for patients.

These are important considerations to recognize because they are reminders that making errors is not so much bad as *inevitable*. In simple terms, error is the downside of having a brain. Reason [6] described *error* as the failure of a planned action to achieve its intended outcome or the difference between what was actually done and what should have been done.

The relationship between human factors and patient safety

It is important for all health-care workers to be mindful of situations that increase the likelihood of error for human beings [7]. This is especially important for students and other inexperienced junior staff.

A number of individual factors affect human performance, thereby predisposing a person to error. Two factors with the greatest impact are fatigue and stress. There is strong scientific evidence linking fatigue and impaired performance making it a known risk factor in patient safety [8]. Prolonged work has been shown to produce the same deterioration in performance as a blood alcohol level of 0.05 mmol/l, which would make it illegal to drive a car in many countries [9].

The relationship between stress and performance has also been confirmed through research. While high stress levels are something that everyone can relate to, it is important to recognize that low levels of stress are also counterproductive, as they can lead to boredom and failure to attend to a task with appropriate vigilance.

The aviation industry requires individual pilots to use a number of personal checklists to monitor

their performance–an approach that health-care workers could easily adopt. All health-care workers should consider using a series of personal error-reduction strategies to ensure that they perform optimally at work.

The acronym IM SAFE (illness, medication, stress, alcohol, fatigue, emotion) that was developed in the aviation industry is useful as a self-assessment technique to determine whether a person is safe for work when they enter the workplace each day. (This tool is discussed further in Topic 5). → T5

Putting knowledge of human factors into practice

There are a number of ways that students can put their knowledge of human factors into practice as they care for patients.

Apply human factors thinking to the work environment [10]
Students can apply human factors thinking as soon as they enter a clinical teaching environment. In addition, the following tips are known to limit the potential for human error.

Avoid relying on memory
To do well in examinations, students must remember lots of facts and information. This is fine for examinations but, when it comes to treating patients, relying solely on memory is dangerous, particularly when the result may be a patient receiving a wrong drug or dosage. Students should look for pictures and diagrams of the steps involved in a treatment process or procedure. Checking one's actions against a picture or diagram can reduce the load on the working memory, freeing the student to focus on the task at hand, such as taking a medical history or administering an appropriate drug.

This is a major reason that protocols are so important in health care–they reduce reliance on memory. On the other hand, having too many protocols is unhelpful, especially if they are not updated in a timely manner or are not evidence-based. Students should ask about the main protocols used in the setting in which they are working, so that they can become familiar with them. It is important to check when the protocols were last reviewed. Finding out more about the process by which protocols are updated reinforces the important point that to be effective, a protocol must be a living document.

Make things visible
Students will observe that many wards and clinics have equipment that is necessary for diagnosing, treating and following-up with patients (e.g. X-ray units, infusion pumps, electric scalpels, oxygen tubes). Many students will be required to use such equipment. Again, the use of pictures and notices about the steps involved in switching these devices on and off and reading the displays will help the student master the skills involved. Another good example of the use of visual reminders is the use of pictorial reminders for staff and patients concerning hand hygiene.

Review and simplify processes
Simple is better. This statement applies to all walks of life, including health care. Some health-care tasks have become so complicated that they are a recipe for error–examples include hand-off (or hand-over) and discharge processes. Making hand-offs simpler by implementing communication strategies that are purposeful, fewer in number and involve the patient will reduce errors. Students can help simplify communication processes by repeating back instructions and ensuring that they understand any protocols being instituted. If there is no protocol for hand-offs, for example, the student could ask how the different health-care professionals ensure that the information they are attempting to communicate is received and understood correctly and how they are confident the patient has been treated correctly, as well as being sure that the patient or their carer has received accurate and timely information.

Other examples of simplifying processes could include: (i) limiting the range of drugs available for prescribing; (ii) restricting the number of different dosage preparations of the drugs that are available; and (iii) maintaining inventories of frequently administered drugs.

Standardize common processes and procedures
Even students who work in only one facility may observe each department or clinic doing certain things differently. This means that they have to relearn how things are done when moving to each new area. Health-care facilities that have standardized the way they do things (where appropriate) help staff by reducing their reliance on memory–this also improves efficiency and saves time. Discharge forms, prescribing conventions and types of equipment can all be standardized within a hospital, region or even a whole country.

Routinely use checklists
The use of checklists has been successfully applied in many areas of human endeavour, such as studying for examinations, travelling and shopping. Following the recent publication of results of research commissioned by WHO in the *New England Journal of Medicine* regarding the use of a safe surgery checklist [11], the use of checklists is now common in many health-care activities. Students should get into the habit of using checklists in their practice, particularly when there is an evidence-based way of selecting or implementing treatment.

Decrease reliance on vigilance
Humans quickly become distracted and bored if there is not much going on. Students should be alert to the potential for error when they are involved in lengthy repetitive activities. In such situations, most of us will pay decreased attention to the task at hand, particularly if we become tired. Our efforts to stay focused will fail at some point.

Summary 

In summary, the lessons from the study of human factors in other industries are relevant to patient safety in all health-care environments. This includes understanding the interactions and interrelationships between humans and the tools and machines they use. Understanding the inevitability of error and the range of human capabilities and responses in any given situation is essential to knowing how the application of human-factors principles can improve health care.

Teaching strategies and formats

This topic is likely to be very new for most people, so it is probably a good idea to first present it as a stand-alone topic. This topic provides an opportunity for imaginative and creative teaching in the clinical environment and is ideally taught using practical exercises rather than didactic lectures. Many faculty staff will not be familiar with this area and may wish to involve teachers from other faculties such as engineering or psychology. These faculties may have experts in human factors engineering who will be able to give an introductory lecture of the principles.

Lecture for general introduction 
Because this topic will be new knowledge for the students it may be appropriate to invite an expert in human factors to give a lecture on the underlying principles. Experts in human factors are usually found in the disciplines of engineering or psychology. Some of these disciplines have incorporated health care into their field. There may also be a clinician who has studied human factors and applied that knowledge to their practice. Invite a suitable person to give a lecture to cover the basic knowledge, using health-care case studies in their presentations.

Individual and small group activities 
Instructors may choose to use practical exercises that explore the human-factors considerations of common clinical equipment. Good and poor examples illustrating human-factors principles can be found in any and every clinical environment. Additionally, instructors might ask students to consider the impact of human factors in nonclinical areas, such as their personal lives, relationships at school and past employment.

Examples:

1. Request students to examine equipment in various parts of the facility in which they are working (e.g. rehabilitation unit, emergency department, clinic, intensive care unit (ICU), radiology department, pharmacy, dental surgery).

- Which area has the most equipment? What are the hazards associated with using a single piece of equipment to treat multiple patients? Is the equipment well-maintained? How do human factors affect the effective, safe functioning of the equipment?

- For the various pieces of equipment they discover, consider the following:
  - How easy is it to find the on/off switch?
  - How easy is it to work out how the equipment works?
  - Are senior students, faculty and technicians struggling to work out how to use the equipment?

2. Consider the practical use of alarms.
   - How often do the alarms on different sorts of equipment go off?
   - How often are alarms ignored?
   - What happens when the alarm is suspended and is it clear how long it is suspended for?
   - Is silencing the alarm an "automatic" response or is there a systematic approach to finding its cause?

3. Consider how the design of a piece of equipment is related to safety. For example, how easy is it to programme a particular infusion pump correctly?

– What hazards are associated with having more than one type of infusion pump in the same work area/facility?

4. Design a checklist for performing an urgent clinical procedure.

Use the investigation of an adverse event to review human-factors issues (see Topic 5: *Learning from errors to prevent harm*).

Case studies

The following cases illustrate how fatigue can compromise the safety of care provided by health-care workers.

Nurses: Too Tired To Be Safe?

Tuesday, July 20, 2004

The News. What's true of doctors is true of registered nurses: Those who routinely work long, often unpredictable hours, such as shifts that exceed 12 hours, make more mistakes than those who work fewer hours.

That's the conclusion of a federally funded study in the July/August issue of the journal *Health Affairs*. The study is one of the first to examine the relationship between medical errors and fatigue among registered nurses, who provide most of the direct care to hospital patients.

The Study. Ann Rogers, an associate professor at the University of Pennsylvania School of Nursing, and her colleagues studied 393 nurses who worked full time in hospitals around the country. Nearly all were female and most were white, middle-aged, employed by large urban hospitals and had more than a decade of experience.

For two weeks, each nurse kept a detailed log of her hours, breaks and mistakes. Overall, 199 errors and 213 near-errors were detected, usually by the nurses themselves. Most errors or near-errors involved medication, including the wrong drug, wrong dose, wrong patient, wrong method of administration, wrong time or failure to give it altogether.

Errors and near-errors increased when nurses' shifts exceeded 12 hours per day, when their work weeks exceeded 40 hours or when they worked unplanned overtime at the end of a regular shift. "Nurses are no different than other occupational groups" Rogers said. "When they work longer hours, the risk of errors goes up."

The Impact on Patients. Like previous studies of medical residents, this one did not attempt to link errors directly to patient harm. An earlier study conducted in Pennsylvania found that adding an extra surgical patient to a nurse's workload increased her patients' chances of dying or suffering a serious complication.

And More Broadly. Concern about the prevalence of medical errors and the effects of fatigue on doctors-in-training have led to new rules in some specialties that limit their work weeks to 80 hours and shifts to a maximum of 24 hours. Some states are considering imposing limits on nurses' shifts, which have lengthened in the past decade because of staff cutbacks by hospitals as well as a nationwide nursing shortage.

Source: Goodman SG. *Nurses: too tired to be safe?* Washington Post. Tuesday, 20 July 2004.

Activity

– Ask students to read the article published in the *Washington Post* and reflect on possible factors that might be associated with tired nurses.

Sleep-deprived health-care worker

After completing her 36-hour work shift at a large academic medical centre, a first-year internal medicine resident got into her automobile to drive home. En route, the resident fell asleep

behind the wheel of her car and struck a car driven by a 23-year-old woman who sustained a head injury that left her permanently disabled.

The injured woman (plaintiff) filed a medical malpractice lawsuit against the medical centre, alleging that the centre "*knew, or should have known, that the resident had worked 34 of the 36 hours she had been on duty and that it knew, or should have known, that the resident therefore was tired from the excessive hours she worked and left the hospital with impaired judgment because she was deprived of sleep.*"

Questions

– Have you encountered a similar situation with any of your peers or co-health workers?

– If you encounter a similar situation, how would you advise this resident after completing a 36-hour work shift?

– Do you agree that the medical centre is liable for the injuries sustained by the woman?

– What measures would you suggest to prevent similar incidents from occurring?

Source: Case supplied by Professor Armando C. Crisostomo, Division of Colorectal Surgery, Department of Surgery, University of the Philippines Medical College/ Philippines General Hospital, Manila, The Philippines.

A swab left behind after an episiotomy

This case illustrates a failure in checking protocols in operating theatres.

Sandra, a 28-year-old woman, consulted her obstetrician complaining of a three-day history of foul-smelling vaginal discharge. Sandra had given birth to a baby boy 10 days earlier. She required an episiotomy during the delivery process. The obstetrician suspected a urinary tract infection and prescribed a five-day course of antibiotics.

Sandra returned to see the obstetrician a week later with the same symptoms. She had completed the course of antibiotics. Vaginal examination revealed tenderness at the episiotomy site and some swelling. The obstetrician went through Sandra's case notes in detail, looking particularly at the notes relating to the delivery and the swab count. The count was documented in the case notes and had been verified by a second nurse. An additional course of antibiotics was prescribed.

As the symptoms persisted, Sandra decided to seek a second opinion and went to see a different obstetrician. The second obstetrician admitted her for an examination under anaesthesia and dilation and curettage. The second obstetrician telephoned the first obstetrician after finding a swab left behind during the packing of the episiotomy wound.

Activity

– If teaching nursing students, ask about the role of the nurse in the operating theatre, particularly in relation to the swab left behind during the original procedure. Ask about the process for establishing the underlying factors that may be associated with the adverse event.

Source: WHO Patient Safety Curriculum Guide for Medical Schools expert consensus group. Case supplied by Ranjit De Alwis, Senior Lecturer, International Medical University, Kuala Lumpur, Malaysia.

Change in routine practice without notifying the health-care team

This case illustrates the effect of human factors on patient safety. This incident reflects lack of communication within the clinical team and failure to follow the agreed-upon treatment protocols, leading to compromised patient care.

Mary is a dentist specializing in root canal treatments. She usually performs the entire treatment procedure in one session, which is a fact well-known by her dental team.

One day, she felt ill while performing a root canal treatment procedure on an upper molar of a patient. Because she was not feeling well, she decided not to fill the root canals of the tooth and to leave this task for another appointment. Mary did not explain the situation to the dental assistant. At the same time, the dental assistant did not annotate the need for a new root canal treatment session.

Mary forgot about the case. The patient followed up his dental treatment with other dentists and, since the case history was not adequately documented, no other dentist particularly worried about the unfinished root canal treatment. Another dentist subsequently filled the tooth cavity without noticing that the root canals were unfilled.

Three months later, the patient came back with a significant lesion near the tooth root with inflammation. At that time, it was necessary

to prescribe an antibiotic treatment before extracting the diseased molar.

Questions

– Nominate some factors that may have contributed to incomplete documentation of the incomplete treatment.

– What factors may have been present that led to other dentists on subsequent follow-up appointments failing to assess the unfilled root canals of the teeth?

– Discuss the responsibilities of different team members (in your area of practice) as they relate to record-keeping and documentation.

Source: Case supplied by Shan Ellahi, Patient Safety Consultant, Ealing and Harrow Community Services, National Health Service, London, UK.

Assessing knowledge of this topic

A range of assessment strategies are suitable for use with this topic, including MCQs, essays, short BAQ, CBD, and self-assessment. Having a student or group of students lead a small group discussion on a human-factors issue in the clinical area is a useful way to elicit understanding. If students are in the workplace, request that they observe how technology is used and what preparatory steps are taken to train health-care workers in using it.

Evaluating the teaching of this topic

Evaluation is important in reviewing how a teaching session went and how improvements can be made. See the Teacher's Guide (Part A) for a summary of important evaluation principles.

Tools and resource material

Patient safety

National Patient Safety Education Framework, sections 4.2 and 4.5 (http://www.health.gov.au/internet/safety/publishing.nsf/Content/C06811AD746228E9CA2571C600835DBB/$File/framework0705.pdf: accessed 21 February 2011).

Clinical human-factors group

http://www.chfg.org; accessed 18 January 2011. This site has a PowerPoint presentation clearly explaining human factors.

Human factors in health care. Australian Commission on Safety and Quality in Health Care, 2006 (http://www.health.gov.au/internet/safety/publishing.nsf/Content/6A2AB719D72945A4CA2571C5001E5610/$File/humanfact.pdf; accessed 21 February 2011).

Gosbee J. Human factors engineering and patient safety. *Quality and Safety in Health Care*, 2002, 11:352-354.

This article is available free of charge on the World Wide Web and provides a basic explanation of human factors and their relevance to patient safety.

Mistake-proofing design

Grout J. *Mistake-proofing the design of health care processes* (prepared under an IPA with Berry College). AHRQ publication no. 070020. Rockville, MD, Agency for Healthcare Research and Quality, May 2007 (http://www.ahrq.gov/qual/mistakeproof/mistakeproofing.pdf; accessed 18 January 2011).

Health-care workers fatigue

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Slides for Topic 2: Why applying human factors is important for patient safety

Didactic lectures are not usually the best way to teach students about patient safety, but this particular topic has some theoretical principles that students must become familiar with. Invite an engineer or psychologist who is an expert in human factors to provide an overview of human factors. If a lecture is being considered, it is a good idea to plan for student interaction and discussion during the lecture. Using a case study is one way to generate group discussion. Engineers may give examples from other industries, such as aviation and transport. If these examples are used, provide also an example that is relevant to health care so the students can see how the theory applies. Another way is to ask the students questions about different aspects of health care that will bring out the issues contained in this topic. The slides for Topic 2 are designed to assist the instructor in delivering the content of this topic. The slides can be changed to fit the local environment and culture. Instructors do not have to use all of the slides and it is best to tailor the slides to the areas being covered in the teaching session.

Topic 3
Understanding systems and the effect of complexity on patient care

Patients injected with wrong solution

Jacqui had an exploratory procedure called an endoscopic retrograde cholangio pancreatography (ERCP) at a large teaching hospital for a suspected disorder of her gall bladder. Under general anaesthetic, an endoscope was inserted into her mouth and guided through the oesophagus to the duodenum. Cannulas were inserted through the endoscope into the common bile duct and a contrast medium injected so an X-ray could be taken.

Two months later, Jacqui was told that she was one of 28 patients who had been injected with contrast medium containing a corrosive substance, phenol. The pharmacy department normally ordered 20 ml vials of Conray 280. However, for a period of approximately five months they incorrectly ordered and supplied to theatre 5 ml vials of 60% Conray 280 with 10% phenol with the label clearly stating "use under strict supervision–caustic substance" and "single dose vial". A nurse finally picked up the mistake, which had been missed by the pharmacy department and many teams of theatre staff.

The way in which medications are ordered, stored, delivered to operating theatres and the method for ensuring that correct medications are given to patients involve multiple steps with many opportunities for errors. Understanding the complexity of the system is necessary to understand where and how the components fit together.

Source: *Report on an investigation of incidents in the operating theatre at Canterbury Hospital 8 February – 7 June 1999*, Health Care Complaints Commission, Sydney, New South Wales, Australia. September 1999:1–37 (http://www.hccc.nsw.gov.au/Publications/Reports/default.aspx; accessed 18 January 2011).

Introduction–Why systems thinking is important for patient safety

Health care is rarely carried out by single individuals. Safe and effective care is dependent not only on the knowledge, skills and behaviours of front-line workers, but also on how those workers cooperate and communicate in the work environment, which itself is usually part of a larger organization. In other words, patients depend on many people doing the right thing at the right time. That is, they depend on a system of care [1]. Being a safe health-care professional requires an understanding of the complex interactions and relationships that occur in health care. Such awareness, for example, can help practitioners identify the opportunities for mistakes that can harm patients and clients and take steps to prevent them. This topic is about the system of health; how to reduce errors is discussed in detail in Topic 5.

Keywords
System, complex system, high reliability organization (HRO).

Learning objective

Understand how systems thinking can improve health care and minimize adverse events.

Learning outcomes: knowledge and performance

Knowledge requirements

Students should be able to explain the terms *system* and *complex system* as they relate to health care and why a systems approach to patient safety is superior to the traditional approach.

Performance requirement

Students should be able to describe the elements of a safe health-care delivery system.

What students need to know about systems in health care: explain what is meant by the terms *system* and *complex system* as they relate to health care

What is a system?

The word *system* is a broad term that is used to describe any collection of two or more interacting parts or "an interdependent group of items forming a unified whole" [2].

Health professional students will be familiar with the concept of systems in the context of biological and organic systems. Organic systems include something as small as a single cell to more complex organisms or whole populations. These systems are in a continuous state of information exchange both internally and externally. The continuous process of input, internal transformation, output and feedback is characteristic of these systems. These same characteristics apply to the multiple systems that make up health care, as well as the health-care system as a whole.

Complex systems

When students first enter a large clinical facility, they are often overwhelmed by its complexity– the large number of health-care providers, allied professionals and clinical specialties, the diversity of patients the different departments, the different smells, etc. These students are seeing and reacting to the health-care facility as a system. It appears chaotic and unpredictable, and they wonder how they will ever adapt to the environment. Eventually, they are assigned to different wards, departments and clinics and they become familiar with the workings of their particular area or discipline. They can then easily forget about the rest of the system.

A complex system is one in which there are so many interacting parts that it is difficult, if not impossible to predict the behaviour of the system based on knowledge of its component parts [3]. The delivery of health care fits this definition of a complex system, especially in a larger facility. Large facilities are usually made up of many interacting parts, including humans (patients and staff), infrastructure, technology and therapeutic agents. The various ways that the parts of the system interact with each other and the way in which they act collectively are highly complex and variable [3].

All health-care professionals need to have an understanding of the nature of complexity in health care, as it is important for preventing adverse events and helpful in terms of analysing situations in which things have gone wrong. (This is covered in more detail in Topic 5.) Otherwise, there can be a tendency to blame only the individuals directly involved in a situation, without realizing that there are usually many other contributory factors. Health care is complex due to [3]:

- the diversity of tasks involved in the delivery of patient care;
- the dependency of health-care providers on one another;
- the diversity of patients, clinicians and other staff;
- the huge number of relationships between patients, carers, health-care providers, support staff, administrators, family and community members;
- the vulnerability of patients;
- variations in the physical layout of clinical environments;
- variability or lack of regulations;
- implementation of new technology;
- the diversity of care pathways and organisations involved;
- increased specialization of health-care professionals–while specialization allows a wider range of patient treatments and services, it also provides more opportunity for things to go wrong and errors to be made.

Students working with patients quickly understand that each individual patient requires care and treatment tailored to his/her own specific condition and circumstances. A student can quickly see that when all of the individualized

health services are combined, they form a system of care.

Many health services present as a system–buildings, people, processes, desks, equipment, telephones–yet unless the people involved understand the common purpose and aim, the system will not operate in a unified fashion. People are the glue that binds and maintains the system.

An understanding of the health-care system requires students to think beyond their own future profession. For the system to work effectively, doctors, nurses, pharmacists, midwives, and other health professionals need to understand each other's roles and responsibilities. The functioning of the system also requires their understanding the effect of complexity on patient care and that complex organizations, such as health-care services, are prone to errors. For example, until relatively recently, we viewed the hundreds of services provided to patients in a hospital as separate distinct services. The work of doctors was separate from that of nurses, pharmacists and physiotherapists. Units and departments were also seen as distinct entities.

If the emergency department was not able to see patients quickly enough, we thought that by fixing the broken bit–the emergency department–without any attention to other services that relate to it, we could solve the problem. But, perhaps the emergency department was not able to transfer patients to the wards in a timely manner because there were no available beds. The staff may have had too many conflicting priorities that impeded their abilities to be responsive to patient needs.

Even though health professionals confront many challenges in their workplaces daily and may even understand the multiple components and relationships that are prone to dysfunction, they often have difficulty thinking in terms of systems because, typically, they have not been trained to think in the concepts or language of systems theory, nor do they use its tools to make sense of the systems in which they work.

Knowledge about the complexity of health care will enable health-care professionals to understand how organizational structure and work processes can contribute to the overall quality of patient care. Much of the knowledge about complex organizations comes from other disciplines, such as organizational psychology. In a study published in 2000, the United States IOM reported that organizational processes, such as simplification and standardization, that are recognized safety principles were rarely applied in the health-care delivery systems they examined [4].

A systems approach requires us to look at health care as a whole system, with all its complexity and interdependence, shifting the focus from the individual to the organization. It forces us to move away from a blame culture toward a systems approach. Using a systems approach, an allied professional will be able to tell a primary provider that there may be a problem with fulfilling an order immediately because of other competing demands. The primary provider and the allied professional can then work out a solution to the problem together, thus foreseeing and avoiding a problem later on.

In summary, a systems approach enables us to examine organizational factors that underpin dysfunctional health care and accidents/errors (poor processes, poor designs, poor teamwork, financial restraints and institutional factors) rather than focus on the people who are associated with or blamed for these events. This type of approach also helps us to move away from blaming toward understanding and improve the transparency of the processes of care rather than focusing solely on the single act of care.

The traditional approach when things go wrong–blame and shame

In such a complex environment, it is no surprise that many things go wrong on a regular basis. When something does go wrong, the traditional approach is to blame the health-care worker most directly involved in caring for the patient at the time–often a student or other junior staff member. While the tendency to blame an individual (the person approach) [5] is strong–and very natural–it is unhelpful and actually counterproductive for a number of reasons. Whatever role that the blamed health-care worker may have had in the evolution of the incident, it is very unlikely that his/her course of action was deliberate in terms of patient harm. (A deliberate action is called a violation.) See Topic 5: *Learning from errors to prevent harm* and Topic 6: *Understanding and managing clinical risk*. → T5 T6

Most health-care workers involved in an adverse event are very upset by the prospect that their action (or inaction) may have been in some way contributory. The last thing they need is punishment.

Wu described the health-care worker as the "second victim" in such circumstances [6]. The natural tendency in such situations is to limit reporting. Workers will be hesitant to report incidents if they believe that they will then be blamed for anything untoward that may have happened. If such a culture of blame is allowed to persist, a health-care organization will have great difficulty in decreasing the chance of adverse incidents of a similar nature occurring in the future (see Topic 5: *Learning from errors to prevent harm*).

→ T5

Unfortunately, many health-care professionals, including senior providers, allied professionals and managers share, with many in the wider community, a different view, which supports the idea that an individual should be blamed. This represents a major challenge, especially for junior staff (see the Introduction to Part B–Topics).

But using a systems approach does not mean that health professionals do not have to be responsible or accountable for their actions. A systems approach requires that we understand all the underlying factors that contributed to the incident; just focusing on the person will not identify the main causes and, therefore, the same incident is likely to reoccur.

Accountability

All health professionals have ethical and legal responsibilities for which they are accountable. While these requirements may vary from profession to profession and country to country, they generally aim to give confidence to the community that the health professional can be trusted to have the knowledge, skills and behaviours set by the relevant professional body. These ethical and legal responsibilities are often misunderstood by health professionals and many remain unsure about the difference between negligent actions, unethical actions and mistakes. The following table sets out the basic differences.

Table B.3.1. Definitions of medico-legal terms

Type of medico-legal behaviour	Definitions	Comments
Negligence	1. Failure to exercise the skill, care and learning expected of a reasonably prudent health-care provider [7]. 2. Care provided failed to meet the standard of care reasonably expected of an average practitioner qualified to care for the patient in question, (SP-SQS 2005) or that fell below the standard expected of physicians in their community [8]. 3. Failure to use such care as a reasonably prudent and careful person would use under similar circumstances [9]. 4. The failure (usually on the part of a physician or other health-care professional) to exercise ordinary, reasonable, usual or expected care, prudence or skill (that would usually or customarily be exercised by other reputable physicians treating similar patients) in the performance of a legally recognized duty, resulting in foreseeable harm, injury or loss to another; negligence may be an act of omission (i.e. unintentional) or commission (i.e. intentional), characterized by inattention, recklessness, inadvertence, thoughtlessness or wantonness; in health care, negligence implies a substandard deviation from the "standard of medical practice" that would be exercised by a similarly trained professional under similar circumstances [10].	The components of negligence are determined by the country in which the action takes place.
Professional misconduct	(In the definition for malpractice.) Professional misconduct or unreasonable lack of skill in the performance of a professional act, a term that may be applied to physicians, lawyers and accountants [10]. Professional misconduct is separate from malpractice and relates to all health professionals. It is defined differently in many countries. Professional misconduct usually refers to a significant departure from the standard of care expected of a health professional.	Each country will have its own system for registering the different health professions and for managing complaints about professional competence and conduct.

Mistakes	1. An action that may conform exactly to the plan, but the plan is inadequate to achieve its intended outcome [11]. 2. A rule-based or knowledge-based error that is an error of conscious thought. Rule-based errors usually occur during problem-solving when a wrong rule is chosen-either because of a misperception of the situation and thus the application of the wrong rule, or because of misapplication of a rule, usually one that is strong (frequently used), that seems to fit adequately. Knowledge-based errors arise because of a lack of knowledge or misinterpretation of the problem [12]. 3. A deficiency or failure in the judgement and/or inferential processes involved in the selection of an objective or in the specification of the means to achieve it, irrespective whether or not the actions directed by this decision-scheme run according to plan; errors of conscious... including rule-based errors that occur during problem solving when a wrong rule is chosen, and knowledge-based errors that arise because of lack of knowledge or misinterpretation of the problem [13].	Failure to be honest about errors may constitute professional misconduct in some countries. In some countries mistakes may be punishable. It is important to know how the country you are studying in manages health-care mistakes.

A systems approach also means that students and health professionals are required to be professionally responsible for their actions. If a dental student administers the wrong medication to a patient because he/she failed to follow the protocol for checking medications, should that student be held accountable? An analysis of such a case using a systems approach would examine the factors that contributed to the student not checking the medication: what if the student was new to the dental clinic and was not being supervised?; or if he/she did not know the steps involved?; or was unaware that a policy existed to help make sure the correct medication is given to the correct patient?; or if he/she was unsure, but there was no one around with whom to check and the student feared getting into trouble for delaying the administration of the drug? Systems thinking would suggest that this student was not prepared for such duties. But if the student was prepared, was being supervised by a dentist and was aware of the protocols, but did not check the medication because he/she was lazy or sloppy or wanted to finish work early, then that student would be responsible for the error. Inexperienced health-care workers may not always be supervised; in such circumstances, they should seek advice from a senior colleague, notwithstanding the pressure to move patients through the service.

Most circumstances surrounding adverse events are complicated, so it is best to use a systems approach to understand what happened and why before making any decisions about personal accountability. It is important to remember that this blame-free culture does not apply only to students, but also to other staff, even those who have been in practise for a long time and have many years of experience.

Accountability is a professional obligation and no one thinks that individuals should not be held accountable. However, in addition to personal accountability, there is also system accountability. System accountability requires that the system examine itself. For too long, health-care systems have passed the responsibility for mistakes and errors in the system onto individual health-care workers.

The best health-care organizations understand the difference between violations and mistakes and have implemented accountability mechanisms that are fair, transparent and predictable, in that staff are aware of the types of matters for which they will be held personally responsible.

Patients are also part of the system and when little attention is paid to their literacy level or their cultural backgrounds, they are at risk of receiving suboptimal care and treatment. These patients are unlikely to complain or raise issues with health-care professionals. Patients as a group usually have the least say in how a health service should operate; they are often required to accommodate inconvenience, inadequate care and treatment and inadequate information. Patients put up with unsatisfactory care because they often understand the pressures on the health-care workers and do not want to offend them. Quite often, patients do not understand

their condition or appreciate the importance of adhering to a treatment protocol–for example, following a medication course as prescribed. It is often the case that when patients feel better, they discontinue taking their medication without referring to a health-care professional. It is therefore important that health-care workers spend time explaining treatment protocols and the impact of non-compliance to patients.

The new approach 13

Safety experts believe that although it is hard to change aspects of complex systems, it is harder to change the behaviour and thinking processes of human beings, in terms of their contributions to errors [5]. Therefore, the main response to an error should be to try to change the system using a *systems approach* [5]. A systems approach to errors in health care requires an understanding of the multiple factors involved in each of the areas that make up the health-care system. Health-care workers are part of the system. Analyses of accidents in other industries indicate that there is rarely ever one cause of an accident. Rather, system failures stem from a wide range of factors. The intention of a systems approach for incident investigation is to improve the design of the system, to prevent errors from occurring in the future and/or to minimize their consequences.

Reason outlined the many elements of the system that should be considered as part of a "systems-thinking" approach to accident investigation in the following categories [14].

Patient and provider factors
These are the characteristics of the individuals involved, including the patient. It is important to remember that health-care providers, students and patients are all part of the system.

Task factors
These are characteristics of the tasks health-care providers perform, including the tasks themselves, as well as factors such as workflow, time pressure, job control and workload.

Technology and tool factors
Technology factors refer to quantities and qualities of technologies in the organization. Such factors include the number and types of technologies and their availability, usability, accessibility and location. The design of tools and technologies, including their integration with other technologies, user training, propensity to breakdown or crash, responsiveness and other design characteristics would also be included in this category.

Team factors
Much of health care is provided by multidisciplinary teams. Factors such as team communication, role clarity and team management have been shown to be important in other industries and their importance in health care is now increasingly being recognized [15].

Environmental factors
These are the features of the environment in which health-care professionals work. These features include lighting, noise and physical space and layout.

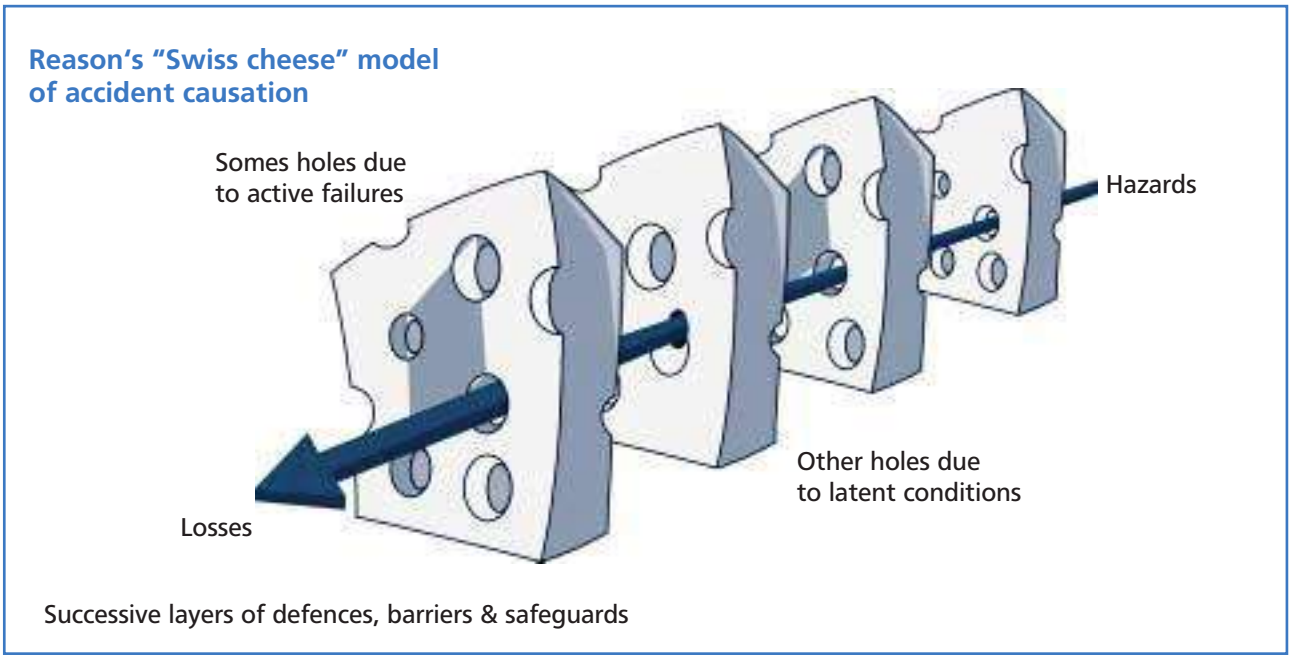
Organizational factors
These are the structural, cultural and policy-related characteristics of the organization. Examples include leadership characteristics, culture, regulations and policies, levels of hierarchy and supervisors' span of control.

The Swiss cheese model 14

Looking at health care from this broad series of perspectives highlights the multifactorial nature of any single patient safety incident or event. This is why students in the health professions must carefully guard against jumping to blame an individual for an adverse event and instead consider the associated systemic issues. Most adverse events involve both systemic and human factors. Reason used the term *active failures* to describe errors made by workers that have immediate adverse effects. But he also described a second essential precondition for the occurrence of an adverse event, namely, the presence of one or more latent conditions. Latent conditions are usually the result of poor decision making, poor design and poor protocols developed by people other than those working on the front line. These conditions are often set in place long before the event in question. Examples of latent conditions for health-care staff include fatigue, inadequate staffing levels, faulty equipment and inadequate training and supervision [16].

Reason created the Swiss cheese model to explain how faults in different layers of a system lead to incidents [5]. This model shows how a fault in one layer of a system of care is usually not enough to cause an accident (see Figure B.3.1). Adverse events usually occur when a number of faults occur in a number of layers (for example, fatigued workers plus inadequate procedures plus faulty equipment) and momentarily line up to permit a "trajectory" of accident opportunity (indicated by the arrow in the Figure B.3.1).

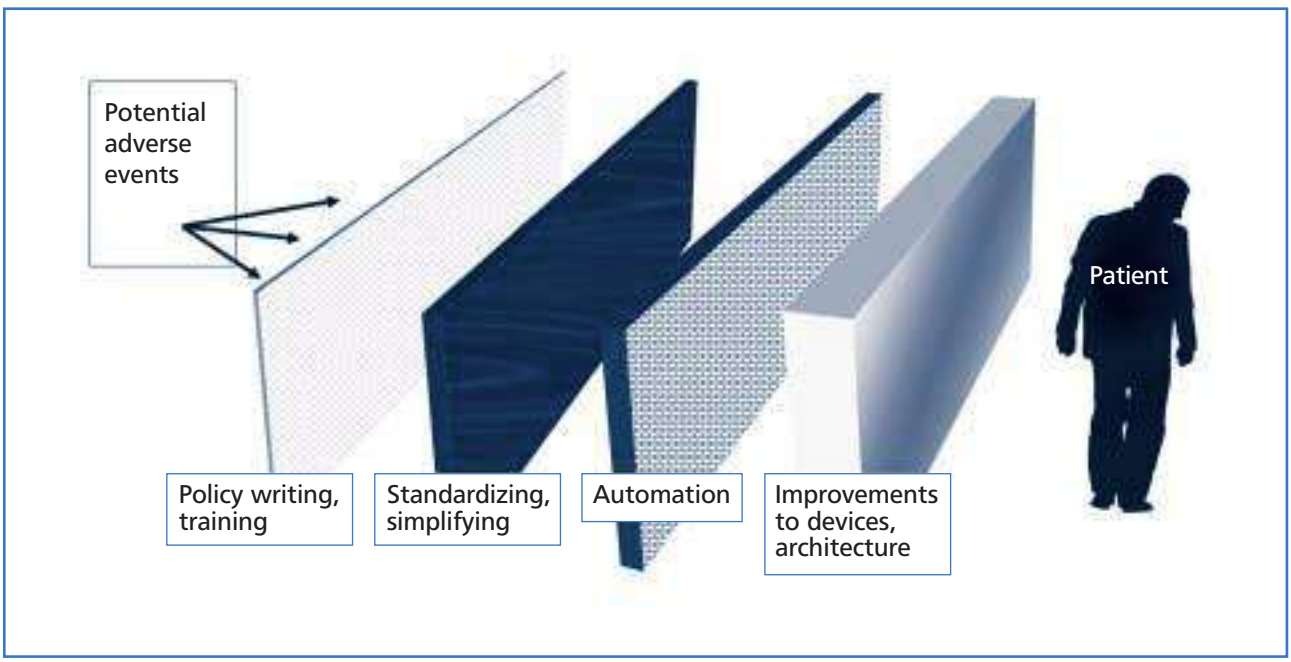
Figure B.3.1. Defences, barriers and safeguards



Source: Reason JT. *Managing the risks of organisational accidents*, 1997 [14].

To prevent these adverse events from occurring, Reason proposed the use of multiple defences in the form of successive layers of protection (understanding, awareness, alarms and warnings, restoration of systems, safety barriers, containment, elimination, evacuation, escape and rescue), designed to guard against the failure of the underlying layer (see Figure B.3.2). The advantage of the systems approach to investigating situations is that it considers all of the layers, to see if there are ways that any of them can be improved.

Figure B.3.2. Layers of defences 



Source: Veteran Affairs (US) National Center for Patient Safety http://www.patientsafety.gov/ [17].

How students can apply this knowledge 16 17 18

Understand the term *high reliability organization* (HRO)

The term HRO [18] refers to organizations that operate under hazardous conditions, but manage to function in a way that is almost completely "failure-free". That is, they have very few adverse events. These organizations include air traffic control systems, nuclear power plants and naval aircraft carriers. While there are many differences between these industries and health care, the message for health care is that it is possible to achieve consistently safe and effective performance despite high levels of complexity and unpredictability in the work environment. These HROs demonstrate to health-care organizations that they too can improve safety by focusing on the systems involved.

The differences between the HROs described above and health-care organizations are significant and go to the very heart of the existing problems. As health-care providers, we do not routinely think that health care will fail. Failure is not part of the professional mindset, unless it has to do with specific treatments. As we provide care, we are generally not mindful of the possibility that health professionals might miscommunicate or that a surgeon may be extremely tired after having worked all night or that a doctor's handwriting might be illegible, so that a pharmacist might dispense the incorrect dose and a nurse might then administer that medicine. Any one of these may be a factor in an adverse event. Health-care professionals are used to talking to individual patients about risks in relation to known side-effects and complications, but they do not apply the same reasoning to the treatment being provided by the system as a whole. Systems thinking requires that health professionals think about both types of potential risk: treatment risks and system risks.

HROs are also known for their resilience–they try to pre-empt failures and take steps to prevent them. Patients are the most resilient component of our health system and many adverse events are avoided because of the resilience of the patients themselves. They get better despite being given the wrong medication or treatment.

We do not yet have a culture of safety in health care. HROs put a lot of effort into establishing and maintaining cultures of safety and provide incentives and rewards for workers. In an HRO, people are rewarded if they admit a mistake because the admission and the resulting actions to prevent future similar errors save the organization time and money. Imagine a health system in which staff could freely admit their mistakes and we had the capacity to adopt/install features and resources, so that similar mistakes could be prevented or minimized. The adverse event rate would significantly decrease, saving many lives, reducing suffering and improving staff morale.

Know the characteristics of high reliability organizations [18]

HROs share the following characteristics:

- *preoccupation with failure*: acknowledge and plan for the possibility of failure due to the high-risk, error-prone nature of their activities;
- *commitment to resilience*: proactively seek out unexpected threats and contain them before they cause harm;
- *sensitivity to operations*: pay close attention to the issues facing the workers on the frontline; and
- *a culture of safety* in which individuals feel comfortable drawing attention to potential hazards or actual failures without fear of criticism from their seniors.

Apply the lessons learned from HROs to health care 19

Health-care organizations can learn from other HROs. We can examine their successes and study what factors made them work. We can also learn from their failures, specifically how disasters occur and what factors are typically present.

The role of regulation

Due to the nature of their work with the public, health-care professionals are regulated in most countries. Professional regulation protects the public by requiring practitioners to achieve the competencies needed to practice the profession and establishing and enforcing standards of practice. Regulation establishes criteria to be entered on the register and maintain a license to practice. The role of regulators includes receiving and investigating complaints against individual health practitioners and taking the appropriate action if required such as suspension, deregistration or conditions placed on their practice.

Summary 20

A systems approach helps us to understand and analyse the multiple factors underpinning adverse events. Therefore, using a systems approach to evaluate the situation–as distinct from a person approach–will have a greater chance of resulting in the establishment of strategies to decrease the likelihood of recurrence.

Case studies

The importance of cross-disciplinary communication

In many cases of avoidable maternal death identified in the UK Confidential Enquiry, care was hampered by a lack of cross-disciplinary or cross-agency cooperation and communication problems, including poor or nonexistent cooperation between team members, inappropriate or inadequate telephone consultations, failure to share relevant information between health professionals, including between general practitioners and the maternity team, and poor interpersonal skills. This study also identified another issue concerning midwifery care that revolved around a failure to recognize deviations from normal, which resulted in women not being referred for appropriate medical evaluation. The following case study highlights the importance of these issues.

An underweight, young, non-English-speaking refugee who also had a low haemoglobin count was booked for midwifery-led care. Her husband, who had very poor English himself, acted as interpreter. She was admitted to the hospital late in pregnancy with bleeding and abdominal pain. Constipation was diagnosed, despite abnormal liver function tests, and she was sent home under midwifery-led care. She was readmitted some weeks later, late in pregnancy with abdominal pain and, despite a further abnormal blood assay, no senior medical opinion was sought and she was again discharged. Some days later, she was admitted *in extremis*, with liver and multi-organ failure, her unborn baby having died in the meantime. Despite the severity of her condition, her care was still uncoordinated and, although she was visited by a critical care senior house officer, she remained in the delivery suite. The woman died two days later of disseminated intravascular coagulation related to fatty liver of pregnancy.

Question

– Using a systems approach, describe the factors that may be associated with this catastrophic outcome and how similar adverse events might be prevented in the future.

Source: The confidential enquiry into maternal and child health (CEMACH). Saving Mother's Lives 2005-2008, London, 2007 (www.cemach.org.uk/; accessed 21 February 2011).

A failure to administer preoperative antibiotic prophylaxis in a timely manner according to protocol

This example highlights how health services may have difficulty accommodating last-minute changes.

The anaesthetist and the surgeon discussed the preoperative antibiotics required for the patient who was about to have a laparoscopic cholecystectomy. The anaesthetist informed the surgeon of the patient's allergy to penicillin and the surgeon suggested clindamycin as an alternative preoperative antibiotic.
The anaesthetist went into the sterile corridor to retrieve the antibiotic, but returned and explained to the circulating nurse that he could not find any suitable antibiotic in the sterile corridor. The circulating nurse got on the phone to request the preoperative antibiotics.
The anaesthetist explained that he could not order them because there were no order forms (he looked through a folder of forms). The circulating nurse confirmed that the requested antibiotics "are coming".

The surgical incision was performed. Six minutes later, the antibiotics were delivered to the OR and immediately injected into the patient.
This injection happened after the time of incision, which was counter to the protocol requiring that antibiotics be administered prior to the surgical incision, in order to avoid surgical site infections.

Questions

– What could be done to ensure that this incident does not happen again?

– How does this case illustrate the need for interdisciplinary communication?

– Who can stop a procedure if a problem occurs?

Source: WHO Patient Safety Curriculum Guide for Medical Schools expert group. Case supplied by Lorelei Lingard, Associate Professor, University of Toronto, Toronto, Canada.

A system failure resulting in death

This example highlights how pressurized environments may fail to provide basic standards of care.

Mrs Brown was a 50-year-old administrative assistant working in the supply department of a hospital. She was overweight. She slipped in her garden while getting the newspaper and struck her leg on a garden tap. She suffered a fracture of her fibula and was admitted to hospital because it was swollen and painful and required reduction. The procedure was delayed because the operating theatre was busy and her injury was a relatively minor one. The orthopaedic ward was full and so she was placed in a medical ward. Two days later, the fracture was reduced and her leg was put in plaster. When she got up to go

home she collapsed and died. At autopsy it was found that she had suffered a massive pulmonary embolus. At no stage was heparin prescribed for the prevention of deep vein thrombosis or any other preventive measures. Her husband was told that she had died from a clot on the lung which had formed in her leg as a result of swelling and trauma. The lack of preventive measures was not mentioned.

Activities

– Construct a flowchart of Mrs Brown's admission from her accident to her death.

– Identify all the health professionals who may have been involved in her care and treatment.

– What are the possible factors that may have contributed to her death?

Source: Case study taken from Runciman B, Merry A, Walton M Safety and ethics in health care: a guide to getting it right. Aldershot, UK, Ashgate Publishing Ltd, 2008:78.

Chain of errors leading to wrong-site dental surgery

This case illustrates how latent problems in the system can lead to errors at the point of care (the sharp end).

An oral surgeon was performing a surgical removal of lower third molar, which was completely impacted. None of the third molars (on either side) were visible.

According to the clinical record, the right third molar was to be extracted. However, the X-ray on the view box appeared to show that it was the right third lower molar that was impacted and that the left third lower molar was absent.

The oral surgeon made the incision, raised the flap and started the osteotomy. The impacted molar did not appear, so the surgeon enlarged the osteotomy. The surgeon finally realized that the right third molar was not there and that he had made a mistake when he had reviewed the clinical notes earlier and planned the operation. Furthermore, the dental assistant had displayed the X-ray in the wrong position, reversing the left and right sides of the mouth.

Questions

– What factors may have existed that caused the surgeon to select the wrong tooth?

– What may have caused the assistant to put the X-ray in the wrong position?

– What could have prevented this error?

Source: Case supplied by Shan Ellahi, Patient Safety Consultant, Ealing and Harrow Community Services, National Health Service, London, UK.

Tools and resource material

Clinical micro system assessment tool

Batalden PB et al. Microsystems in health care: part 9. Developing small clinical units to attain peak performance. *Joint Commission Journal on Quality and Safety*, 2003, 29:575–585 (http://clinicalmicrosystem.org/materials/publications/JQIPart9.pdf; accessed 20 February 2011).

Learning to improve complex systems of care

Headrick LA. Learning to improve complex systems of care. In: *Collaborative education to ensure patient safety*. Washington, DC, Health Resources and Services Administration/Bureau of Health Professions, 2000: 75–88.

Organizational strategy

Kohn LT, Corrigan JM, Donaldson MS, eds. *To err is human: building a safer health system*. Washington, DC, Committee on Quality of Health Care in America, Institute of Medicine, National Academies Press, 1999.

Runciman B, Merry A, Walton M. *Safety and ethics in health care: a guide to getting it right*, 1st ed. Aldershot, UK, Ashgate Publishing Ltd, 2007.

Teaching strategies and formats

Interactive DVD

The WHO *Learning from Error* workshop includes a DVD or downloadable file (www.who.int/patientsafety/education) about intrathecal vincristine, which depicts a case of intrathecal vincristine administration and the systems issues that contributed to the evolution of this incident. The aims of the workshop are: to enhance awareness of the risks of vincristine administration; to develop an understanding of the need for a new emphasis on patient safety in hospitals; to equip participants with the skills to contribute to patient safety and to identify local policies and procedures to make the workplace safer. (This workshop could apply to most of the topics in this Curriculum Guide).

Lecture on systems and complexity

Small group discussion

Small group discussions could be held about the various levels of the system in your workplace.

The group could discuss a relevant professional article, such as *The wrong patient* [19], with a tutor. Alternatively, the group could select one of the cases above to discuss using a systems perspective. As part of this exercise, the group could discuss the roles of different team members.

Other student activities

– Follow a patient from the time he/she enters a health-care facility to the time he/she is discharged and identify all the steps and types of health-care workers involved in treating that patient.
– Arrange for the students to meet in small groups with a tutor and discuss their findings and observations.
– Discuss the roles and functions of people from different parts of the health-care system.
– Visit unfamiliar parts of the organization.
– Participate in or observe a root cause analysis.

Assessing knowledge of this topic

Each student could be asked to write an account of a patient's experience, in which the student follows that patient throughout the course of his/her treatment.

A range of assessment strategies are suitable for this topic, including MCQs, essays, short BAQ, CBD, and self-assessment. Having a student or group of students lead a small group discussion on the various levels of the system in their own workplace is a useful way to elicit understanding.

Evaluating the teaching of this topic

Evaluation is important in reviewing how a teaching session went and how improvements can be made. See the Teacher's Guide (Part A) for a summary of important evaluation principles.

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Slides for Topic 3: Understanding systems and the effect of complexity on patient care

Didactic lectures are not usually the best way to teach students about patient safety. If a lecture

is being considered, it is a good idea to plan for student interaction and discussion during the lecture session. Using a case study is one way to generate group discussion. Another way is to ask the students questions about different aspects of health care that will bring out the issues contained in this topic, such as the blame culture, the nature of error and how errors are managed in other industries.

The slides for Topic 3 are designed to help the instructor deliver the content of this topic. The slides can be changed to fit the local environment and culture. Instructors do not have to use all of the slides and it is best to tailor the slides to the areas being covered in the teaching session.

Topic 4
Being an effective team player

A treating team did not communicate with each other

Simon, an 18-year-old man, was brought by ambulance to hospital. He had been involved in a fight and suffered a serious head injury when his head hit the pavement. The ambulance officers were very busy and did not have time to brief the health professionals in the emergency department. Simon wasn't able to say his name or speak clear words when he was first examined by a triage nurse then a doctor. The doctor in attendance, an intern, was only weeks out of medical school. He didn't have a supervisor on that night and he and the nursing staff failed to recognise the seriousness of Simon's head injury.

Simon had been drinking and the intern decided that he was simply drunk; a diagnosis supported by Simon's rowdy and aggressive behaviour. However, such behaviour can also indicate serious head injury. Simon was prescribed medication for nausea and placed under observation. On a number of occasions, the nurses and intern separately tested his verbal and motor responses.

As time passed, the nurses documented his deteriorating condition in the clinical notes but did not communicate this directly to the intern. Unfortunately, the intern relied on verbal communications and didn't take sufficient notice of the notes. Simon died four and half hours after entering the hospital.

Source: National Patient Safety Education Framework, Commonwealth of Australia, 2005.

Introduction–Why teamwork is an essential element of patient safety

Effective teamwork in health-care delivery can have an immediate and positive impact on patient safety [1]. The importance of effective teams in health care is increasing due to factors such as: (i) the increased incidence of complexity and specialization of care; (ii) increasing co-morbidities; (iii) the increasing incidence chronic disease; (iv) global workforce shortages; and (v) initiatives for safe working hours.

A typical example of complex care involving multiple teams is the treatment of a pregnant woman with diabetes who develops a pulmonary embolus. Her health-care team might include nurses, a midwife, an obstetrician, an endocrinologist and a respiratory physician, as well as the pregnant woman herself. In addition, the health-care professionals looking after her during the day are not the same as those who care for her at night and on the weekend. In a large teaching hospital, there will be teams of doctors for each specialty area and professions, all of whom need to coordinate care with each other–the nursing staff, pharmacists, other allied health providers and the patient's primary care team. In a place where there are limited resources, the team may only be a nurse, midwife, a doctor and the pregnant woman, but it is just as important that they act in a coordinated way with good communication at all times.

Many students will be familiar with the medical team commonly associated with large hospitals. The medical team is hierarchical and includes the most senior doctors to the most junior. From a patient perspective, the team is broader than just the medical team. It also includes nurses,

allied health professionals and ward staff who are caring for and treating the patient.

This topic acknowledges that students in the early parts of their training programmes are unlikely to have personally worked as members of a health-care team and often have little understanding of how health-care teams are constructed and operate effectively. In this topic, we aim to draw on students' past experiences of teamwork and look toward the teams they will increasingly participate in as advanced students and practising clinicians.

Keywords
Team, values, assumptions, roles and responsibilities, learning styles, listening skills, conflict resolution, leadership, effective communication.

Learning objectives

Students should understand the importance of teamwork in health care and know how to be effective team players. Recognize that, as a student, you will be a member of a number of health-care teams.

Learning outcomes: knowledge and performance

Knowledge requirements

Knowledge requirements for this topic include a general understanding of the different types of teams in health care, how teams improve patient care, how teams form and develop the characteristics of effective teams and effective leadership, communication techniques for health-care teams, techniques for resolving disagreement and conflict, the barriers to effective teamwork and how to assess team performance.

Performance requirements

Application of the following teamwork principles will promote effective health care.

- Be mindful of how one's values and assumptions affect interactions with others. This is particularly important when patients and staff are from different cultural backgrounds.
- Be mindful of the other members of the team and how psychosocial factors affect team interactions.
- Be aware of the impact of change on teams.
- Include the patient in the team, as well as his/her family when appropriate.
- Use appropriate communication techniques.
- Use mutual support techniques.
- Resolve conflicts.
- Be open to changing and observing behaviours.

Introduction to health-care teams

What is a team?

The nature of teams is varied and complex. In health care the most effective team from the patient's perspective is the multidisciplinary team, but teams may draw from a single professional group. Team members may work closely together in one place or be located across a geographic area. Some teams have a constant set of members whereas the memberships of other teams may change frequently. Examples of teams include choirs, sporting teams, military units, aircraft crews and emergency response teams. In health care, patients are treated in a variety of environments–the home, clinics, small hospitals and large teaching hospitals. In each of these places how well the team communicates with one another and with the patient will determine how effective the care and treatment is, as well as how the team members feel about their work.

Regardless of their nature, health-care teams can be said to share certain characteristics. These include the team members:

- knowing their role and the roles of others in the teams and interact with one another to achieve a common goal [2];
- making decisions [3];
- possessing specialized knowledge and skills and often function under high-workload conditions [4,5];
- acting as a collective unit, as a result of the interdependency of the tasks performed by team members [6]. A team is not the same as some other small groups, such as a committee who come together from a variety of backgrounds for a particular purpose and not usually associated with hands-on patient care.

Salas defined a team as:

- a distinguishable set of two or more people who interact dynamically, interdependently and adaptively towards a common and valued goal/objective/mission, who have been each assigned specific roles or functions to perform and who have a limited lifespan of membership [7].

Health-care professionals are required to sit on many committees, which are established to assist management with problems or planning exercises; these are not teams.

The different types of teams found in health care

There are many types of teams in health care. These include rural health-care clinics, women and baby clinics, birthing units, ICUs, medical wards, primary-care teams working in the community, teams assembled for a specific task, such as emergency response teams, and multi-professional teams, such as multidisciplinary cancer care teams, that come together to plan and coordinate a patient's care.

Teams can have a common geographic location, as in a rural clinic or hospital, or team members may be spread across multiple locations, as in a multidisciplinary cancer team or primary health-care team. Teams can include a single discipline or involve the input of professionals from multiple disciplines, including administrative staff; the patient should always be considered as part of the team. The roles these professionals play will vary between and within teams at different times. Roles of individuals on the team are often flexible and opportunistic. For example, the leadership might change depending on the expertise required.

In support of patient-centred care and patient safety, patients and their carers are increasingly being considered as active members of the health-care team. As well as being important for shared decision-making and informed consent, engaging the patient as a team member can improve the safety and quality of care, as the patient is a valuable source of information, being the only member of the team who is present at all times during care. They are also the ones with expertise in the experience of their illness or condition.

The TeamSTEPPS™ [8] programme developed in the United States identifies a number of different, but interrelated team types that support and deliver health care.

Core teams

Core teams consist of team leaders and members who are directly involved in caring for the patient. Core team members include direct care providers such as nurses, pharmacists, doctors, dentists, assistants and, of course, the patient or their carer. These members operate from the health-care facility clinic or ward. Core members also include continuity providers-those who manage the patient from assessment to discharge, for example, case managers. The core team may change often, but usually would consist of a physician and nurse and, depending on the area of health care, could also include the physiotherapist, dentist and/or pharmacist.

Coordinating teams

The coordinating team is the group responsible for day-to-day operational management, coordination functions and resource management for core teams. Nurses often fill such coordinating roles in hospitals. In rural settings and clinics, the coordinating team may comprise managers of health services, nurses, doctors or other health professionals.

Contingency teams

Contingency teams are formed for emergent or specific events (e.g. cardiac arrest teams, disaster response teams, obstetric emergency teams, rapid response teams). The members of a contingency team are drawn from a variety of core teams.

Ancillary services

Ancillary service teams consist of individuals such as cleaners or domestic staff who provide direct, task-specific, time-limited care to patients or support services that facilitate patient care. The members of these teams are often not located where patients receive routine care.

Ancillary service teams are primarily service delivery teams whose mission is to support the core team. This does not mean that they should not share the same goals. The successful outcome of a patient undergoing surgery requires accurate information on catering and instructions in relation to "nil by mouth" orders, so that he/she does not inadvertently receive a meal that may present a choking risk. In general, ancillary service teams function independently. However, there may be times when they should be considered as part of the core team.

Support services

Support services teams consist of individuals who provide indirect, task-specific services in a health-care facility. The members of these service-focused teams help to facilitate the optimal health-care experience for patients and their families. Their roles are integrated in that they manage the environment, assets and logistics within a facility. Support services consist primarily of a service-focused team whose mission is to create an efficient, safe, comfortable and clean health-care environment, which affects the patient care team, market perception, operational efficiency and patient safety.

Administration
Administration includes the executive leadership of a unit or facility and has 24-hour accountability for the overall function and management of the organization. Administration shapes the climate and culture for a teamwork system to flourish by establishing and communicating vision, developing and enforcing policies and providing necessary resources for their successful implementation, setting expectations for staff (roles and responsibilities), holding teams accountable for their performance and defining the culture of the organization.

How the use of teams improves patient care

Health care has traditionally viewed the individual clinician as being solely responsible for a patient's care and treatment. However, patients today are rarely looked after by just one health professional. Patient safety, in the context of a complex health-care system, recognizes that effective teamwork is essential for minimizing adverse events caused by miscommunication with others caring for the patient and misunderstandings of roles and responsibilities. Patients have a vested interested in their own care and they too must be part of the communication pathways; their involvement has been shown to also minimise errors and potential adverse events.

The link between nontechnical skills, such as teamwork, and adverse events is now well established [9,10], as is the increasing burden of chronic disease, co-morbidities and aging populations. These challenges require a coordinated and multidisciplinary approach to care [11].

In a major review of team training, Baker et al. [1] said that the training of health professionals as teams "*constitutes a pragmatic, effective strategy for enhancing patient safety and reducing medical errors*."

Teamwork has been associated with improved outcomes in areas such as primary care [12] and cancer care [13]. Teamwork has also been associated with reduced medical errors [14, 15]. As summarized in Table B.4.1, improving teamwork can have benefits beyond improved patient outcomes and safety, including benefits for the individual practitioners in the team and the team as a whole, as well as the organization in which the team resides [11].

Table B.4.1. Measures of effective teamwork

Measurable outcomes of effective teamwork

		Individual benefits	
Organizational benefits	*Team benefits*	*Patients*	*Team members*
Reduced hospitalization time and costs	Improved coordination of care	Enhanced satisfaction with care	Enhanced job satisfaction
Reduced unanticipated admissions	Efficient use of health-care services	Acceptance of treatment	Greater role clarity
Better accessibility for patients	Enhanced communication and professional diversity	Improved health outcomes and quality of care Reduced medical errors	Enhanced well-being

Source: Adapted from Mickan SM, Rodger SA. *Effective health care teams: a model of six characteristics developed from shared perceptions.* Journal of Interprofessional Care, 2005 [16].

How teams form and develop

Considerable research into how teams form and develop has been conducted in other high-stakes industries. As detailed in Table B.4.2 there are four stages of team development: forming; storming; norming; and performing [17].

Table B.4.2. Stages of team development

Stage	Definition
Forming	Typically characterized by ambiguity and confusion. Team members may not have chosen to work together and may communicate in a guarded, superficial and impersonal manner. They may be unclear about the task.
Storming	A difficult stage when there may be conflict between team members and some rebellion against the tasks assigned. Team members may jockey for positions of power and there may be frustration at a lack of progress in the task.
Norming	Open communication between team members is established and the team starts to confront the task at hand. Generally-accepted procedures and communication patterns are established.
Performing	The team focuses all of its attention on achieving the goals. The team is now close and supportive, open and trusting, resourceful and effective.

Source: Modified from Flin RH, O'Connoer P, Crichton M. *Safety at the sharp end: a guide to nontechnical skills*, 2008 [18].

Similar to other industries, many health-care teams, such as emergency or surgical teams, are required to work together and need to be fully functional without any time to establish interpersonal relationships and go through the forming or norming phases described above [18]. For this reason, it is important that health-care professionals know how to be an effective team member prior to their joining the team. The following section describes the characteristics of effective teams.

Characteristics of successful teams

There are many models to describe effective teamwork. Historically, these have come from other industries, such as aviation's crew resource management (CRM). Box B.4.1 sets out the main characteristics of CRM developed in the aviation industry.

Box B.4.1. Summary of crew resource management

The application of CRM in health care

CRM was developed by the aviation industry to improve communications in the cockpit and implement team-centred decision making systems. CRM is defined as "using all available sources –information, equipment, and people– to achieve safe and efficient flight operations." (The National Transportation Safety Board, USA). CRM has been used in health care to improve team work and communications and initiate other safe processes.

Health-care teams come in many guises; some are very stable, but others can be very unstable with frequent changes in membership. Each member of the team will have different levels of knowledge and skills, which have to be accommodated. Mickan and Roger [16] have described the following list of simple characteristics that underpin effective health-care teams irrespective of how stable or unstable they are.

Common purpose
Team members generate a common and clearly defined purpose that includes collective interests and demonstrates shared ownership.

Measurable goals
Teams set goals that are measurable and focused on the team's task.

Effective leadership
Teams require effective leadership that set and maintain structures, manage conflict, listen to members and trust and support members. The authors also highlighted the importance of team members agreeing on and sharing leadership functions.

Effective communication
Good health-care teams share ideas and information quickly and regularly, keep written records and allow time for team reflection. Some of the most in-depth analysis of interprofessional team communication (across disciplines and not just among medical specialties) has focused on high-stakes teams, such as are found in surgery [19, 20].

Good cohesion
Cohesive teams have a unique and identifiable team spirit and commitment and have greater longevity as team members want to continue working together.

Mutual respect
Effective teams have members who respect each others talents and beliefs, in addition to their professional contributions. Effective teams also accept and encourage a diversity of opinion among members.

Additional requirements
Additional requirements for effective teams include [8, 18, 21]:
- individual task proficiency (both in terms of personal technical skills and teamwork skills);
- task motivation;
- flexibility;
- the ability to monitor their own performance;
- effective resolution of and learning from conflict;
- engagement in situation monitoring.

Leadership 13 14
Effective leadership is a key characteristic of an effective team. Effective team leaders facilitate, coach and coordinate the activities of other team members by:
- accepting the leadership role;
- asking for help as appropriate;
- constantly monitoring the situation;
- setting priorities and making decisions;
- utilizing resources to maximize performance;
- resolving team conflicts;
- balancing the workload within the team;
- delegating tasks or assignments;
- conducting briefings, huddles and debriefings;
- empowering team members to speak freely and ask questions;
- organizing improvement and training activities for the team;
- inspiring other members of the team and maintaining a positive group culture;
- ensuring that the team stays on track and meets expected outcomes.

Including the patient as a member of the health-care team is a new concept. Traditionally the role of the patient has been more passive as the recipient of health care. But we know that patients bring their own skills and knowledge about their condition and illness. Students can begin showing leadership in this area by trying to include patients and their families as much as possible. Establishing eye contact with patients, checking and confirming information and seeking additional information can all be done in the context of a ward round or clinic consultation. Include the patient in a safety check to ensure that the correct information and complete information is available to everyone on the team.

Communication techniques for health-care teams 15
The Irish-English writer, George Bernard Shaw, famously said, "The greatest problem with communication is the illusion that it has been accomplished". Good communication skills lie at the core of patient safety and effective teamwork. The following strategies can assist team members in accurately sharing information and ensuring that the focus is on the information being communicated. Use of a tool called ISBAR (**I**ntroduction, **S**ituation, **B**ackground, **A**ssessment, **R**ecommendation) has recently been demonstrated to improve telephone referrals by medical students in an immersive simulated environment [22].

The following description and case examples have been taken from the TeamSTEPPS™ programme [8].

ISBAR
ISBAR is a technique for communicating critical information about a patient's concern that requires immediate attention and action. The technique is intended to ensure that the correct information and level of concern is communicated in an exchange between health professionals.

***I**ntroduction*
"My name is Mary Smith and I am a nurse looking after Mrs Joseph, who is in ward 4 in bed 5."

***S**ituation*
What is going on with the patient?
"I am calling about Mrs Joseph in room 251. Chief complaint is shortness of breath of new onset."

***B**ackground*
What is the clinical background or context?
"Patient is a 62-year-old female post-op day one from abdominal surgery. No prior history of cardiac or lung disease."

***A**ssessment*
What do I think the problem is?
"Breath sounds are decreased on the right side with acknowledgement of pain. Would like to rule out pneumothorax."

***R**ecommendation*
What would I do to correct it?
"I feel strongly that the patient should be assessed now. Can you come immediately?"

If the health-care team member is dissatisfied with the response to their request for immediate attendance, they should seek assistance and advice from another more senior person.

Call-out

Call-out is a strategy to communicate important or critical information to inform all team members simultaneously during emergent situations. This technique helps team members anticipate the next steps and directs responsibility to a specific individual responsible for carrying out the task. An example of a call-out exchange between a team leader and a resident is shown below.

Leader: *Airway status?*
Resident: *Airway clear.*
Leader: *Breath sounds?*
Resident: *Breath sounds decreased on right.*
Leader: *Blood pressure?*
Resident: *BP is 96/92.*

Check-back

This is a simple technique for ensuring that information conveyed by the sender is understood by the recipient as intended [23]:

Step one: Sender initiates message.
Step two: Recipient accepts message and provides feedback.
Step three: Sender double-checks to ensure that the message has been understood.

Doctor: *Give 25 mg Benadryl IV push.*
Nurse: *25 mg Benadryl IV push?*
Doctor: *That's correct.*

Hand-over or hand-off

Hand-over or hand-off is a crucial time for the accurate exchange of information. Errors in communication can result in patients not being treated correctly and they may suffer an adverse outcome. Clinical hand-over refers to the transfer of professional responsibility and accountability for some or all aspects of care for a patient or group of patients, to another person or professional group on a temporary or permanent basis. *"I pass the baton"* is a strategy to assist timely and accurate hand-offs.

I	Introduction	Introduce yourself, your role and job and the name of the patient
P	Patient	Name, identifiers, age, sex, location
A	Assessment	Present chief complaint, vital signs, symptoms and diagnosis
S	Situation	Current status/circumstances, including code status, level of (un)certainty, recent changes and response to treatment
S	Safety concerns	Critical lab values/reports, socioeconomic factors, allergies and alerts (falls, isolation, etc.)
The		
B	Background	Co-morbidities, previous episodes, current medications and family history
A	Actions	What actions have been taken or are required? Provide a brief rationale
T	Timing	Level of urgency and explicit timing and prioritization of actions
O	Ownership	Identify who is responsible (person/team), including patient/family
N	Next	What will happen next? Anticipated changes? What is the plan? Are there contingency plans?

Resolving disagreement and conflict

The ability to resolve conflict or disagreement in the team is crucial to successful teamwork. This can be especially challenging for junior members of the team, such as students, or in teams that are highly hierarchical in nature.

However, it is important for all members of the team to feel they can comment when they see something that they feel will impact on the safety of a patient.

The following protocols have been developed to help members of a team express their concern in a graded manner.

Psychological safety

This is the degree to which people perceive their work environment as conducive to taking these interpersonal risks [24].

Two-challenge rule

The two-challenge rule is designed to empower all team members to stop an activity if they sense or discover an essential safety breach. There may be times when an approach is made to a team member, but is ignored or dismissed without consideration. This will require a person to voice his/her concerns by restating their concerns at least twice if the initial assertion is ignored (thus the name "two-challenge rule"). These two attempts may come from the same person or two different team members:

The first challenge should be in the form of a question.
Nurse: *I am worried about Mrs Jones in bed 23. She looks unwell and her symptoms are different to those she normally presents with. Can you have a look at her?*

The second challenge should provide some support for the team member's concern.
Nurse: *I am really worried about Mrs Jones. Her symptoms are worrying me. I think she needs to be seen now.*

Remember, this is about advocating for the patient. The two-challenge tactic ensures that an expressed concern has been heard, understood, and acknowledged.

The team member being challenged must acknowledge the concerns.
Doctor: *From what you have said, you seem pretty worried about Mrs Jones. I will see her now.*

If this does not result in a change or is still unacceptable, then the person with the concern should take stronger action by talking to a supervisor or the next person up the chain of command.

CUS

CUS is shorthand for a three-step process for assisting people in stopping a problematic activity.

I am **C**oncerned
I am **U**ncomfortable
This is a **S**afety issue

DESC script

DESC describes a constructive process for resolving conflicts. The goal is to reach consensus.

Describe the specific situation or behaviour and provide concrete evidence or data.
Express how the situation makes you feel and what your concerns are.
Suggest other alternatives and seek agreement.
Consequences should be stated in terms of their effect on established team goals or patient safety.

Challenges to effective teamwork

A number of specific barriers exist to establishing and maintaining effective teamwork in health care. Some of these are described below.

Changing roles

In many health-care environments there is considerable change and overlap in the roles played by different health-care professionals. Examples include changes in the role of midwives, radiographers reading plain film X-rays, nurses performing colonoscopies, dental therapists performing extractions and simple dental restorative procedures, and nurse practitioners, nurse-midwives and pharmacists prescribing drugs. These changing roles can present challenges to teams in terms of role allocation and acknowledgement. In addition, there may be members of the team who do not have any particular qualifications such as a dental assistant or a nurse aid or assistant. These people are important members of the team and should be coached and supported as equal team members. In some instances they may be required to carry out duties they are not trained for. If this occurs they should be properly prepared and supported.

Changing settings

The nature of health care is changing in many ways, including increased delivery of care for chronic conditions in community care settings and the transfer of many surgical procedures to outpatient centres. These changes require the development of new teams and the modification of existing teams.

Health-care hierarchies

Health care is strongly hierarchical in nature, which can be counterproductive to well-functioning and effective teams where all members' views should be considered; the team leader is not necessarily a doctor. While there has been growing acknowledgement that teamwork is important in health care, this has not been translated into changed practices, especially in countries where the cultural norms of communication may not take naturally to teamwork.

Individualistic nature of health care

Many health-care professions, such as nursing, dentistry and medicine, are based on the autonomous one-to-one relationship between the provider and patient. While this relationship remains a core value, it is challenged by many concepts of teamwork and shared care. This can be observed at many levels, from clinicians being unwilling to share the care of their patients through to the medico-legal implications of team-based care.

Instability of teams

As discussed previously, health-care teams are often transitory in nature, coming together for a specific task or event (e.g. cardiac arrest teams). The transitory nature of these teams places great emphasis on the quality of training for team members, which raises particular challenges in health care, where education and training are often paid insufficient attention as workers focus on service delivery.

Accidents in other industries

Reviews of high-profile incidents, such as aviation disasters, have identified three main types of teamwork failings as contributing to accidents, namely, unclear definition of roles, lack of explicit coordination and other miscommunication [18,25].

Assessing team performance

Assessing the performance of a team is an important step in improving team performance. A number of teamwork assessment measures are available [18, 26, 27]. Teams can be assessed in a simulated environment, by direct observation of their actual practice or through the use of teamwork exercises, such as those described in the sections below on teaching teamwork.

Teams can be assessed either at the level of individual performance within the team or at the level of the team itself. Assessments may be performed by an expert or through peer-ratings of performance.

An analysis of the learning styles or problem-solving skills individuals bring to teamwork can be useful following the assessment of team performance [28].

Summary of knowledge requirements

Effective teamwork does not just happen. It requires an understanding of the characteristics of successful teams, as well as knowledge of how teams function and ways to maintain effective team functioning. There are a variety of tools that have been developed to promote team communication and performance, including ISBAR, call-out, check-back and "I pass the baton".

What students need to do to apply teamwork principles

Students can apply teamwork principles as soon as they start their training. Many health-care degree programmes are based on problem-based learning (PBL) or involve small group discussions which require students to work together in teams to build knowledge and solve problems. Through these activities, students can begin to understand how teams function and what makes an effective learning group. Learning to share information, textbooks and lecture notes is a forerunner to sharing information about patients or clients.

Be mindful of how one's values and assumptions affect interactions with other team members

Students learn by observing how different health professionals interact with each other. They will realize that even though a team may be made up of many personalities and practice styles, this will not necessarily make the team less effective. Rather, the complimentary strengths and weaknesses of different members of the team can facilitate the delivery of high-quality, safe care.

Be mindful of the roles of team members and how psychosocial factors affect team interactions and recognize the effect of change on team members

It can often be difficult for students (and indeed practising clinicians) to appreciate the different roles that health-care professionals play in teams, or how teams respond to change or psychosocial factors. Students can be encouraged to make structured observations of teams, to observe the roles that different individuals play and how the allocation of these roles relates to both the personal characteristics and professions of the individual team members. Students can be encouraged to talk to different team members about their experiences of working in a team. Faculty can themselves ensure that students are included in teams and assigned roles, so that they can observe these processes from the inside. It is crucial that all team members understand the role and functions of the different professions so that appropriate referrals and treatment are instituted for patients.

Include the patient as a member of the team

When students are interviewing patients, taking a history, performing a procedure or providing

care interventions for patients, they should take time to communicate and engage with the patient. This can include talking with patients about what they are doing or talking about any anxieties or concerns the patient or their carers might have. Students can actively include patients in clinics and ward rounds by either inviting them to participate at the time or by discussing with the team how patients might be included in such discussions.

Use mutual support techniques, resolve conflicts, use appropriate communication techniques and change and observe behaviours

Students can practise all of these competencies either in their work with their peers in study groups or within health-care teams as they move through their programme and are increasingly involved in patient care. As detailed below, many teamwork exercises can be used with groups of students and practitioners to explore leadership styles, conflict-resolution techniques and communication skills. The degree to which students can experience or observe these activities will be dependent on how safe the health-care professionals feel in raising issues or problems with the team or the team leader.

A number of practical tips exist to help students improve their communication skills. Students can start practising good teamwork at the very beginning of their training. Clear and respectful communication is the basis for good teamwork. Always introduce yourself to the patient and the team or those you are working with, even if you will only be working together for a few minutes. Learn the names of team members and use them. Some people do not bother to learn the names of the team members who are less present, such as allied health-care workers, believing that they are not as important. However, team members will have better relationships with other team members if they use people's names rather than referring to them by their profession, such as "nurse" or "assistant." When delegating tasks to people, look at them and check that they have the information to enable them to do the task. Talking into the air is an unsafe practice because it may not be clear who you are addressing. Use objective language, not subjective language.

Read back instructions and close the communication loop in relation to patient-care information. State the obvious to avoid confusion.

Nurse: *Mr Brown is going to have an X-ray.*
Student: *So, we are taking Mr Brown to have an X-ray now.*

Ask for clarification if something does not make sense. Ask questions and continually clarify. Clarify your role in different situations.

Nurse: *Mr Brown is going to have an X-ray.*
Student: *So, we are taking Mr Brown to have an X-ray now.*
Nurse: *Yes.*
Student: *Who is taking Mr Brown for his X-ray?*

Be assertive when necessary. This is universally difficult, yet if a patient is at risk of serious injury, then health professionals, including students, must speak up. Senior clinicians will be grateful in the longer term if one of their patients avoids a serious adverse event. When conflict occurs, concentrate on "what" is right for the patient, not on establishing "who" is right or wrong.

Brief the team before undertaking a team activity and perform a debriefing afterwards. This encourages every member of the team to contribute to discussions about how things went and what can be done differently or better next time.

Case studies

Faulty communication by the team

This case study highlights how poor teamwork can contribute to patient harm.

A doctor was coming to the end of his first week in the emergency department. His shift had ended an hour before, but the department was busy and his registrar asked if he would see one last patient. The patient was an 18-year-old man. He was with his parents who were sure he had taken an overdose. His mother had found an empty bottle of paracetamol that had been full the day before. He had taken overdoses before and was under the care of a psychiatrist. He was adamant that he had only taken a couple of tablets for a headache. He said he had dropped the remaining tablets on the floor, and so had then thrown them away. The parents said they had found the empty bottle six hours earlier and felt sure that he could not have taken the paracetamol more than four hours before they found the bottle (i.e. 10 hours earlier).

The doctor explained that a gastric lavage would be of no benefit. He took a blood test instead to establish paracetamol and salicylate levels. He asked the lab to phone the emergency department with the results as soon as possible. A student nurse was at the desk when the lab technician phoned. She wrote the results in the message book. The salicylate level was negative.

When it came to the paracetamol result, the technician said, "two," paused, and then said, "one three." "Two point one three," repeated the nurse, and put down the phone. She wrote "2.13" in the book. The technician did not say whether this level was toxic and he did not check whether the nurse had understood. When the doctor appeared at the desk, the nurse read out the results. The doctor checked a graph he had spotted earlier on the notice board, which showed how to treat overdoses.

There was also a protocol for managing paracetamol overdoses on the notice board, but it was covered by a memo. The graph showed that 2.13 was far below the treatment level. The doctor thought briefly about checking with the registrar, but she looked busy. Instead, he told the student nurse that the patient would need to be admitted overnight, so that the psychiatrist could review him the next day. The doctor went off duty before the printout came back from the lab. It read "paracetamol level: 213". The mistake was not discovered for two days, by which time the patient was starting to experience the symptoms of irreversible liver failure. It was not possible to find a donor liver for transplant and the patient died a week later. If he had been treated when he arrived at the emergency department, he might not have died.

The doctor was told what had happened by his consultant on Monday when he started his next shift and, while still in a state of shock, explained that he had acted on what he thought was the correct result. He had not realized, he admitted, that paracetamol levels are never reported with a decimal point. Because he had not seen the protocol, he had also not appreciated that it might have been appropriate to start treatment before the paracetamol level had come back anyway, bearing in mind that the history, although contradictory, suggested the patient might well have taken a considerable number of tablets. It would be unfair to blame the doctor, the student nurse or the technician individually. The real weakness is the lack of safety checks in the system of communicating test results. At least three people made a series of small mistakes and the system failed to pick them up.

Activities

– Draw a diagram of the flow of information among the health professionals in this story and highlight the points of communication breakdown.
– Discuss how the doctor and student nurse might have felt and how to assist them through debriefing without placing blame.

A failure to relay information between staff and confirm assumptions, resulting in an adverse patient outcome

This example highlights how the dynamics between surgical trainees and staff and the movement of staff in and out of the operating room can allow adverse events to happen.

Before a routine gastric bypass patient was brought into the operating room, one nurse reported to a second nurse that the patient was allergic to "morphine and surgical staples". This information was repeated again to the staff surgeon and the anaesthetist before the start of the procedure.

As the surgery was coming to an end, the staff surgeon left the operating room, leaving a surgical fellow and two surgical residents to complete the procedure. The surgical fellow then also left the operating room, leaving the two residents to close the incision. The two surgical residents stapled a long incision closed along the length of the patient's abdomen. They stapled the three laparoscopic incisions closed as well. When the residents began the stapling, a medical student removed a sheet of paper from the patient's chart and took it over to the residents. The medical student tapped one of the residents on the shoulder, held the paper up for her to read and told her that the patient was allergic to staples. The resident looked at it and said, "You cannot be allergic to staples".

The staff surgeon returned to the operating room as the residents were completing the stapling. He saw that the residents had stapled the incisions and informed them that the patient did not want staples. He told them that they would have to take all the staples out and suture the incision. He apologized for neglecting to inform them of this allergy. One of the residents asked whether you could be allergic to staples and the staff surgeon said, "It does not matter. The patient is convinced that she is." The staff surgeon told the residents they would have to remove all

the staples and sew the incisions. This took an additional 30 minutes.

Discussion
– Discuss how this case demonstrates the importance of clear communication between all team members, as well as the issue of patient needs and preferences.

Source: WHO Patient Safety Curriculum Guide for Medical Schools. Case supplied by Lorelei Lingard, Associate Professor, University of Toronto, Toronto, Canada.

Emergency resuscitation requires teamwork
This case illustrates the importance of the team being prepared to carry out an effective code blue or emergency resuscitation.

Simon, a medical officer, was in the cafeteria eating a late lunch. Halfway through his meal, a cardiac arrest announcement was made over the public address system. He ran to get the lift up to the fifth floor ward where the emergency was. It was peak hour and the lifts were busy. By the time he reached the patient, a nurse had wheeled in the cardiac arrest trolley and another nurse had an oxygen mask on the patient.

"Blood pressure, pulse, heart rate?" yelled the doctor.

A nurse grabbed a blood pressure cuff and began to inflate it. The nurse holding the oxygen mask tried to find a pulse on the patient's wrist. The medical officer shouted for an electrocardiogram monitor to be placed on the patient and for the head of the bed to be lowered. The nurses tried to follow his orders; one stopped trying to get the blood pressure and lowered the bed. This made the oxygen mask fall off as the tubing got caught in the side panels of the bed.

Simon became agitated. He had no idea of the heart rate or rhythm. The patient did not seem to be breathing. The heart monitor came on and showed ventricular fibrillation.

"Pads and 50 joules", called Simon.
The nurses look at him and say, "What?"
"Pads and 50 joules, stat!" Simon replied.
"Call a doctor, any doctor, to come and assist me now!" he yelled.
They could not revive the patient.

Activity
– Describe this confusing case in a clear manner. Identify the key factors and outcomes.

Source: WHO Patient Safety Curriculum Guide for Medical Schools. Case supplied by Ranjit De Alwis, Senior Lecturer, International Medical University, Kuala Lumpur, Malaysia.

Everyone on the team counts
This is an example of how an initiative such as a preoperative team briefing can provide an opportunity for individual members of the operative team to provide information that affects a patient's outcome.
A preoperative team briefing is a short gathering including nurses, surgeons and anaesthetists held before a surgery with the goal of discussing important patient and procedure-relevant issues.

In preparation for a low anterior resection and ileostomy, the interprofessional team met for a briefing. The surgeon asked a nurse whether she had anything to contribute. The nurse reported that the patient was worried about her hernia. In response to this, the surgeon questioned the patient (who was still awake) about the hernia. The surgeon then explained to the operating room team how he would proceed around the hernia and that he might use mesh.

Questions
– Is this the place for discussion with a patient who most likely had preoperative medication?

– What type of informed consent was the patient able to provide? What is meant by "patient was worried about her hernia"?

– Should the nurse have brought this up prior to the patient arriving in the operating theatre?

– Should this have been documented in the medical record with follow-up?

Source: WHO Patient Safety Curriculum Guide for Medical Schools. Case supplied by Lorelei Lingard, Associate Professor, University of Toronto, Ontario, Canada.

Emergency in a dental office
This case study illustrates the importance of all members of the team being adequately prepared to work together in an emergency.

During a molar extraction, the patient started sweating and became pale. The patient asked the dentist to stop the treatment as he was feeling sick.

The dentist stopped the treatment and laid the patient flat and raised his legs. He then took her pulse and asked for the emergency equipment.

The dental assistant had only been working in the centre for a short time. No one had told her where the emergency equipment was kept. She left the dental office, leaving the dentist alone with the patient while she looked for the emergency equipment.

The patient's clinical situation continued to deteriorate rapidly. The dentist, who was alone in the office without any emergency equipment, went out to ask for help.

Two minutes later, the dentist came back with the dental assistant (who had now located the emergency equipment) and two other colleagues.

The patient did not seem to be breathing at that time. The dentists began cardiopulmonary resuscitation (CPR). The dental assistant phoned for an ambulance.

The team were unable save the patient.

Questions

– What factors are associated with this incident?

– In what ways could improved communication between team members have prevented this death?

Source: Case supplied by Shan Ellahi, Patient Safety Consultant, Ealing and Harrow Community Services, National Health Service, London, UK.

Teaching strategies and formats

This topic includes a number of strategies for learning and practising teamwork. Effective teams do not just happen and there is a substantial body of underpinning theory that can be appropriately delivered in a didactic manner. The knowledge requirements listed above can form the basis for didactic presentations.

Given that one of the most effective ways of learning about teamwork is to participate in a team, we include a number of team-based activities that can easily be run with small groups of students with limited resources. Given that students will often have had little experience participating in health-care teams, we include activities in which students can reflect on their experiences of teamwork unrelated to health care.

To familiarize students with actual health-care teams, we have also included activities that anticipate the types of teams that students will increasingly encounter as they move forward in their training and careers.

A recent systematic review of teamwork training developed for medical students and junior doctors found that teaching teamwork skills to students and young doctors was moderately effective over the short term and appeared to be more effective when more teamwork principles were addressed within the training programme [29].

Any team education and training programme must consider local culturally acceptable behaviour, in regard to speaking up in a team and the nature of hierarchies in a given country.

We conclude this section with a discussion of interprofessional education that may or may not be an option for consideration within your curriculum.

Teamwork education over the course of a programme

Over the course of a year training programme, there are opportunities to stratify teaching and learning around teamwork. For instance, a programme could be structured in the following way:

Early year(s)

Didactic presentations on:

- the basics of teamwork and learning styles;
- different types of teams in health care;
- different learning styles.

Small group activities that focus on:

- building fundamental team-based skills;
- appreciating different learning and problem-solving styles;
- reflecting on experiences in teams outside of health care;
- the roles of various health-care teams.

Middle and later year(s)

Didactic presentations on:

- the roles and responsibilities of different health professionals in teams;
- characteristics of effective teams;
- strategies for overcoming barriers to effective teamwork.

Small group activities that include:

- interprofessional participation;
- refection on the experience of participating in health-care teams as a student;
- teamwork simulation in a health-care context (high or low fidelity).

Teaching activities

Engaging role models

Given that teamwork is not always recognized or valued in the health-care environments encountered by students, it is important to engage clinical role models in the delivery of teamwork education. If possible, identify clinicians with good reputations for working in multidisciplinary teams to serve as role models. Ideally, these role models should present different aspects of the theory behind teamwork and give examples from their own experiences. Whenever possible, role models should be drawn from multiple health-care professions.

Reflective activities around experiences of teamwork

A simple way to introduce teamwork concepts to students is to get them to reflect on teams they may have participated in during school or university. These may include sporting teams, work teams, choirs, etc. Reflective exercises can include the creation of simple surveys that can be used to draw out questions concerning teamwork.

Reflective exercises can also be built around examples of teamwork failures or successes that may be topical and/or current within the local community. This may include the development of quizzes or group discussions about newspaper articles describing failures of sporting teams associated with teamwork failures or high-profile examples of clinical errors due to failures in teamwork. The case studies provided for this topic could also be used to reflect on failures in teamwork.

High-profile examples of teamwork failures and successes outside of health care, such as plane crashes or nuclear power station failures, are often used in the teaching of teamwork principles. A number of these are described in detail by Flin et al. [18].

Team-building exercises

There are a wide range of activities that can help promote an understanding of team dynamics and different learning styles. A simple search of the Internet will provide many examples. These can be useful for any team participant and require no prior knowledge of health care or teamwork. These exercises can be fun and often have a positive side-effect of bonding student groups together.

Remember, one of the most important parts of any team-building exercise is the debriefing at the end of the exercise. The purpose of the debriefing is to reflect on what worked well for the team, so that effective behaviours are reinforced. The team should also reflect on the difficulties and challenges they faced. Strategies to manage the challenges should be explored and then practised in subsequent sessions.

Building newspaper towers: an example of a team-building exercise

This is an example of an interactive exercise that requires no physical contact and that can be varied depending on group size, dynamics and the time available.

To begin, divide the students groups of 2–6 people. Issue each group an equal number of sheets of newspaper (the fewer the more difficult, 20–30 sheets is fine for a 10–15 minute exercise), and a roll of sticky tape. The task is to construct the tallest freestanding tower made only of newspaper and sticky tape in the allotted time. The point of the exercise is to demonstrate the importance of planning (time, method of construction, creativity) and the motivational effect of a team task. Instructions need to be very clear. For instance, does the tower have to be free-standing or can it be braced? It does not matter which; it matters only that any issues affecting a clear result are clarified.

You can allocate as many sheets as you wish, depending on the main purpose of the exercise and, to an extent, the amount of time available and the number of individuals on each team. As a general rule, fewer sheets should be used when teams are smaller and less time is available for the exercise. Short periods of time, large teams, and lots of sheets lead to lots of chaos. This may be ideal for demonstrating the need for leadership and management. Unless your focus is leadership and managing the planning stage, avoid the combination of small numbers of sheets and large teams. Small teams do not need lots of sheets, unless you make a rule that all of the material must be used, in order to put pressure on the planning and design stage.

Simulated health-care environments

Simulation is increasingly used to learn and practise teamwork in health care. Simulated environments are ideal for learning as they combine safety–there is no real patient–with the ability to increase or decrease the speed of evolution of the scenarios, especially if mannequin-based simulation techniques are used. This is ideal for teamwork exercises, as the

importance of sound teamwork behaviours is particularly manifest in emergency, time-critical situations. In addition, students get a chance to experience what it is like to manage a situation in real time.

Ideally, simulated environments may be used to explore teamwork using mixed groups of health-care professionals. When exploring teamwork, the focus should not be on the technical skills of the students, but rather their interaction and communication with one another. The best way to ensure that this remains the focus of the exercise is to allow the students to learn and practise the technical aspects of the scenario together prior to the actual scenario, usually through an initial procedural workshop. If the team struggle with basic knowledge and skills, then the opportunity to discuss teamwork may be lost, as there may be so many important clinical and technical issues to discuss. However, if the students are well-drilled on the technical aspects of the scenario beforehand, the challenge is for them to put what they know into action as a team. The simulation then becomes a powerful opportunity to explore the nontechnical aspects of the scenario, namely the teamwork, leadership and communication issues that emerge as the scenario unfolds [18].

As with the other team-building exercises discussed above, it is vital that a structured debriefing be conducted to explore the way the teams performed in the exercise: what worked well and why, what was difficult and why, and what could be done to improve performance on subsequent occasions. If different health-care students are working together in the simulation, the different roles, perspectives and challenges of each profession can be discussed during the debriefing as well.

The major constraint associated with simulation exercises is that they can be resource intensive, especially if a computerized mannequin is used and/or attempts are made to make a teaching setting look like a clinical environment.

Participating in health-care teams

Students, particularly in the later parts of their training programmes, should be encouraged to participate in different types of health-care teams at every opportunity. If clinicians from a particular department or clinic maintain the traditional silo (not multidisciplinary) approach to health care, this should not prevent students from working with other health professionals as part of a team.

The faculty should identify teams to which students will be welcomed and ideally given some form of participatory role. These teams may include well-established multidisciplinary care planning teams, such as those found in mental health or oncology, or more fluid teams, such as those found in emergency departments. They may also include primary health-care teams in the community.

It is important for students to reflect on their team-based experiences in health care and share these experiences with their peers and faculty. This will allow discussion of both the positive and negative aspects of their experiences. Students should be asked to identify model teams and explain why they believe these teams can be identified as such. They should be encouraged to ask questions such as:

- what were the strengths of the team?
- what professions were represented on the team and what were their roles?
- did the team have clear goals?
- was there a clear leader?
- were all team members permitted to participate?
- how did members of the team communicate with one another?
- how could the student see the team improving?
- was the patient part of the team?
- what were the outcomes and were they effective?

Students should be asked to explore and reflect on areas of teamwork in which errors are know to occur, such as communication between primary- and secondary-care providers or during hand-over/hand-off.

It may also be possible for students to take part in a panel discussion with an effective multidisciplinary team to discuss how the team functions and works together.

Interprofessional education

Teamwork in health care cannot be discussed without mentioning the important role of interprofessional education (IPE) in undergraduate health education.

At the heart of IPE is the preparation of future practitioners for effective team-based practice, by bringing students from different disciplines together during their undergraduate education to learn from and with each other. This helps students learn to appreciate and respect the different roles of health professionals before they have joined specific professional groups themselves.

While there is a compelling argument that undergraduate IPE should improve subsequent teamwork, the research to support this argument is not yet conclusive.

Universities have taken different approaches to introducing IPE into their curricula depending on available resources, the available undergraduate programmes and the degree of support for the concept at senior levels. Approaches have ranged from a full re-engineering and alignment of all health curricula through the addition of IPE modules and activities to supplementing existing curricula on a relatively opportunistic basis.

The resources and activities included in this guide are intended to be useful for teaching students in a particular professional field, as well as multi-professional student groups.

A list of further reading on IPE and links to universities that have introduced IPE into their curricula is provided below.

Tools and resource material (IPE)

Greiner AC, Knebel E, eds. *Health professions education: a bridge to quality*. Washington, DC, National Academies Press, 2003.

Almgren G et al. *Best practices in patient safety education: module handbook*. Seattle, University of Washington Center for Health Sciences Interprofessional Education, 2004.

Universities that have introduced major initiatives in IPE include:

- Faculty of Health Sciences, Linkoping University, Sweden. (http://www.hu.liu.se/?l=en; accessed 20 February 2011).
- College of Health Disciplines, University of British Columbia, Canada. (http://www.chd.ubc.ca/; accessed 20 February 2011).

Free team-building games can be found at the following web site: http://www.businessballs.com/teambuildinggames.htm; accessed 20 February 2011.

Summary

In summary, team training for students in the health-care professions can be based on a variety of techniques, many of which can be delivered in the classroom or in low-fidelity simulated environments.

Ideally, students should take part in real teams and learn through experience and guided reflection and team training should focus on as many principles of effective teamwork as possible.

Tools and resource material

TeamSTEPPS™: Strategies and tools to enhance performance and patient safety. United States Department of Defence, in collaboration with the Agency for Healthcare Research and Quality (AHRQ) (http://teamstepps.ahrq.gov/abouttoolsmaterials.htm; accessed 20 February 2011). TeamSTEPPS™ also includes free access to a number of videos.

The SBAR Toolkit is available on the above-mentioned TeamSTEPPS web site (http://www.ahrq.gov/teamsteppstools/instructor/fundamentals/module6/igcommunication.htm#sbarsl9; accessed 14 November 2010).

Assessing knowledge of this topic

Many different modalities can be used to assess teamwork. MCQ can be used to explore knowledge components. A portfolio can be used to record and reflect on team activities encountered over the course of the training programme.

Assignments can be specifically designed to require teamwork among students. This may include students self-selecting a health- or non-health-related project to complete or faculty suggesting a project such as planning the development of an apartment for a person who uses a wheelchair or planning the development of a rural outreach programme for oral health. In developing the assignment, the emphasis is not so much on the outcome of the project, but rather how students work together.

Later assessments can be more complex. Students could review a team with which they have worked and development recommendations for how that team could be improved.

A writing assignment could include tracking team functions by following either a patient's hospital stay for a defined period of time or tracking a health-care provider and reviewing how many teams he/she intersects with and what his/her roles are on each team.

Teams could be asked to identify a safety issue, collect data on it, analyse the data and describe interventions to prevent or mitigate the safety issue.

Depending on available resources, simulation exercises can also be used for effective formative

and summative assessments of health-care teamwork.

Ideally, some assessments would require students from different health professions to work together.

Evaluating the teaching of this topic

As with any evaluation exercise, a number of evaluation phases need to be considered. These include:

- a needs analysis (or prospective evaluation) to judge how much teamwork instruction currently exists and how much is needed;
- a process evaluation during the delivery of any programme to maximize its effectiveness;
- an impact evaluation to track the impact of the programme on knowledge and competencies gained during the programme.

See the Teacher's Guide (Part A) for more information on evaluation.

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Slides for Topic 4: Being an effective team player

Didactic lectures are not usually the best way to teach students about patient safety. If a lecture is being considered, it is a good idea to plan for student interaction and discussion during the lecture. Using a case study is one way to generate group discussion. Another way is to ask the students questions about different aspects of health care that will bring out the issues contained in this topic.

The slides for Topic 4 are designed to help the instructor deliver the content of this topic. The slides can be changed to suit the local environment and culture. Instructors do not have to use all of the slides and it is best to tailor the slides to the areas being covered in the teaching session.

Topic 5
Learning from errors to prevent harm

Distractions can lead to disastrous consequences

A 3-year-old boy, on his first visit to the dentist, was examined by a dentist who found no dental caries and then handed over the boy to a dental hygienist for routine teeth-cleaning. After cleaning the child's teeth, the dental hygienist used a swab to spread a stannous fluoride gel over the boy's teeth as a decay-preventive measure.

According to the mother, the hygienist was engrossed in conversation while working on the child and, after handing him a cup of water, failed to instruct him to wash his mouth out and spit out the solution. She said that her child drank the water.

The child began vomiting, sweating and complaining of headache and dizziness. His mother, appealing to the dentist, was told that the child had been given only routine treatment. However, the boy's mother was still not satisfied, and so the boy was sent to the nearby ambulatory paediatric care unit in the same building. They waited there for two and a half hours. Despite her appeals for help, the child became progressively sicker and lapsed into what she thought was sleep, but was actually a coma.

Eventually, the boy was seen by a doctor who summoned the supervisor. The child was treated with an injection of adrenaline directly into his heart in an attempt to revive him. An ambulance was called and transferred the child to hospital, which was a five-minute drive away.

After arriving at the hospital, the mother and child waited for more than an hour. By that time, the boy had lapsed back into a coma. The doctors tried to pump his stomach, but the boy went into cardiac arrest and died. According to the county toxicologist, the child ingested 40 ml of 2% stannous fluoride solution; triple the amount sufficient to have been fatal.

Source: Case supplied by a WHO Expert Committee participant, Paris, October 2010.

Introduction–Coming to terms with health-care errors

This case study reflects the underpinning factors of the tragic death of a 3-year-old boy. If we analyzed the above case study, we would uncover the many errors that contributed to the tragic and preventable outcome and identify the steps that could be taken to prevent it ever happening again. The most important aspect of analysing errors is to discover what happened and how to prevent their recurrence. For this reason, it is crucial that all health-care students have a basic understanding of the nature of error. All health-care workers need to understand different types of errors and how they occur. This is essential for devising strategies to prevent errors and/or intercept them before they can cause harm to patients.

An equally important consideration is the issue of learning from errors–one's own as well as those of others. It is through investigation of errors

and error-causing conditions that improvements in system design can be implemented, in the hope of decreasing the frequency and impact of errors. (This is further discussed in Topic 3: *Understanding systems and the effect of complexity on patient care*). → T3

Keywords
Error, violation, near miss, hindsight bias, root cause analysis.

Learning objective 2

Understand the nature of error and how health-care providers can learn from errors to improve patient safety.

Learning outcomes: knowledge and performance

Knowledge requirements 3

Knowledge requirements for this topic include students understanding how they can learn from errors. Understanding of the terms *error*, *slip*, *lapse*, *mistake*, *violation*, *near miss* and *hindsight bias* is essential.

Performance requirements 4

By the end of the course students should be able to:

- identify situational and personal factors that are associated with the increased risk of error;
- participate in analyses of adverse event and practise strategies to reduce errors.

Errors 5

In simple terms, an error occurs "when someone is trying to do the right thing, but actually does the wrong thing" [1]. In other words, there is a non-deliberate deviation from what was intended. The cognitive psychologist, James Reason, stated this fact of life more formally by defining errors as "planned sequences of mental or physical activities that fail to achieve their intended outcomes, when these failures cannot be attributed to the intervention of some chance agency" [2]. Errors may occur when the wrong thing is done (commission) or when the correct thing is not done (omission).

A violation is different from errors caused by the system. Violations are errors caused by deliberate deviation by an individual from an accepted protocol or standard of care. 6

Errors and outcomes are not inextricably linked. Students will often observe patients who have bad outcomes in the absence of any human error. Some treatments have well-recognized complications that can occur even in the best of hands and under the best of circumstances. In other cases, numerous errors may not lead to bad outcomes, as long as they are recognized in time and appropriate steps are taken to counteract any damage that may have been caused. Sometimes, as mentioned in Topic 3, patients themselves are resilient and may be okay even though an error was made, because their own body or immune system has withstood the incorrect treatment. 7

It is important to point out that there is no mention of outcome in this definition of error, though the fact of the (usually untoward) outcome is often what draws our attention to the fact that an error has occurred. Indeed, most errors in health care do not lead to harm for patients because they are recognized before harm occurs and the situation is remedied. There is no doubt that the nature of the outcome usually influences our perception of the error, often due to the phenomenon of "hindsight bias," in which knowledge of the outcome of a situation influences our perception (usually unfavourably) of the standard of care before and during the incident in question [2].

One only has to consider one's last "silly mistake" in everyday life to be reminded of the inevitability of error as a fundamental fact of life (see Topic 2: *Why applying human factors is important for patient safety*). → T2 8 9 10

The challenging reality for health-care workers is that the same mental processes that lead us to make "silly mistakes" outside the workplace are also in play when we are at work. However, the work context makes the consequences vastly different.

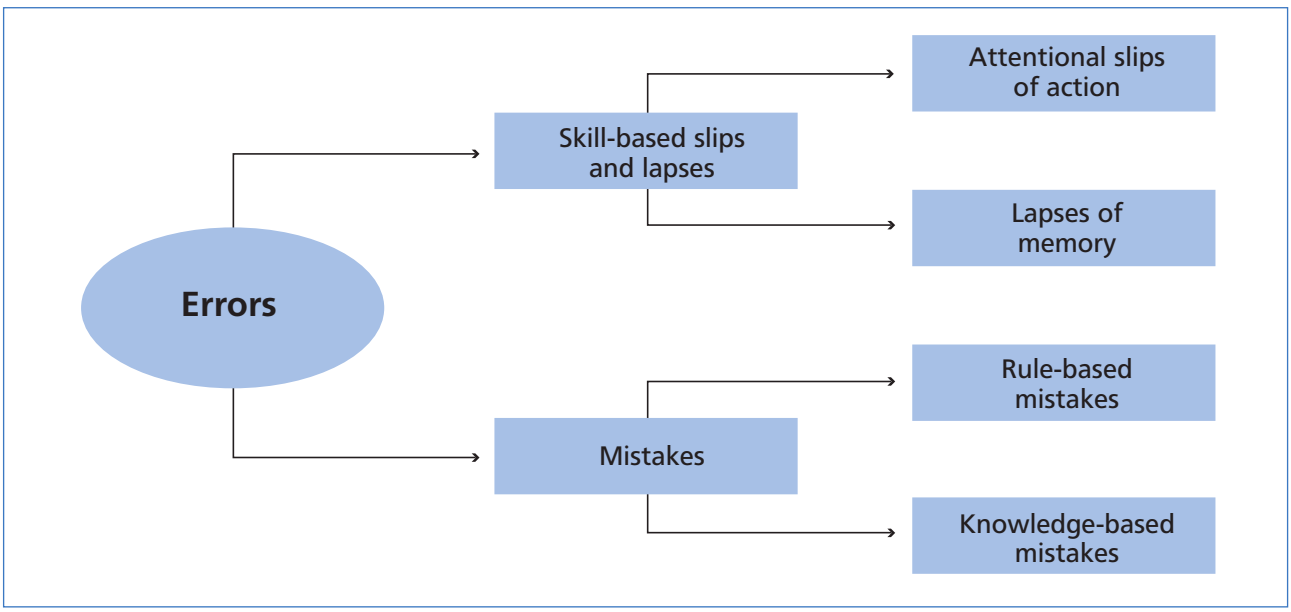
The terms *medical error or health-care error* are slightly misleading, as they may give the impression that the kinds of errors that can occur in health care are unique to health care. This is not the case. The patterns of errors that occur in health-care settings are no different from the sorts of problems and situations that exist in other settings. What is different about health care is that there remains an element of a culture of infallibility that denies the prevalence of error. Another unique feature of health care-associated errors is that when failure occurs (omission or commission), it is the patient(s) who suffer.

Errors occur because of one of two main types

of failures: either actions do not go as intended or the intended action is the wrong one [3]. The former situation is a so-called error of execution and may be further described as being either a *slip*, if the action is observable, or a *lapse*, if it is not. An example of a slip is accidentally pushing the wrong button on a piece of equipment. An example of a lapse is a memory failure, such as forgetting to administer a medication.

A failure that occurs when the intended action is actually incorrect is called a *mistake*. A mistake is a failure of planning (i.e. the plan is wrong). This can be either rule-based, when the wrong rule is applied, or knowledge-based, when a clinician does not take the correct course of action. An example of a rule-based mistake would be getting the diagnosis wrong and so embarking on an inappropriate treatment plan. Knowledge-based mistakes tend to occur when health-care providers are confronted with unfamiliar clinical situations (see Figure B.5.1 below).

Figure B.5.1. Principal types of errors 11



Source: Reason JT. Human error: models and management. *British Medical Journal*, 2000 [4].

Slips, lapses and mistakes are all serious and can potentially harm patients. The actual potential for harm depends on the context in which the error occurs.

Situations that increase the likelihood of error as well as personal error-reduction strategies are described in Topic 2: *Why applying human factors is important for patient safety*. Some other general error-reduction principles are outlined below. Reason has also promoted the concept of "error wisdom" [4] for front-line workers, as a means to assess the risk present in different contexts depending on the current state of the individual involved, the nature of the context and the error potential of the task at hand.

→ T2

Situations associated with an increased risk of error 12

We know from various studies that students and new clinicians are particularly vulnerable to errors under certain circumstances.

Inexperience

It is very important that students not perform a procedure on a patient or administer a treatment for the very first time without appropriate preparation. Students need to first understand what they are doing and to practise on a mannequin or other prop in a simulated environment. If it is his/her first time, the student should be properly supervised and watched while he/she performs the procedure or gives the treatment.

Students are in a privileged position. Patients do not expect students to know much, they appreciate that they are learning. This is why it is very important they do not pretend or let others present them as having more experience than they do.

Shortage of time
Time pressures encourage people to cut corners and take shortcuts when they should not. Not cleansing hands properly is an example of this. Another example would be a pharmacist not taking the time to properly counsel someone receiving medication, or a midwife not properly informing a woman about the different stages of delivery.

Inadequate checking
The simple act of checking saves thousands of patients from receiving the wrong medications. Pharmacists routinely check drugs and assist the other members of the health-care team in making sure each patient receives the correct dosage of the correct drug by the correct route. Students (medical, dental, midwifery) should establish good relationships with pharmacists and nurses who have habitual checking routines built into their professional routines. Checking is a simple thing that students can start practising as soon as they are placed into a clinical environment or community care setting.

Poor procedures
This can relate to a number of factors–inadequate preparation, inadequate staffing and/or inadequate attention to the particular patient. Students may be required to use a piece of equipment without fully understanding its function or how to use it. Before using any piece of equipment for the first time, students should familiarize themselves with it. Watching someone use a piece of equipment and then talking with that person about the procedure for which it is used is very instructive.

Inadequate information
Continuous quality health care and treatment depends on each health-care professional recoding the patient details accurately, in a timely way and in legible handwriting in the patient record (medical record, drug chart or other method used for storing patient information). It is crucial that students habitually check the information being recorded and ensure that the information they write is legible, accurate and up to date. Misinformation, incorrect and inadequate information are often factors contributing to adverse events. Accurate verbal transmission of information is also crucial. With so many health professionals involved in caring for patients it is essential that verbal and written communications are checked and accurate.

Individual factors that predispose students (and other health-care workers) to errors

In addition to situations known to be prone to errors, there are also individual factors that predispose for errors.

Limited memory capacity
How students perceive of themselves in their chosen health-care profession and the workplace hierarchy may relate to how confident and willing they are to ask for help. Asking for help is expected of all students, yet many still find this to be very challenging. This in turn may affect their ability to recognize their limitations. Lack of confidence can be a significant factor in whether students ask for help in mastering a new skill. If students are unwilling or lack the confidence to ask for help with simple tasks, will they have the confidence to ask for help when they are in trouble?

Learning to ask for help is an essential skill for all students and new clinicians. Researchers have examined the preparedness of medical and nursing students for clinical practice. These studies have revealed that many graduating medical students in their early years have deficiencies in basic clinical skills. The first year of practice for nurses is also a time of inadequate competencies and stress. This may be due to a reluctance to ask for help as students. Inadequate understanding of the crucial signs of acute illness, airway obstruction, fetal and maternal well-being and basic life support were examples of specific areas in which new doctors had inadequate knowledge and skills.

Many students think that if they can regurgitate the technical information stored in textbooks, they will be good health professionals. However, this is not the case. The amount of information that many health-care providers are required to know today is far beyond that which can be memorized. The human brain is only capable of remembering a finite amount of information. Students should not rely on memory, particularly when there are a number of steps involved. Guidelines and protocols have been developed to help health-care professionals provide care and service following the best available evidence. Students should get into the habit of using checklists and not relying on memory.

Fatigue

Memory is affected by fatigue. Fatigue is a known factor in errors involving health-care practitioners. In recognition of the problems caused by fatigue, many countries have already or are in the process of reforming the excessive hours worked by doctors [5]. The connection between sleep deprivation of interns due to long shifts and circadian interruption and well-being was made three decades ago, yet it is only recently that governments and regulators have become serious about limiting hours. A 2004 study by Landrigan et al. [6] was one of the first of its kind to measure the effects of sleep deprivation on medical errors. This study found that interns working in the medical intensive unit and coronary care unit of Brigham and Women's Hospital (Boston, MA, United States) made substantially more serious mistakes when they worked frequent shifts of 24 hours or more as compared to when they worked shorter shifts. Other studies show that sleep deprivation can have similar symptoms to alcohol intoxication [7-9]. Problems with nurses working 12-hour shifts and the use of mandatory overtime and the fact that these practices can lead to increased errors have been documented in the professional literature.

Stress, hunger and illness

When students feel stressed, hungry or ill, they will not function as well as when they have none of these issues. It is very important for students to monitor their own status and well-being. Students should be mindful of the fact that if they are feeling unwell or stressed, they are more likely to make errors. Burnout in new nurses has led to errors and to nurses leaving the profession. Stress and burnout are related.

There are many mnemonic devices to help students monitor themselves. HALT is one such aid.

Pay attention to whether you are: 

H Hungry
A Angry
L Late or
T Tired

Another memory tool for self-monitoring is IM SAFE. 

I Illness
M Medication (prescription and others)
S Stress
A Alcohol
F Fatigue
E Emotion

Language or cultural factors

The potential for communication errors caused by language and cultural factors is obvious, but there are many interactions between patients and their health-care providers that occur without an interpreter or common language. Students should appreciate the problems caused by language barriers and misunderstandings of cultural norms. Literacy is another important issue to keep in mind. Health-care providers must be aware of how well patients and their carers can understand written instructions.

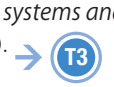
Hazardous attitudes

Students who perform procedures or interventions for patients without supervision might be said to display a hazardous attitude. These students may be more interested in practising or getting experience than attending to the well-being of the patient. Students should always appreciate that contact with patients is a privilege that should not be taken for granted.

Ways to learn from errors

Incident reporting

Incident reporting and monitoring involve collecting and analysing information about any event that could have harmed or did harm a patient in a clinical setting or health-care organization. An incident-reporting system is a fundamental component of an organization's ability to learn from error. The lessons learned through the use of these procedures allow the organization to identify and eliminate "error traps". (More information on organizational responsibility for incident monitoring is presented in Topic 6: *Understanding and managing clinical risk*). 

Incidents are traditionally underreported, often because the person approach to incident analysis is still pervasive in health care, whereby the front-line nurses, pharmacists, doctors, dentists or midwives –often the ones who report the incident–are criticized for their role in the evolution of the incident. As mentioned above, this situation is often exacerbated by the phenomenon of hindsight bias. The person approach is counterproductive on several levels. (See Topic 3: *Understanding systems and the effect of complexity on patient care*). 

The frequency of reporting and the manner in which incidents are analysed–whether a systems approach or person approach is used–are heavily dependent on the leadership and culture of an organization. In recent years, more attention

has been paid to the importance of organizational culture in health care [10], reflecting lessons learned in other industries in relation to system safety. There is likely to be a correlation between the organizational culture of a health-care facility and the safety of patients being treated at that facility.

An organization's culture reflects the shared values and beliefs that interact with an organization's structure and control systems to produce behavioural norms [11]. Organizations with a strong reporting culture are well placed to learn from errors because the staff members feel free to report actual or potential problems without fear of ridicule or reprimand. Students and new clinicians are part of the work culture. They may feel that they have no power to change or affect anything in the work environment. However, they too can look for ways to improve the system. This can be as simple as being respectful to the other members of the health-care team, including patients, in discussions about care or asking if other team members would like a cup of coffee if the student is making a cup for himself/herself. Refraining from finger pointing to individuals involved in an adverse event is another way students can help change the culture. If a student hears staff talking about a particular staff member who has made a mistake, they can move the focus away from the individual to discussion about underlying factors that may be involved.

Other successful strategies in terms of incident reporting and monitoring include [7] anonymous reporting, timely feedback, open acknowledgement of successes resulting from incident reporting and reporting of near misses. The reporting of near misses is useful in that "free" lessons can be learned. That is, system improvements can be instituted as a result of the investigation, without patients having incurred any harm.

Root cause analysis

See also Topic 7: *Using quality-improvement methods to improve care*. → T7

A number of models have been developed using root cause analysis (RCA) principles. One such model, called *the London Protocol*, was developed by Charles Vincent and colleagues. This is an easy-to-understand model that takes the team through each of the steps of a clinical investigation. See Box B.5.1 for an outline of the steps involved.

Box B.5.1. The London Protocol

Details of investigation process	Analysis of case
Which incidents should be investigated?	If the protocol is followed systematically and the interview and analysis conducted thoroughly, the report and implications of the incident should emerge from the analysis in a relatively straightforward fashion. When the composite is complete, there should be a clear summary of the problem and the circumstances that led up to it, and the flaws in the care process should be readily apparent. The final section of the report will consider what implications the incident has for the department or organization and will make recommendations for remedial actions.
Reviewing case records	
Framing the problem	
Interviewing staff	
How did it happen?–identifying the care management problems Why did it happen?–identifying the contributory factors	

Source: Vincent C et al. How to investigate and analyse clinical incidents: clinical risk unit and association of litigation and risk management protocol. *British Medical Journal*, 2000, 320: 777–781.

The Veterans Affairs National Center for Patient Safety of the United States Department of Veterans Affairs (VA) developed another model, which also uses a structured approach of RCA to evaluate and analyse severe adverse events and develop system improvements to prevent their reoccurrence [12]. All models that review retrospectively ask the following set of questions [1]:

- what happened?
- who was involved?
- when did it happen?
- where did it happen?
- how severe was the actual or potential harm?
- what is the likelihood of recurrence?
- what were the consequences?

RCA focuses on the system, not the individual worker, and assumes that the adverse event that harmed a patient is a system failure. The VA system and systems used in Australia and elsewhere use a severity assessment code to help triage reported incidents to ensure that those indicating the most serious risks are dealt with first.

The RCA model focuses on prevention, not blame or punishment. (Other processes are used when the focus of interest is holding people accountable for their actions.) The focus of this type of analysis is on system-level vulnerabilities as opposed to individual performance. The model examines multiple factors, such as communication, training, fatigue, scheduling of tasks/activities and personnel, environment, equipment, rules, policies and barriers.

The defining characteristics of root cause analysis include [13]:

- review by an interprofessional team knowledgeable about the processes involved in the event;
- analysis of systems and processes rather than individual performance;
- deep analysis using "what" and "why" probes until all aspects of the process are reviewed and contributing factors are considered;
- identification of potential changes that could be made in systems or processes to improve performance and reduce the likelihood of similar adverse events or close calls in the future.

Strategies to reduce errors

Students can immediately start practising error-reduction behaviours by looking after their own health. Students should:

- be aware of when they are tired;
- become familiar with the environment they work in; and
- be prepared for the usual, knowing that unusual things can happen.

We know that it is impossible for any one individual to know everything, so it is important that students become accustomed to asking questions whenever they do not know something relevant and important to their patients. Here are some personal error-reduction strategies for students:

- care for one's self (eat well, sleep well and look after yourself);
- know your environment;
- know your task(s);
- prepare and plan (*what if*...);
- build checks into your routine;
- ask if you do not know.

Students should assume that errors will occur. This will be a change for many because, in some cultures, there is still the belief that only bad or incompetent health-care providers make mistakes. Students should assume that errors will be made and prepare for them. This includes identifying those circumstances most likely to lead to errors (e.g. high-risk times).

For example, research has identified high-risk situations in which the risk of nursing students making errors as they administer medications increases [14]. These situations involve:

- non-standard dosages and/or dosage times ordered;
- non-standard or improper documentation;
- unavailable medical administration records;
- partial drug administration ordered;
- held or discontinued medications;
- monitoring issues–for example, student needs to check vital signs before administering the drug;
- use of liquids that are only for oral use, but are then given via a parenteral route.

It is important to have contingency plans in place to cope with problems, interruptions and distractions. Students should always mentally rehearse complex procedures or any activity involving a patient that they are doing for the first time.

Summary

Medical error is a complex issue, but error itself is an inevitable part of being human. These tips are known to limit the potential errors caused by humans [15].

- Avoid reliance on memory
- Simplify processs
- Standardize common processes and procedures
- Routinely use checklists
- Decrease reliance on vigilance.

See also the discussion in Topic 2: *Why applying human factors is important for patient safety.* T2

Learning from error can occur at both an individual level and an organizational level through incident reporting and analysis. Barriers to learning from error include a blame culture that applies a person approach to investigations, as well as the phenomenon of hindsight bias. A broadly based systemic approach is required for organizational learning and the possibility of system change.

Root cause analysis (RCA) is a highly structured systemic approach to incident analysis that is generally reserved for the most serious patient-harm episodes. Students may have little opportunities to participate or observe a root cause analysis process but once employed in the hospitals or health service newly qualified health professionals should seek out opportunities to join an RCA process.

Teaching strategies and formats

Simulation exercises

Different scenarios could be developed concerning adverse events and the need to report and analyse errors. Practical exercises that show how errors are avoided can be used and students should also be encouraged to rehearse strategies for managing errors.

An interactive/didactic lecture

Use the accompanying slides as a guide for covering the whole topic. PowerPoint slides can be used or converted to overhead slides for a projector. Start the session with a case study from the Case Study Bank or have the students identify some errors they have recently made.

Small group discussion

A small group discussion could focus on common errors in the workplace. One or more students could be asked to lead a discussion about the areas covered in this topic. The students could follow the headings as outlined above and present the material. The tutor facilitating this session should also be familiar with the content, so information can be added about the local health system and clinical environment.

Other teaching activities

Different methods for generating discussion about the areas in this topic include:

– asking students to keep journals in which they write about an observed error or near miss (what happened, categorize the type of error, make recommendations as to what might be done to prevent a similar thing from happening again);
– selecting a case study from those presented above that sets the scene for a discussion about the most common errors in health care;
– using examples that have been published/broadcast in the media;
– using de-identified case examples from your own clinic or practice;
– using a case study to encourage students to brainstorm about possible errors and their associated factors;
– considering examples of lessons about error and system failure from other industries;
– inviting a professional from another discipline, such as engineering or psychology, to discuss error-causation theory, cultures of safety and the role of error reporting in safety;
– inviting respected senior health professional to talk about errors they have made;
– asking the staff person responsible for quality improvement in a hospital to talk to students about data collection, analysis and outcomes, as well as the roles of different staff members in the quality-improvement process;
– inviting a quality and safety officer to talk about systems in place to minimize errors and manage adverse events in a particular facility/system;
– discussing the difference between system failures, violations and errors (see Topic 4);
– using a case study to analyse the different avenues for managing an adverse event;
– participating in or observing a RCA.

Activities for students in their workplace or clinical placements

Students might be asked to:

– attend a RCA investigation;
– find out whether their health-care facility conducts mortality and morbidity meetings or has other peer-review forums in which adverse events are reviewed;
– talk with each other about errors observed in the work environment using a non-blaming approach. Ask students to identify not only errors, but also possible strategies for their prevention;
– select a clinic or treatment setting in which they are training and inquire about the main types of errors in that area and the steps that are taken to minimize and learn from them.

Case studies

Vincristine administration alert
The following case studies relate to the administration of the drug vincristine and the adverse events that may follow.

Hong Kong, 7 July 2007

A 21-year-old female has died after being administered vincristine accidentally via a spinal route in error. An inquiry is under way. Vincristine (and other vinca alkaloids) should only be given intravenously via a minibag. Vincristine, a widely-used chemotherapeutic agent, should only be administered intravenously, and never by any other route. Many patients receiving IV vincristine also receive other medication via a spinal route as part of their treatment protocol. This has led to errors where vincristine has been administered via a spinal route. Since 1968, this error has been reported 55 times in a variety of international settings. There have been repeated warnings over time and extensive labelling requirements and standards. However, errors related to the accidental administration of vincristine via a spinal route continue to occur.

Other recent deaths and near misses:

United States, November 2005

A 21-year-old male was being treated for non-Hodgkin's lymphoma. A syringe containing vincristine for another patient had been accidentally delivered to the patient's bedside. A physician administered vincristine via a spinal route, believing it was a different medication. The error was not recognized and the patient died three days later.

Spain, October 2005

A 58-year-old female was being treated for non-Hodgkin's lymphoma. Vincristine was prepared in a 20 ml syringe and delivered in a package containing two other drugs, including methotrexate. Route of administration was not indicated on the solutions. The intrathecal treatment was administered at noon. The haematologist was particularly busy and requested help from another doctor who had not recently participated in intrathecal procedures. The medication was delivered in the patient's room. The nurse who assists was not familiar with the intrathecal procedures. The 20 ml syringe with vincristine was passed to the doctor who started to inject it. After administering approximately 2 ml, he noticed the size of the syringe and ceased administration realizing the error. The patient died approximately 100 days later.

Australia, 2004

A 28-year-old male with Burkitt's lymphoma was receiving methotrexate via a spinal route. The doctor documented that "vincristine and methotrexate [were] given intrathecally as requested". The warning label on the vincristine was incomplete, in small print and read in a darkened room. The error was not recognized until five days later, after paralysis of the lower limbs had occurred. The patient died after 28 days.

Questions
– What factors may have been present that caused the error in these above examples?

– What steps could the organization take to ensure that the catastrophic events are not repeated?

– If you were the hospital manager what would you do in each of these cases?

Source: World Health Organization, SM/MC/IEA.115 (http://www.who.int/patientsafety/highlights/PS_alert_115_vincristine.pdf; accessed 20 February 2011).

A nurse speaks up to avoid further error and protect the patient from an adverse outcome
This case illustrates the importance of speaking up if there are concerns for the safety of patients.

As the preoperative team briefing (team discussion before a surgical procedure) was coming to an end, a nurse spoke up and reported that "The patient has a contact lens in his left eye."

The anaesthetist asked whether it was permanent and the nurse verified that it was disposable. The anaesthetist asked the patient why the contact lens was being worn, but the patient was sedated and not very coherent when he attempted to respond. The nurse explained that the patient was unable to see without the contact lens. The anaesthetist explained to the operating room team that the patient could not have the contact lens with anaesthetic and that the patient should not have been sedated with it. One of the team members asked the anaesthetist if he wanted the contact lens to be taken out and the anaesthetist replied, "Well, he cannot have anaesthesia with it."

The surgical resident helped the patient remove the contact lens from his eye. The patient asked for something to put it in, so saline solution was located and the contact lens was stored in a small container of saline solution.

Question

– What might be some preoperative nursing implications for this case? What might be done to prevent similar incidents from occurring in the future?

Source: The WHO Patient Safety Curriculum Guide for Medical Schools working group. Case supplied by Lorelei Lingard, Associate Professor, University of Toronto, Toronto, Canada.

Wrong medication in the labour ward

The following case study shows how multiple factors can culminate in patient harm.

A 25-year-old primipara at 32 gestational weeks arrived in the Emergency Department with severe back pain. She was triaged and sent to the busy, understaffed labour ward. The fetal monitoring strip showed contractions every 8–10 minutes. The obstetrician examined the client and recommended a continuing infusion with tocolytic drugs to decrease the uterine activity and avoid the preterm birth of the infant.

All midwives were busy with other clients giving birth and a student midwife was asked to prepare the infusion. She did not know the case history and was anxious to ask her midwifery mentor. Despite the woman being obviously pregnant at 32 weeks, the student failed to assess the fundal height. The student prepared and applied an infusion with oxytocin (for labour augmentation) instead of the tocolytic drug. The error was not recognized for hours and the next day the client gave birth to a preterm baby who had to be transferred to the neonatal intensive care unit due to severe breathing problems.

Discussion

– Discuss this case by examining the following factors: student factors; patient factors; mentor factors; organizational factors; and environmental factors.

– How might this adverse event be avoided?

Source: Case supplied by Andrea Stiefel, MSc, Zurich University of Applied Sciences, Winterthur, Switzerland.

Death of a child

Read the case study in the introduction to this topic and ask the students to discuss the following questions.

– Using a systems approach, consider what could have been done differently at different points in this story, in the dental office, ambulatory clinic and hospital.

– How could the transfer (hand-over) between the ambulatory clinic and the hospital have been handled differently to ensure that the patient might have been treated more promptly?

– What are some precautions that can be taken in clinical settings to prevent accidental poisonings among children?

Source: Case supplied by Shan Ellahi, Patient Safety Consultant, Ealing and Harrow Community Services, National Health Service, London, UK.

Tools and resource material

A range of resources on medical error and related topics can be found on the website of the Agency for Healthcare Research and Quality, New York Medical College, New York, USA (http://www.ahrq.gov/qual/errorsix.htm; acessed 21 February 2011).

Assessing knowledge of this topic

A range of assessment strategies are suitable for this topic, including MCQ, essays, short BAQ, CBD, and self-assessments. Having a student or a group of students lead an adverse event investigation or even a mock root cause analysis is a highly engaging way to elicit understanding.

Evaluating the teaching of this topic

Evaluation is important for reviewing how a teaching session went and how improvements can be made. See the Teacher's Guide (Part A) for more information on evaluation.

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Additional reading

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Slides for Topic 5: Understanding and learning from errors

Didactic lectures are not usually the best way to teach students about patient safety. If a lecture is being considered, it is a good idea to plan for student interaction and discussion during the lecture. Using a case study is one way to generate group discussion. Another way is to ask the students questions about different aspects of health care that will bring out the issues contained in this topic, such as the blame culture, nature of error and how errors are managed in other industries.

The slides for Topic 5 are designed to help the instructor deliver the content of this topic. The slides can be changed to fit the local environment and culture. Teachers do not have to use all of the slides and it is best to tailor the slides to the areas being covered in the teaching session.

Topic 6
Understanding & managing clinical risk

An unintended outcome from inattention to a bandaged foot

A father brought his 2-year-old daughter, Hao, into the emergency department of a regional hospital on a Friday evening. Hao had a recent history of a "chesty cold" and had already been seen as an outpatient. The medical officer admitted Hao for treatment of pneumonia. An IV cannula was inserted in her left upper foot and a bandage applied. She was then transferred to the ward for the weekend where she was under the care of a team of nurses and a visiting medical officer. The bandage on her foot was not removed until early Sunday evening (nearly 48 hours later), despite the fact that damage to the skin is a known risk factor in infants that can occur within 8 to 12 hours. There was an area of necrosis noted on the left heel and ulcers developed later on the left upper foot. After discharge and outpatient treatment locally, Hao was eventually admitted to a major children's hospital where she required ongoing treatment. She also developed behavioural problems as a result of her experience.

Source: Case studies – investigations, *Health Care Complaints Commission Annual Report 1999-2000*:59, Sydney, New South Wales, Australia.

Introduction–Why clinical risk is relevant to patient safety

Risk management is routine in most industries and has traditionally been associated with limiting litigation costs. In health care, this is usually associated with patients taking legal action against a health professional or hospital alleging harm as a result of their care and treatment. Many corporations implement strategies to try to avoid financial loss, fraud or failure to meet production expectations. To avoid problems, such as those described in the above-mentioned case study, hospitals and health organizations use a variety of methods to manage risks. However, the success of a risk-management programme depends on creating and maintaining safe systems of care, designed to reduce adverse events and improve human performance [1]. Many hospitals, clinics, and health services have well-established systems already in place such as reporting patient falls, medication errors, retained swabs and misidentification of patients. Nevertheless, most health services are only beginning to focus on all aspects of clinical care in an effort to reduce risks to patients.

Students, along with everyone else who works in a health-care facility, have a responsibility to take the correct action when they see an unsafe situation or environment. Taking steps to ensure a wet, slippery floor is dried and preventing a patient from falling is as important as ensuring that the medication a patient is taking is the correct one. In the event of a patient falling on a slippery floor or receiving the wrong medication, it is important that students report the incident so that steps can be taken to avoid similar

incidents in the future. While nurses have long been reporting certain types of incidents today all health-care professionals are expected to report incidents and to learn from them. Even if students observe some senior staff not reporting, they should be mindful that a health service with a culture of reporting is safer than one where no reporting occurs. Leadership by senior health professionals will show students the value of a reporting culture.

Effective risk management involves every level of the health service. For this reason, it is essential that all health-care workers understand risk management and the objectives of risk-management strategies and their relevance in their own workplace. Unfortunately, even though a clinic or hospital may have policies for reporting incidents, such as medication errors and falls, the actual reporting of these incidents is often sporadic. Some nurses are diligent in reporting, while doctors in the same unit can be sceptical of the benefit of reporting because they do not see any improvement. Students can begin to practise reporting incidents by talking with the health-care team about health-care risks and errors and the strategies in place to manage and avoid them.

The role of the whistle-blower (a person who raises a concern about alleged wrongdoing occurring in an organization) in health care has not had a good history, despite the evidence that most whistle-blowers have usually tried to rectify the problems through the standard channels. The refusal or inability of an organization to fix the problem forces the concerned person to take the matter to higher authorities. Not all countries have laws protecting whistle-blowers. While health-care professionals are not required to be heroic whistle-blowers, they do have a duty to protect the patients they care for. Research shows that nurses are more used to reporting incidents than other health professionals. Inadequate reporting may be because the blame culture in health care is a strong deterrent to reporting. Today, most risk-management programmes aim to improve safety and quality, in addition to minimizing the risk of litigation and other losses (staff morale, loss of staff, diminished reputation). However, the success of these programmes depends on many factors.

Clinical risk management is specifically concerned with improving the quality and safety of health-care services by identifying the circumstances and situations that put patients at risk of harm and then acting to prevent or control those risks. The following simple four-step process is commonly used to manage clinical risks:

1. identify the risk;
2. assess the frequency and severity of the risk;
3. reduce or eliminate the risk;
4. assess the costs saved by reducing the risk or the costs of not managing the risk.

Students, along with all other health professionals will be mainly concerned about the risk to patients. Topic 1 in this Curriculum Guide outlines the extent of the harm done by health care. It is against this backdrop that organizations are concerned about managing clinical risks. Clinical risk management allows identification of potential errors. Health care itself is inherently risky and although it is impossible to eradicate all risk, there are many activities and actions that can be introduced to minimize opportunities for errors. Clinical risk management is relevant to students because it recognizes that clinical care and treatment are risky and negative incidents may occur. Students (as well as all other health-care professionals) must actively weigh the anticipated risks and benefits of each clinical situation and only then take action. This includes recognising one's limitations and lack of experience and refraining from any unsupervised care and treatment. Students should seek out information about past risks and actively participate in efforts to prevent their reoccurrence. For example, students might seek out information concerning compliance with hand hygiene protocols to minimize the spread of infection. In this sense, students can act proactively to avoid problems, as opposed to just reacting to problems as they appear.

Keywords
Clinical risk, reporting near misses, reporting errors, risk assessment, incident, incident monitoring.

Learning objective

Know how to apply risk-management principles by identifying, assessing and reporting hazards and potential risks in the workplace.

Learning outcomes: knowledge and performance

Knowledge requirements
Students need to:

- know how to gather information about risk;
- understand fitness-to-practise requirements for their profession and personal accountability for managing clinical risk;

- know how to report risks or hazards in the workplace;
- know when and how to ask for help from an instructor, supervisor, senior health practitioner or other health-care professional.

Performance requirements
Students need to:
- keep accurate and complete health-care records;
- participate in meetings to discuss risk management and patient safety;
- respond appropriately to patients and families after an adverse event;
- respond appropriately to complaints;
- maintain their own health and well-being.

Gathering information about risk

Students may not be immediately aware of a risk-management programme in their hospital, clinic or workplace. Nevertheless, health-care facilities in most countries employ a range of mechanisms to measure harm caused to patients and staff, as well as avoid known problems. Some countries have well-developed state and national data sets of incidents. In Australia, the Advanced Incident Management System is a comprehensive approach to reporting health-care incidents and analysing them. In the United States, the Department of Veterans Affairs has established a National Center for Patient Safety that uses a structured approach called *root cause analysis* (RCA) to evaluate, analyse and treat these types of problems. (See Topics 5 and 7 for information about RCA).

The principle underpinning RCA is that the actual (root) cause of a particular problem is rarely immediately recognizable at the time of the mistake or incident. A superficial and biased assessment of any problem usually does not fix the problem and additional incidents will occur in similar situations.

An essential part of any RCA is the implementation of the findings of the analysis. Many clinics, hospitals and organizations fail to complete the process either because the recommendations involve resources that are not available or because there is no commitment by the senior hospital management to carry through the recommendations.

Some health-care organizations that mandate reporting of incidents can become so overloaded with reported incidents that many remain unanalysed due to inadequate resources. To address this problem, many health-care organizations have introduced a severity-assessment code to help identify those incidents that indicate the most serious risk. However, even the introduction of a triage system to flag the most serious incidents has not resolved this dilemma in some systems.

Some activities commonly used to manage clinical risk are described below.

Incident monitoring

Incident reporting has existed for decades. Many countries now have national databases of adverse events pertaining to different specialties, such as surgery, anaesthesia and maternal and child health. WHO defines an incident as an event or circumstance that could have or did lead to unintended and/or unnecessary harm to a person and/or a complaint, loss or damage. The main benefit of incident reporting lies in the collection of information useful for the prevention of similar incidents in the future. Other, quantitative methods are required for analyses of the frequencies of these incidents.

Facilitated incident monitoring refers to mechanisms for identifying, processing, analysing and reporting incidents with a view to preventing their reoccurrence [2]. The key to an effective reporting system is for staff to routinely report incidents and near misses. However, unless staff members trust that the organization will use the information for improvement and not to blame individuals, they are reluctant to report these incidents. Trust also includes the belief that the organization will act upon the information. If students report an incident to an instructor, supervisor or other health professional who dismisses their effort, then those students will be less likely to make additional reports in the future. Even when this happens, students should be encouraged by faculty staff to continue to report incidents. Today's students will eventually become the senior health professionals of tomorrow whose actions will greatly influence younger colleagues and students.

Facilitated monitoring is a process for identifying and analysing a greater proportion of incidents with a view to making improvements to care. This type of monitoring is a continuous activity of the health-care team involving the following actions:
- discussion about incidents as a standing item at the weekly staff meetings;
- a weekly review of areas where errors are know to occur;
- a detailed discussion about the facts of an incident and follow-up action required is held

with the team–this discussion should be educational rather than focusing on attributing blame;
- identification of system-related issues, so they can be addressed and other staff can be made aware of the potential difficulties.

In addition to the reporting of actual incidents, some organizations encourage the reporting of near misses because of the value such reporting holds for identifying new problems and the factors that contribute to them and how they may be prevented before serious harm is done to a patient. A near miss is an incident that did not cause harm. Some people call near misses "near hits" because the actions may have caused an adverse event, but corrective action was taken just in time or the patient had no adverse reaction to the incorrect treatment. In some environments in which there is a strong blame culture, talking about near misses may be easier than talking about incidents that had negative outcomes because no one is available to blame as there was no adverse outcome to the patient. For example, it may be easier for a pharmacist to discuss a dispensing error involving a wrong drug in the context of a wrong drug about to be dispensed being captured through a checking system. In these cases, the errors are not made, but could have been if there were no systems in place to identify and prevent them. See Table B.6.1 for more analysis of incident monitoring.

Table B.6.1. Types of issues identified by incident monitoring

Type of incident	% of reports [a]
Falls	29
Injuries other than falls (e.g. burns, pressure injuries, physical assault, self-harm)	13
Medication errors (e.g. omission, overdose, underdose, wrong route, wrong medication)	12
Clinical process problems (e.g. wrong diagnosis, inappropriate treatment, poor care)	10
Equipment problems (e.g. unavailable, inappropriate, poor design, misuse, failure, malfunction)	8
Documentation problems (e.g. inadequate, incorrect, incomplete, out-of-date, unclear)	8
Hazardous environment (e.g. contamination, inadequate cleaning or sterilization)	7
Inadequate resources (e.g. staff absent, unavailable, inexperienced, poor orientation)	5
Logistical problems (e.g. problems with admission, treatment, transport, response to an emergency)	4
Administrative problems (e.g. inadequate supervision, lack of resource, poor management decisions)	2
Infusion problems (e.g. omission, wrong rate)	1
Infrastructure problems (e.g. power failure, insufficient beds)	1
Nutrition problems (e.g. fed when fasting, wrong food, food contaminated, problems when ordering)	1
Colloid or blood product problems (e.g. omission, underdose, overdose, storage problems)	1
Oxygen problems (e.g. omission, overdose, underdose, premature cessation, failure of supply)	1

[a] An incident may be assigned to more than one category.

Source: Runciman B, Merry A, Walton M. *Safety and ethics in health care: a guide to getting it right*, 2007 [3].

Sentinel events

A sentinel event is an "adverse event that should never be allowed to happen" [3] and is usually unexpected and involving a patient death or serious physical or psychological injury to a patient. The current trend in many countries in analysing adverse events is to rank the seriousness of the event. The term *sentinel event* is the designation reserved for the most serious ones.

Many health-care facilities have mandated the reporting of these types of events because of the significant risks associated with their repetition. These events are often classified into categories (e.g. surgery on the wrong patient or body site, incompatible blood transfusion, medication error leading to death, wrong tooth being removed, wrong drug being dispensed, newborn being given to the wrong mother, etc.). Events that do not fit neatly into the established

categories are referred to as "other catastrophic events". These "other catastrophic events" account for half of all the sentinel events reported in the United States and over two-thirds of those reported in Australia [3]. The causes of the sentinel event may have been multiple and left unchecked, thus resulting in a catastrophic outcome for the patient.

The role of complaints in improving care

A complaint is defined as an expression of dissatisfaction by a patient, family member or carer with the provided health care. Because students will be treating patients under instruction or supervision, they may be named in a complaint about care and treatment. A student may feel vulnerable when this happens and worry that they will be blamed or that their career may suffer.

Students, similar to health professionals, may feel embarrassed, remorseful, angry or defensive if they are named in a complaint and believe that the complaint is unjustified. While complaints from patients or their families may be uncomfortable to deal with, they are a very good opportunity for improving professional practice and restoring a trusting relationship between the patient, the patient's family and the health-care team [4]. Complaints often highlight problems that need addressing, such as poor communication or suboptimal decision making. Communication problems are common causes of complaints, as are problems with treatment and diagnosis. Complaints can be avoided if the student or health professional ensures that their patient never leaves an encounter feeling discounted, dismissed or diminished in any way.

Students who are at the beginning of their health-care careers are learning about clinical decision making and patient management and are seeing just how complex these tasks can be. So, it is not surprising that miscommunication or suboptimal care may sometimes occur. Patient complaints help to identify areas in the processes of care that could be improved. The complaint may lead to better instruction or supervision of students in a particular setting. The information from complaints can also be used to educate and inform health professionals about problem areas.

In addition to the benefits described above, complaints also [4]:
- assist the maintenance of high standards;
- reduce the frequency of litigation;
- help maintain trust in the profession;
- encourage self-assessment;
- protect the public.

Students should be aware that most health-care professionals will receive complaints during the course of their careers and that this is not an indication of incompetence or that they are bad people. Even the most conscientious and skilful health-care professionals can and do make mistakes. Sometimes, patients may have unrealistic expectations of their health care. Health-care error is a subset of human error; all humans make mistakes.

If a student is involved in a complaint or receives one while working as a health-care professional, he/she should be open to discussing the complaint with the person who made the complaint. It is a good idea to have a more senior person present during these discussions. If the health-care organization requires a student to provide a written statement about his/her actions, it is important that the statement be factual and relate directly to their involvement. It is important to always check with an instructor or supervisor if a written complaint is received and a statement required. The health-care facility will most likely have a policy in place for managing complaints.

Complaints and concerns of individual responsibility

From a patient's perspective, individual patients should be able to have their concerns examined to see if there has been a departure from professional standards. After examination or investigation, it may become clear that system-related issues are at the heart of the problem, but the treating professional or health-care team may also have contributed to the poor outcome–for example, by cutting corners and breaching accepted protocols. The standard of care may have been low, resulting in suboptimal care. Guidelines may not have been followed or facility rules broken.

For example, the failure of a staff member to use appropriate hand hygiene might have resulted in the transmission of infection from one patient to another. While the initial approach to the investigation of this incident should by system-based, it is important to remember that individuals are also required to meet their professional responsibilities. It may be that the staff member was indeed directly at fault through failing to adhere to accepted standards of care.

Coronial investigations

Most countries have some system for establishing cause of death. Specifically appointed people, called coroners in many countries, are responsible

for investigating deaths in situations where the cause of death is uncertain or thought to be due to unethical or illegal activity. Coroners often have broader powers than a court of law and, after reporting the facts, will make recommendations for addressing any system-wide problems.

Fitness-to-practise requirements

Students and all health professionals are accountable for their actions and conduct in the health service environment. They are responsible for their actions according to the circumstances in which they find themselves. Related to accountability is the concept of *fitness to practise*. Why is fitness to practise an important component of patient safety?

Of the many factors underpinning adverse events, one factor relates to the competence of health-care professionals. Many mistakes leading to adverse events are associated with the fitness of professionals to practise. Are they competent? Are they practising beyond their level of experience and skill? Are they unwell, suffering from stress or illness? Most countries will have a system for registering different types of health-care professionals, dealing with complaints and maintaining standards. It is important that students understand why it is important to be vigilant about their own fitness and that of their colleagues. The health-care professions place duties and obligation upon practitioners with the aim of keeping patients safe.

Selecting the right students for training in the health-care professions is the first step in making sure that the people who are trained to work in these fields have the attributes necessary for safe and ethical practice. Many training programmes now use OSCE-type (Objective Structured Clinical Examination) processes to help identify those students who, in addition to their examination results, also have the attitudes and behaviours best suited to work in health care. Attributes such as compassion, empathy and a vocational aspiration to provide benefit to society are the sustaining qualities.

It is important that health-care professionals engage in learning activities throughout their career, in order to properly maintain their skill sets and remain current with developments in their field of expertise. As students become more familiar with the concepts and principles described in this Curriculum Guide they will gain deeper understanding and become more proficient and adept at performing safely.

The duties of a health-care professional (and student) include reporting a peer or colleague who is unsafe because of either incompetence or unprofessional or unethical behaviour. Some countries require mandatory reporting of practitioners if they are unfit, while others rely on individuals to use their conscience in this regard.

Health-care organizations are obligated to ensure that health professionals who participate in patient care and treatment have the appropriate qualifications and are competent. Health-care services are required to check that a health-care professional has the right qualifications and experience to practise in the intended area. The processes for doing this are presented below.

Credentialing

The Australian Council on Healthcare Standards defines credentialing as the process of assessing and conferring approval on a person's suitability to provide specific consumer/patient care and treatment services, within defined limits, based on an individual's licence, education, training, experience, and competence. Many hospitals, clinics and health services have credentialing processes in place to check whether a professional has the required skills and knowledge to undertake specific procedures or treatments. Clinics and hospitals will restrict the type of procedures they offer if there are no qualified personnel or if the available resources are not available or appropriate for the particular condition or treatment.

Accreditation

Accreditation is a formal process to ensure delivery of safe, high-quality health care based on standards and processes devised and developed by health-care professionals for health-care services. It can also refer to public recognition of achievement by a health-care organization of requirements of national health-care standards.

Registration (licensure)

Most countries require health-care practitioners to be registered with a government authority or under a government instrument, such as the Australian Health Practitioners Registration Agency, which is responsible for the registration of most of the health professions. The principal purpose of a registration authority is to protect the health and safety of the public through mechanisms designed to ensure that health practitioners are fit to practise. It achieves this by ensuring that only properly trained professionals are registered and that registered professionals maintain proper standards of conduct and

competence. Proper registration/licensure is an important part of the credentialing and accreditation processes mentioned above.

Personal accountability for managing risk

Most senior students will begin to establish clear roles and responsibilities as members of health-care teams when they spend more time in workplace settings and working with patients. Close to the completion of their training, many will be required to demonstrate competence in a number of basic technical tasks. The following activities are not exhaustive or indeed prescriptive. They are offered to give some idea of the competencies students need to have by the time they complete their degrees and start working in their chosen field.

Students should:

- Learn how to organize a referral or request for consultation from another health-care provider or health-care team. These skills include using correct identification procedures and providing an accurate summary of the patient's background, current health/welfare problem, and the results of any investigations. It is important to only include relevant and necessary information in the referral or request for consultation and write legibly.
- Learn how to make a telephone call to a primary-care doctor or other professional member of the health-care team. Initially students should make sure they are supervised or observed by an experienced person during this activity. They should practise providing accurate information about the patient, correctly pronouncing relevant terminology, using techniques to ensure the person they are speaking with has understood what has been said, seeking information about concerns, and writing a summary of the telephone conversation in the patient's medical record. Some of these techniques are described in Topic 4: *Being an effective team player*. → T4
- Learn how to write a referral letter when a patient's care is being transferred to another health-care provider or team. The letter should contain the relevant patient identification information, dates of admission and discharge/treatment and the name of the professionals responsible for that treatment, an accurate summary of treatment provided, the final diagnosis, key investigations, reason for treatment, and the status of the patient's clinical problems. Describe the treatment and interventions undertaken, the outcome, follow-up arrangements and outstanding investigations. The letter should include an accurate and complete list of therapies and medications including dose, route and planned duration of therapy. It is very important that this letter be completely legible and signed by the responsible person.
- Know who the lead professionals are in any given situation.

The role of fatigue and fitness to practise 11

There is strong scientific evidence linking fatigue and performance. Students should be aware that when they are fatigued they will be less alert and unable to perform as normal in a variety of psychomotor tasks.

Studies conducted in Ireland and the United Kingdom have shown that fatigue can affect the mental well-being of medical residents (depression, anxiety, anger and confusion) [5]. Recent controlled studies have confirmed that sleep deprivation can negatively affect clinical performance [6]. Fatigue has also been linked to increased risk of errors [7-8] and motor vehicle accidents. A 2004 study by Landrigan et al. [8] was one of the first to measure the effects of sleep deprivation on medical errors. This study found that interns working in the medical intensive unit and coronary care unit of Brigham and Women's Hospital (Boston, MA, United States) made substantially more serious mistakes when they worked frequent shifts of 24 hours or more than when they worked shorter shifts. Other studies have shown that sleep deprivation can have symptoms similar to those of alcohol intoxication [9].

Studies of hours of work and nurses show that risks of making an error were significantly increased when work shifts were longer than twelve hours, when nurses worked overtime, or when they worked more than forty hours per week [10].

Similarly pharmacists identified the main contributing factors in dispensing errors to be high prescription volumes, pharmacist fatigue, pharmacist overwork, interruptions to dispensing, and similar or confusing drug names [11].

Students should know their rights concerning work and rest schedules. The organizations they work for have a duty to ensure that they do not work more hours than permitted unless there are extenuating circumstances or organizational permission.

Stress and mental health problems

Students are also prone to stress caused by examinations, part-time work and family and workplace concerns. Strong evidence suggests physicians are prone to mental health problems [12], particularly depression, in their first postgraduate years, as well as in later years. Students also suffer from stress and associated health problems that they carry with them when they start practising. Stressed staff and staff with low morale are to be expected in health care because as well as caring for the sick and vulnerable, they usually work with other overworked colleagues and have multiple tasks to complete on an hourly basis.

While rates of depression and mental health problems among doctors are higher than those experienced by the general population, the literature shows that when interns and residents are supported by fellow house officers and senior clinicians and are members of well-functioning teams, they are less likely to feel isolated and suffer stress.

Performance is also affected by stress. There is strong evidence to indicate that inadequate sleep contributes to stress and depression, rather than the number of hours worked. Other stressors identified in the literature include financial status, educational debt and term allocation and emotional pressures caused by demands from patients, time pressures and interference with one's social life.

Work environment and organization

Health-care facilities can be very stressful places for newcomers. Unfamiliar work practices can be very difficult in the early phase of a new job. In addition, long hours cause fatigue.

Certain factors and time periods, such as shift work, overtime, shift changes, nights and weekends, are associated with increased numbers of errors. The factors underpinning these errors can range from lack of oversight and instruction or supervision to tiredness. Students should be extra vigilant during these times.

Instruction and supervision

Good instruction or supervision is essential for every student and the quality of the instruction or supervision will determine, to a large extent, how successfully a student integrates and adjusts to the hospital or health-care environment. The failure of health professionals to provide adequate instruction or supervision to students makes them more vulnerable to making mistakes either by omission (failing to do something) or commission (doing the wrong thing). Students should always request that a more experienced person be present if it is the first time that they are attempting a skill or procedure on a patient. They should also advise the patient that they are students and request their permission to proceed to treat them or perform the procedure.

Poor interpersonal relationships between students, other health-care professionals, junior staff, and instructors or supervisors are also contributing factors in errors. If a student is having a problem with an instructor or supervisor, he/she should seek help from another faculty member who may be able to mediate or help the student with techniques to improve the relationship. The literature also shows that students who have problems with inadequate skills' acquisition also have poor supervision. Many health professionals who learned to perform procedures while unsupervised have later been judged by supervisors to have poor technique and inadequate mastery of those procedures. Students should never perform a procedure or manipulate or examine a patient without sufficient preparation and instruction.

Communication issues → T4 T8

Multiple health professionals, such as nurses, midwives, doctors, dentists, pharmacists, radiologists, are all required to make an accurate recording of their communications in the health-care records, including any liaison with laboratory personnel. Transferring information, verbally and in writing is a complex process and not easy. Few health facilities have standard ways for such communications. The role of good communication in the provision of quality health care and the role poor communication plays in substandard care are both well documented. How successfully patients are treated will often depend on informal communications among staff and their understanding of the workplace [13]. Treatment errors caused by miscommunication and absent or inadequate communication occurs daily in all health-care settings. Checklists, protocols and care plans designed for particular categories of patients are effective ways of communicating patient-care orders.

Additionally, the quality of the communication between patients and the health professionals providing their treatment strongly correlates with treatment outcomes.

How to understand and manage clinical risks

Know how to report known risks or hazards in the workplace
Students should seek information on the incident-reporting system used in the facility where they are training. There will usually be a specific method for reporting–either an electronic or paper form. Students should become familiar with the system in place and seek information about how to report incidents.

Keep accurate and complete health-care records
A health-care record (medical record, patient record, medication chart, drug chart) is a document that contains different kinds and types of information about a patient. Students should be aware that good quality records are essential to the care and treatment of patients. Health-care records will be subject to a number of government and institutional/facility-specific requirements regarding who can have access to them, who can write in them, and where they are stored and for how long.

Students have an ethical and legal obligation to accurately record their observations and findings to ensure good patient care. When writing in health-care records, students (and all other health-care professionals) should:

- provide sufficient information to identify the patient to whom the record relates, so that other members of the health-care team can continue caring for the patient;
- note any information relevant to the patient's diagnosis or treatment and outcomes;
- make sure records are up-to-date and written as close to the time of the event as possible;
- note any information or advice given to the patient.

Know when and how to ask for help from an instructor, supervisor or appropriate senior health-care professional
Many students fear that if they admit to not knowing something, their teachers will consider them as bad students and think less of them. It is important for students to recognize the limitations associated with their lack of knowledge and experience and the importance of seeking help and asking for information; patients can be harmed by inexperienced health-care professionals. Students should clearly understand who they report to in the work setting and when and how that person can be contacted. This person will be able to assist them if they get into situations beyond their current knowledge and skills. It is essential that students ask for help even if they feel uncomfortable about doing so. All health professionals appreciate that students are at the beginning stage of their careers and will have limited knowledge and skills. They do not expect students or new health-care professionals to have accumulated the depth of knowledge required to independently treat patients. They expect students to ask for help. But it can be very difficult to have an instructor or supervisor who is rarely available. If this is the case, the student should seek out another appropriate person who is present on a regular basis. This can be discussed with the supervisor, so that he/she is aware of the arrangement.

Participate in meetings to discuss risk management and patient safety
At first, it may not be obvious what risk-management programmes exist in a particular health-care facility. Students can ask senior health professionals or managers about the risk-management programmes in place and whether it is possible to attend a meeting to see how the system works to protect patients.

Respond appropriately to patients and families after an adverse event
Students will not be expected to accept responsibility for disclosing adverse events to patients or their families. If they are asked to do this, they should immediately seek assistance from a faculty member or senior instructor. Many health-care organizations are now introducing open-disclosure guidelines (guidelines to assist honest communication with a patient after an adverse event). It is vital that any open-disclosure process not be rushed, be transparent, and involve taking steps to make sure that any mistakes that were made are not made again.

Respond appropriately to complaints
All students who are involved in a complaint should write complete and factual statements about what happened. They should be honest about their role or actions while minimizing subjective or emotional statements.

Summary

Health-care professionals are responsible for the treatment, care and clinical outcomes of their patients. This responsibility lies with all members of the team–not just the most senior person. Personal accountability is important, as any person in the chain might expose a patient to risk. One way for professionals to help prevent adverse events is to identify areas prone to errors.

The proactive intervention of a systems approach for minimizing the opportunities for errors can prevent adverse events. Individuals can also work to maintain a safe clinical working environment by looking after their own health and responding appropriately to concerns from patients and colleagues.

Teaching strategies and formats

An interactive/didactic lecture

Use the accompanying slides as a guide for covering the whole topic. The PowerPoint slides can be used or the slides may be converted for use with an overhead projector. Start the session with a case study and ask the students to identify some of the issues presented in that case study.

Panel discussions

Invite a panel of respected health professionals to give a summary of their efforts to improve patient safety. If the students are pharmacy students, inviting senior pharmacists to discuss their experience and practises would be appropriate; similarly for midwives and dentists. But keeping the panel multidisciplinary is also instructive and highlights the common problems across all health professions. Inviting a patient to participate is important as it keeps the focus on the potential harm to them if there are no risk management strategies in place. Students could also have a list of questions about preventing and managing adverse events and time could be scheduled for their questions. Experts on risk management in other professional fields may also be invited to speak about the general principles involved in their work.

A small group discussion session

The class can be divided up into small groups and three students in each group can be asked to lead a discussion about one of the types of incidents described in Table B.6.1. Some students can focus on the tools and techniques available to minimize opportunities for errors, while others address the role of mortality and morbidity meetings.

The tutor facilitating this session should also be familiar with the content so that information can be added about the local health system and health-service environment.

Simulation exercises

Different scenarios could be developed concerning adverse events and techniques for minimizing opportunities for errors, such as practising briefings, debriefings and assertiveness to improve communication. Additionally, students could role play a peer-review meeting or a mortality and morbidity meeting using a person approach and then a systems approach. Other role-playing activities could be based on situations in which a student notices something is wrong and needs to speak up.

Other teaching activities

– Students could observe a risk-management meeting or meet with the people who manage complaints for the department or health-care facility. Part of the exercise would be for students to ask about the facility's policy on complaints and what usually happens when a complaint is received. Alternatively, students could take part in an open-disclosure process.

– After these activities, students should be asked to meet in pairs or small groups and discuss with a tutor or instructor what they observed and whether the features or techniques being studied were present or absent, as well as whether the techniques employed were effective.

Case studies

Inadequacy in an orthopaedic surgeon's practice-management system

Accurate and legible records are essential for maintaining continuity of care.

Brian was being treated by a new specialist and needed his records from the orthopaedic surgeon who operated on his knee two years earlier. When the records finally arrived, Brian's new doctor informed him that they were not "up to scratch".

The records were poorly documented with no meaningful notes concerning the consent discussion for Brian's operation. There were also gaps in the information recorded in the operation report and there was no documentation of the orthopaedic surgeon's verbal advice about the risks and complications of the operation. Brian was dismayed to discover that the surgeon had not followed up on a missed postoperative review.

Question

– What factors may have been present that resulted in poor documentation of Brian's first operation?

Source: Case adapted from: Payne S. Case study: managing risk in practice. United Journal, 2003, Spring:19.

Acknowledgment of a health-care error
This case shows the value of open disclosure.

Frank is a resident of an aged-care facility. One night, a nurse mistakenly gave Frank insulin, even though he does not have diabetes. The nurse immediately recognised his error and brought it the attention of the other staff, who in turn informed Frank and his family. The facility took immediate action to help Frank and arranged his transfer to a hospital where he was admitted and observed before being returned to the aged-care facility. The nurse was commended for fully and immediately disclosing the incorrect administration of the insulin. Following this incident, the nurse undertook further training in medications to minimize the possibility of a similar error occurring in the future.

Question
The possible causes of the error are not clear. The assumption appears to be that the nurse did or did not do something that led to error. In this type of case, it is important to use a systems approach to learn more about what really happened.

– What are the environmental and organizational factors that might have provided a culture in which the nurse was comfortable in disclosing the medication error?

Source: Open disclosure. Case studies. Health Care Complaints Commission, Sydney, New South Wales, 2003, 1:16–18.

General practice rooms not up to standard
This case shows the importance of complaints for improving health care.

When Denise visited her local medical practice, she was shocked to see that the practice was not as hygienic as she had expected. It was so bad that she complained to the New South Wales Department of Health. A health inspector noted that chloroxylenol (a liquid disinfectant) was stored in a beverage container, drugs were stored beyond their expiration dates, there was no adrenaline in the surgery to treat a heart attack, patients at times had unsupervised access to the doctor's medical bag containing injectable narcotics and a prescription pad, the paper sheets on the examination table were not changed between patients, and the doctor did not cleanse his hands following examinations. There were also no sinks in the consulting rooms.

The Health Care Complaints Commission recommended counselling by the New South Wales Medical Board and an on-site visit to advise the staff on Department of Health guidelines on infection control and make sure that appropriate steps were taken to protect public health. Denise was glad to learn that the centre made improvements as a result of her complaint.

Discussion
– Ask students to identify the types of complaints that are made about the student's workplace (hospital, clinic, pharmacy) and discuss the methods for handing such complaints.

Source: Review of investigation outcomes. Health Care Complaints Commission, Sydney, New South Wales. Annual Report 1998–1999:39–40.

Inadequate complaint management
This case shows the importance of timely attention to complaints.

Alexandra had been seeing a psychologist who was practising in a private hospital. During both her first and second consultations, the psychologist breached patient confidentiality by discussing personal details about his other patients. Alexandra found this disturbing and decided she should raise her concerns with someone at the hospital. She attended one meeting with hospital representatives about a number of concerns she had with the hospital, including those with the psychologist. Many months passed with no written response from the hospital detailing the actions the representative had promised to take. With the help of the Patient Support Office, Alexandra attended a meeting with the chief executive officer and deputy chief executive officer of the hospital. The hospital apologized to Alexandra and a made a commitment to ongoing staff training in complaints management. They also encouraged Alexandra to lodge a formal complaint with the Psychologists Registration Board regarding the psychologist's behaviour.

Activity
– Use a systems approach to identify what could have been done differently in this case and what the hospital can do to help prevent similar incidents in the future.

Source: Patient Support Service, Health Care Complaints Commission, Sydney, New South Wales. Annual Report 1999–2000:37–46.

An impaired nurse

This case shows how health professionals need to maintain their fitness to practise.

During Alan's operation, a nurse knowingly replaced the painkiller fentanyl, which was ordered to treat Alan, with water. This nurse placed Alan in physical jeopardy because of his own desperate need to obtain an opiate drug to satisfy his drug addiction.

This was not the first time that the nurse had stolen a restricted drug for the purposes of self-administering it. A number of complaints had been made about the nurse while he was working at another hospital, including professional misconduct, impairment due to drug addiction and lack of good character, which rendered the nurse unfit to practise.

Questions

– What steps could health professionals have taken to assist the nurse who was in trouble?

– What policies should the health service have to protect patients from health professionals who are drug-addicted or impaired?

Source: Swain D. The difficulties and dangers of drug prescribing by health practitioners. Health Investigator, 1998, 1:14–18.

Failure to check pregnancy status

This hypothetical case illustrates why the possibility of pregnancy should be considered in all relevant female patients before any surgery that could pose risks to a mother or fetus. Local preoperative policies should be reviewed to ensure that pregnancy status is checked within the immediate preoperative period. The check should be recorded on preoperative documentation used by staff performing final clinical and identity checks before surgical intervention.

Hannah, a 28-year-old woman, had a history of recurrent abdominal pain and had been on a waiting list for several months for a laparoscopy to diagnose the problem. She was duly admitted and investigative surgery was undertaken under general anaesthetic. Prior to discharge, Hannah experienced severe cramps and vaginal bleeding. The nurse on duty recognized that she was having a miscarriage.

Question

– What factors may have been present that led to the misdiagnosis of her pregnancy?

Background and source: between October 2003 and November 2009, the United Kingdom National Health Service National Patient Safety Agency received 42 reports of patients undergoing a planned procedure without having a documented pregnancy check in the pre-operative period. Three cases of spontaneous abortion were reported following these procedures (Department of Health gateway reference NPSA/2010/RRR011. Issue date, 28 April 2010. Current information may be found at http://www.nrls.npsa.nhs.uk/resources/?EntryId45=73838; accessed 21 February 2011).

Neonatal administration of medicine

As shown in this hypothetical case study, there is a need for safer use of intravenous gentamicin for neonates. Patient safety incidents have been reported involving administration of gentamicin at the incorrect time, prescribing errors and issues relating to blood level monitoring.

Baby Edward, a preterm infant with respiratory distress requiring ventilation, was prescribed intravenous gentamicin for a serious infection. The intensive-care nurse and pediatrician were extremely busy due to the admission of very pre-term twins. The drug was administered 90 minutes later than prescribed.

Discussion

– Identify all the possible factors that may have been present at the time of this incident.

– Should this incident be reported?

– Discuss the different methods for reporting incidents.

Background: a review of neonatal medication incidents reported to the UK Reporting and Learning System (RLS) between April 2008 and April 2009 identified 507 patient safety incidents related to the use of intravenous gentamicin. These incidents accounted for 15% of all reported neonatal medication incidents during this period.

Poor communication

This case is an example of a common mistake, in which a patient was prescribed an antibiotic and was wrongly dispensed an anti diabetic drug, leading to hypoglycaemic shock.

A physician prescribed a patient an antibiotic and analgesics, which were to be taken after the removal of a tooth. The prescribed antibiotic was amoxicillin. The name of the drug was written poorly on the prescription and was misinterpreted and dispensed by the pharmacist as glibenclamide, which is an anti-diabetic drug.

That night, the patient had to be rushed to the emergency room for treatment of hypoglycaemic shock.

Questions

– What were the factors contributing to this patient becoming ill?

– Who should this error be reported to?

– Who should do the reporting?

– How should the information be used once received?

Source: Case supplied by Shan Ellahi, Patient Safety Consultant, Ealing and Harrow Community Services, National Health Service, London, UK.

Tools and resource material

'Being open'

An e-learning package from the UK National Health Service National Patient Safety Agency, 2009. *Being open, communicating with patients, their families and carers following a patient safety incident*. Issue date, 19 November 2009 (http://www.nrls.npsa.nhs.uk/alerts/?entryid45=65077; accessed 21 February 2011).

Sentinel events

A useful glossary of terms for a sentinel event can be found at: http://en.wikipedia.org/wiki/Sentinel_event; accessed 21 February 2011.

Other resource material

Better practice guidelines on complaints management for health care services. Australian Commission for Safety and Quality, 2006 (http://www.safetyandquality.gov.au/internet/safety/publishing.nsf/Content/F3D3F3274D393DFCCA257483000D8461/$File/guidecomplnts.pdf; accessed 21 February 2011).

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Safer use of gentamicin for neonates. National Health Service National Patient Safety Agency. Patient safety alert no. NPSA/2010/PSA001. Issue date, 30 March 2010 (http://www.dhsspsni.gov.uk/hsc_sqsd_4_10.pdf; accessed 21 February 2011).

Assessing knowledge of this topic

A range of assessment methods are suitable for use with this topic, including observational reports, reflective statements about surgical errors, essays, multiple-choice questions, short best-answer questions, case-based discussions and self-assessments. Students can be encouraged to develop a portfolio approach to patient safety learning. The benefit of a portfolio approach is that at the end of the students' training, they will have a collection of all their patient safety activities. Students will be able to use this to assist job applications and in their future careers.

Knowledge of clinical risk management can be assessed using any of the following methods:

- a portfolio;
- case-based discussion, written observations about a risk-management activity, such as an open-disclosure process or incident-monitoring system;
- students can also be asked to write reflective statements about how complaints are managed at the hospital or clinic, the systems in place for reporting health-care errors or how clinicians learn from errors.

The assessment can be either formative or summative; rankings can range from satisfactory/unsatisfactory to giving a mark. See the forms in Part B, Annex 2 for assessment examples.

Evaluating the teaching of this topic

Evaluation is important in reviewing how a teaching session went and how improvements can be made. See the Teacher's Guide (Part A) for a summary of important evaluation principles.

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Slides for Topic 6: Understanding and managing clinical risk

Didactic lectures are not usually the best way to teach students about patient safety. If a lecture is being considered, it is a good idea to plan for student interaction and discussion during the lecture. Using a case study is one way to generate group discussion. Another way is to ask the students questions about different aspects of health care that will bring out the issues contained in this topic, such as the blame culture, the nature of error and how errors are managed in other industries.

The slides for Topic 6 are designed to assist the teacher deliver the content of this topic. The slides can be adapted to fit the local environment and culture. Instructors do not have to use all of the slides and it is best to tailor the slides to the areas being covered in the teaching session.

All drug names used are according to the *WHO International Nonproprietary Names for Pharmaceutical Substances* (http://www.who.int/medicines/services/inn/en/; accessed 24 March 2011).

Topic 7
Using quality-improvement methods to improve care

Introduction–Why do students need to know about methods for reducing harm and improving care?

Since the first studies on the extent of harm caused to patients, patient safety has developed into a discipline with a theoretical basis and safety science methods designed to measure adverse events and make meaningful and sustainable improvements to prevent similar events from occurring in the future [1]. It is not enough that we recognize that adverse events occur, we also have to understand their causes and make the changes necessary to prevent further harm. Emmanuel et al. describe *safety science* as the methods by which knowledge of safety is acquired and applied to create highly reliable systems. High reliability organizations plan for failure by designing and operating systems that are "fail-safe". A range of methods have been developed for this purpose, many of which come from fields outside health care, such as engineering, applied psychology, human physiology and management.

Most students will be familiar with the term *evidence-based practice*, as well as randomized controlled trials, which enable researchers to establish whether a particular treatment is validated by evidence or merely rests on the belief of the practitioners. Scientific research methods, such as the randomized controlled trial, are used to measure clinical effectiveness; the randomized controlled trial is the gold standard of clinical research. Quality-improvement research uses methodologies that are designed to measure the unique features associated with an adverse event, the contextual components or the process of care that may result in an adverse event, and the development and testing of appropriate solutions. It is more than counting the frequency of an event. When a problem becomes apparent as patients are being cared for, it must be solved or managed as soon as possible. One cannot control events as in experimental studies. In order to understand what happened and why, one needs to study and analyse the specific event. These observations and conclusions can then be used to design safer systems. Later on in this topic we describe the differences in measurement between research and improvement processes.

Quality-improvement methods have been used for decades in other industries. In contrast, students of the health-care professions may be less familiar with the goal of improving quality of care, which involves changing the way health-care workers and systems function in order to achieve better patient outcomes [2].

Patient safety requires deep understanding of the processes of patient care, as well as the ability to measure patient outcomes and test whether the interventions used to fix a problem were effective. If the outcomes of patient care are not measured, it is difficult to know whether the steps taken by health-care workers to fix a problem actually improved the situation. Just implementing a protocol might not fix a problem; there may have been other factors contributing to the problem other than staff not following the correct steps. Understanding the multiple causes of adverse events requires the use of methods designed to elicit all the likely causes. Safety science includes measures to prevent adverse events from happening. Improvement-focused scientific research methods may incorporate a wide range of methodologies and usually consider the context and the complexity of social change [1].

The implementation of most quality-improvement methods involves teams of people who work together using an agreed upon process to fix or prevent a particular problem. But, first of all, team members need to agree that the issue at hand is a problem worth fixing. Students are encouraged to find out whether the health facility in which they are training has a quality-improvement programme and whether they might be able to observe or join a team undertaking an improvement activity.

Students can begin to understand the role of quality improvement by:

- asking and learning about tools that can be used to improve patient safety;
- recognizing that good ideas can come from anyone;
- being aware that the local environment is a key factor in the improvement process;
- being aware that the ways that people in the system think and react are as important as the structures and processes in place;
- realizing that the spread of innovative practices is a result of people adopting new processes;
- understanding that measurements of patient outcome are necessary for the design of appropriate strategies and for evaluating improvement.

The central principle underpinning improvement in health care is that the quality of care is not something controlled at the end of the line, but rather throughout the entire work process. This topic explains some of the basic underlying theory behind this principle.

Traditional attempts to persuade and influence health professionals to change their behaviour, such as ensuring compliance with a protocol or promoting vigilance programmes in regard to drug interactions, have been difficult to achieve for many health professions, such as medicine, dentistry and nursing, but others, such as pharmacy, have had more success. There have been thousands of recommendations by hundreds of committees and peer groups for improving the safety and quality of patient care over recent decades, yet we have seen that the publication of evidence in medical peer-reviewed journals does not in itself lead to clinicians changing their practice [3].

A series of improvement methods have been designed to attempt to address this gap and provide health professionals with the tools to: (i) identify a problem; (ii) measure the problem; (iii) develop a range of interventions designed to fix the problem; and (iv) test whether the interventions were effective.

The identification and examination of each step in the delivery of health care is the basis of improvement methods. When each step in the process is examined, one begins to understand how different factors are connected, interact and how they can be measured. Measurement is critical for safety improvement.

Keywords
Quality improvement, PDSA cycle, change concepts, variation, quality-improvement methods, improvement tools, flowcharts, cause and effect diagrams (Ishikawa/fishbone diagrams), Pareto charts, histograms, run charts.

Learning objective

Describe the principles of improvement and the basic methods and tools used to measure improvement in patient safety.

Learning outcomes: knowledge and performance

It is important that students understand the information presented in this topic because improvement will only be achieved and sustained through continuous measurement. However, this topic will also be one of the most difficult to teach because many health-care organizations do not have the resources or knowledge to measure particular aspects of health care. An effective way for students to understand the benefits of using improvement methods is to observe or participate in an improvement activity at a health-care facility. Students can also apply the principles and tools presented in this topic to their own self-improvement projects, such as improving study habits, developing an exercise regime, spending more time with family or friends.

Knowledge requirements

Students should be able to describe:

- the science of improvement;
- basic change concepts;
- improvement principles;
- the role of measurement in improvement.

Performance requirements

- Identify the opportunities for using safety science to analyse errors.
- Appreciate the range of improvement methods available for reducing harm to patients.
- Apply at least one improvement tool in a particular clinical context.
- Participate in an improvement activity (if possible).

The science of improvement

The science of improvement has its origins in the work of W. Edwards Deming, the father of improvement theory. He described the following four components of knowledge that underpin improvement [4]: appreciation of a system; understanding of variation; the theory of knowledge; and psychology.

Deming stated that we do not need to understand these components in depth to apply knowledge [5]. An analogy used by improvement leaders is that we can drive a car without understanding how it works [4, 6]. Students beginning their health-care careers only need a basic understanding of the science of improvement. The most important thing is that they know that there are methods for improving processes of care [7].

Appreciation of a system

In applying Deming's concepts to health care, we need to remember that most patient-care outcomes or services involve complex systems of interactions between health-care professionals, procedures and equipment, organizational culture, and patients. Therefore, it is important that students understand the interdependencies and relationships among all of these components (doctors, dentists, pharmacists, midwives, nurses, allied health professionals, patients, treatments, equipment, procedures, theatres and so on), thereby increasing the accuracy of any predictions they might make about the impact of any change on the system.

Understanding variation

Variation is the difference between two or more similar things, such as different rates of success for appendectomies performed in two different regions of a country or different rates of tooth decay in two different regions. There is extensive variation in health care, and patient outcomes can differ from one ward to another, from one hospital to another, from one region to another and from one country to another. However, we should keep in mind that variation is a feature of most systems. Shortages of personnel, equipment, drugs or beds can lead to variations in care. Students can get into the habit of asking their teachers and supervisors about the expected outcomes of a particular treatment or procedure. Did the three women who were transferred to a hospital after the delivery of their babies at a rural clinic indicate a problem with the birthing process? Did the extra nurse on duty make a difference with patient care? Does a failure seating a dental restorative crown indicate a problem with the process? Were there fewer medication errors when a pharmacist joined the team in ward rounds? The ability to answer such questions and others like them is part of the goal of improvement activities.

Theory of knowledge

Deming says that the theory of knowledge requires us to predict that changes we make will lead to better results. Predicting the results of a change is a necessary step in the preliminary planning process. Many students will have experience with such predictions, having written study plans predicting what information they will need to know in order to pass an exam. Those with specific experiences may be better at focused predictions. For example, health professionals who work in a particular health-care setting, such as a rural clinic, may be better at predicting the results of a change in that particular environment. Because they have more knowledge about these clinics and the way they function (or should function), they can better predict the way a particular change will affect patients and their families. When health professionals have experience in and knowledge of the area they wish to improve, the changes they propose are more likely to result in true improvements. Comparing results with predictions is an important learning activity. Building knowledge by making changes and then measuring the results or observing differences is the foundation of the science of improvement.

Psychology

The last component is the importance of understanding the psychology of how people interact with each other and the system. Any change, large or small, will have an impact and knowledge of psychology can help us understand how people might react and why they might resist change. A medical ward in a hospital, for example, includes a number of people who will vary enormously in their reactions to a similar event, such as the introduction of an incident-monitoring system to track adverse events. The potential different reactions must be considered when a change is being made.

These four components form the system of knowledge underpinning improvement. According to Deming, it is impossible or improvement to occur without the following actions: developing; testing; and implementing changes.

Basic change concepts

Nolan and Schall [6] defined a change concept as a general idea with proven merit and a sound scientific or logical foundation that can stimulate specific ideas for changes that lead to improvement. They identified a range of sources for thinking about possible changes and they can come from anywhere: critical thinking about the current system; creative thinking; observing the process; an idea from the literature; a patient suggestion; or an insight gained from a completely different area or situation.

Many people intuitively use change concepts in their daily lives, such as asking what changes can be made to improve a particular situation, for example, poor study habits, tension with a family member or difficulties at work. They ask, "what can I do to make the situation better, to make an improvement?".

A health-care team that wants to improve patient care may take an abstract concept and attempt to apply it to the local environment, a particular situation or the task they are trying to improve. This process will take into account particular aspects of the local situation. This is an important step because it engages the local team in the improvement process. Team members who take part in this step of the process will be more committed to the improvement project.

Box B.7.1. Example of the application of a change concept

A health-care team wants to adhere to the recommendations of the *WHO Guidelines on Hand Hygiene in Health Care*. They believe that it is a good idea, in particular because these *Guidelines* are based on evidence documented in the scientific literature and expert opinion. One could predict that if these *Guidelines* were used, there would be a subsequent improvement, i.e. a decrease in the transmission of infection via health-care workers' hands.

A guideline is an example of an abstract concept. The team would then make more specific plans for implementing the guideline in their workplace. That is, they will apply the abstract concept to the practical aim of reducing infections in their workplace. If the change concept is abstract as opposed to practical, then it should be backed by literature and evidence.

As the concept becomes more local and practical (applied), it should become increasingly concrete, logically connected and sensitive to the local situation.

Improvement principles underpinning models for improvement

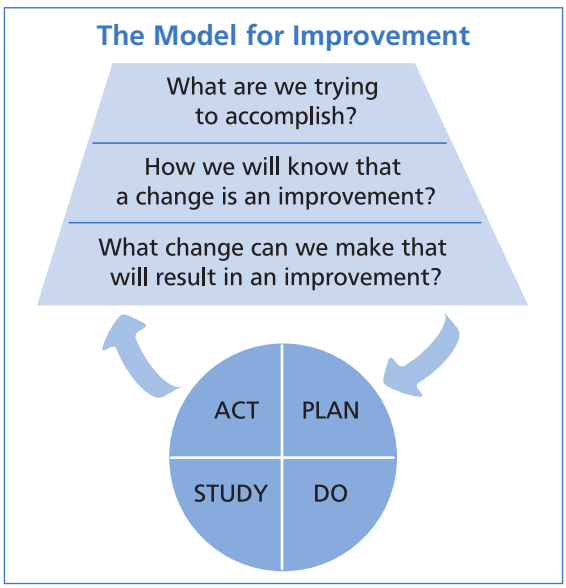
Quality improvement includes any process or tool aimed at reducing a quality gap in systemic or organizational functions. The basic principles of quality improvement are fairly intuitive: a patient/customer focus, strong leadership, involvement of all team members, the use of a process approach, the use of a system approach to management, continual improvement, a factual approach to decision making and relationships that are mutually beneficial to all parties.

Improvement implies both building and applying knowledge. Most improvement models involve a questioning phase, followed by the PDSA cycle described by Deming (see Figure B.7.1 below).

Key questions in any improvement process are:
1. what are we trying to accomplish?
2. how will we know whether a change constitutes or has resulted in an improvement?

It is not unusual to use a trial-and-error approach in efforts to make a change for the better. This same approach underpins the PDSA process used to make all sorts of improvements, both big and small.

Figure B.7.1. Model for improvement



Source: Langley GJ, Nolan KM, Norman CL, Provost LP, Nolan TW. *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance,* 1996 [4].

1. What are we trying to accomplish?
Asking this question helps focus the health-care team on the areas they are concerned about improving or fixing. It is important that everyone on the team agrees that a problem exists and that it is worthwhile to try and fix it. Some examples are:

(a) do we all agree that the infection rate in patients who have had a knee operation is too high?

(b) do we all agree that we need a better appointment system for the people using the clinic?

(c) do we all agree that the way the drugs are stored at the dental clinic risks damage to the drugs?

Confirmation that there is a problem requires that supporting evidence (qualitative or quantitative) exists indicating the extent of the problem. For example, staying with the problem examples above:

(a) do we have the figures indicating the high infection rate?

(b) are there complaints about the appointment system used at the clinic?

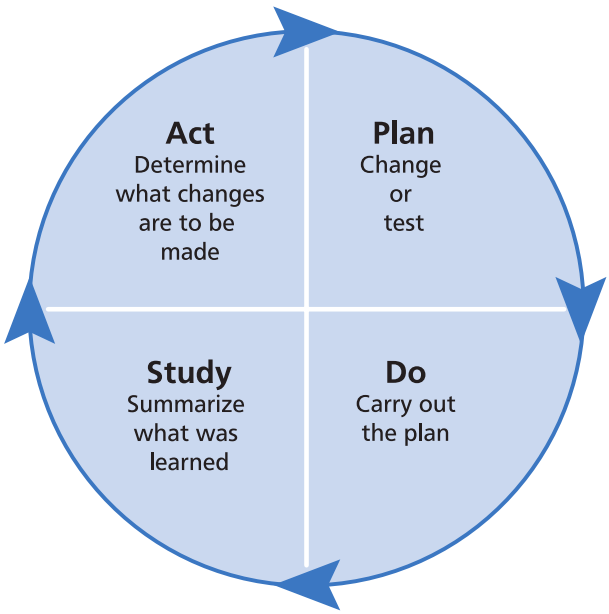
(c) have any drugs stored at the dental clinic been damaged in the last month?

It is not a good idea to put a lot of effort into something that only one person thinks is a problem.

Many countries will have national and international databases for specific disease indicators. These databases are very useful, particularly for benchmarking. These data are important because they allow the team to focus their efforts on the correct area. In some cases, there might not be much data available. However, irrespective of the extent of information available, try to keep the changes as simple as possible.

2. How will we know that a change has resulted in an improvement?
Health professionals and students will need to measure the outcomes/parameters in question before and after the change to see whether the actions the team took made a difference. The improvement can be confirmed when the collected data show that the situation has improved over time. The improvements have to be sustained before the team can be confident that their changes have been effective. This involves the team testing the different interventions they have designed and implemented. The PDSA cycle shown in the diagram below describes a method used to assist in testing a range of ways to see whether an intervention has been effective.

Figure B.7.2.
The plan-do-study-act cycle



Source: Langley GJ, Nolan KM, Norman CL, Provost LP, Nolan TW. *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance*, 1996 [4].

The cycle begins with a plan and ends with an action. The study phase is designed to elicit new information and knowledge. This is an important step in improvement science because new information allows for better predictions about the effects of changes. The application of the PDSA model can be simple or complex, formal or informal. Practical examples of situations in which the PDSA cycle can be used include improving waiting times in a clinic, decreasing surgical infection rates in theatres, reducing length of stay after surgery, minimizing dental mishaps, reducing the number of test results being sent to the wrong person, improving the birthing experience for women. A formal improvement activity may require detailed documentation, more complex tools for data analysis or more time for discussion and team meetings. The PDSA model depends on a format that repeats steps over and over until an improvement has been made and sustained.

Issues to consider when beginning an improvement project

The following aspects need to be taken into consideration when setting out to use an improvement method.

A team needs to be established
Including the right people on a process-improvement team is critical to a successful improvement effort. Teams vary in size and composition, with each organization building teams to suit its own needs. For example, if the goal of the project is to improve discharge planning, then the team should include people who know about discharge–nurses, primary-care physicians, pharmacists, dentists or midwives (depending on the patients in question) and patients.

The team needs to set out the aims and objectives of the improvement process
Improvement requires setting aims and objectives. Objectives should be time-specific and measurable and should also define the specific population of patients that will be affected. This helps keep the team and its efforts focused.

The team needs to establish how it will measure the changes
Teams use quantitative measures to determine whether a specific change actually leads to an improvement.

The team will need to select the changes to be made
All improvement requires change, but not all changes result in improvement. Organizations, therefore, must identify the changes that are most likely to result in improvement.

The team needs to test the changes
The PDSA cycle is shorthand for testing a change in the real work setting, including planning a change, trying it, observing the results and acting on what has been learnt. This is an example of the scientific method.

The team needs to implement the changes
After testing a change on a small scale, learning from each test and refining the change through several PDSA cycles, the team can implement the change on a broader scale–for example, for an entire pilot population or throughout a health-care facility.

The team needs to spread the changes
Successful implementation of a change or set of changes for a pilot population or an entire unit can permit the team or managers to then spread the changes to other parts of the organization or to other organizations.

The role of measurement in improvement

Quality-improvement activities require health professionals to collect and analyse data generated by the processes of health care. For example, students cannot study a change in their study habits without obtaining some information about their current study habits and the environment in which they live and study. They first need to examine the data to see whether there is a problem with their study habits. Then they need to decide what information is required to measure whether any improvements have been made.

Table B.7.1. Different measures for different purposes

	Measurement for research	Measurement for learning and process improvement
Purpose	To discover new knowledge	To bring new knowledge into daily practice
Tests	One large "blind" test	Many sequential, observable tests
Biases	Control for as many biases as possible	Stabilize the biases from test to test
Data	Gather as much data as possible "just in case"	Gather just enough data to learn and complete another cycle
Duration	Can take long periods of time to obtain results	Small tests of significant changes accelerate the rate of improvement

Source: Institute for Healthcare Improvement (http://www.ihi.org/IHI/Topics/Improvement/ImprovementMethods/Measures/ [8].

In this analogy, the aim of the improvement project is to make a change in the students' study habits, leading to their improved success on examinations, rather than simply identifying students with poor study habits.

Measurement is an essential component of improvement because it forces people to look at what they do and how they do it. All improvement methods rely on measurement. Most activities in health care can be measured, yet currently they are not. There is strong evidence to show that when people use the appropriate tools to measure change, significant improvements can be made. The students in our example above will only learn whether they have improved their study habits by measuring the before and after situation. Table B.7.1 sets out some differences in measurement between research and improvement.

There are three main types of measures used in improvement: outcome measures; process measures; and balancing measures.

Outcome measures

Examples of outcome measures include frequency of adverse events, number of unexpected deaths, patient satisfaction surveys and other processes that capture the patients' and their families' experiences. These include surveys, audits of medical records and other methods, such as interviews, that seek to ascertain the incidence of adverse events or peoples' perceptions or attitudes concerning a service and their level of satisfaction with their health-care facility.

Some specific examples include:

- access: waiting time for appointments and examinations;
- critical care: number of deaths in the emergency department or the number of deaths/near misses due to postpartum haemorrhage or eclampsia;
- medication systems: the number of medication dosing or administration errors that occurred and/or were detected.

In audits of medical records, red flags are used to identify and measure the frequency of adverse events.

Process measures

Process measures refer to measurements of the workings of a system. These measures focus on the components of systems associated with a particular negative outcome, as opposed to the incidence of these events. These measures are usually used when a senior health professional or manager wants to find out how well a part or aspect of a health service or system is working or being performed.

Some specific examples:

- surgical care: number of times swab count completed;
- drug administration: delays in administration of drugs, taking into account factors affecting the prescribing, dispensing and administration of the drug;
- delays in transfer to the labour ward;
- access: number of days the ICU is full and has no spare beds.

Balancing measures

These measures are used to ensure that any change does not create additional problems. They are used to examine the service or organization from a different perspective. For example, if students change their study habits in a way that leaves no time for them to see friends, there may be a negative effect on their well-being. An example of a balancing measure in a health-care context might involve making sure that efforts to reduce the length of stay in hospital for a particular group of patients do not lead to increased readmission rates for those patients caused by patients not knowing how to appropriately care for themselves.

Examples of improvement methods

There are a number of examples of improvement methods in health care. Many students will become familiar with the methods used in their respective workplaces as they progress in their careers. Dr Brent James (USA) [9] has led significant improvements in health care using a method called clinical practice improvement (CPI) methodology. Two other popular methods used in many countries are root cause analysis (RCA) and failure modes and effects analysis (FMEA). These three models for improvements are briefly described below.

Clinical practice improvement

CPI methodology is used by health-care professionals to improve the quality and safety of health care. It does this through a detailed examination of the processes and outcomes in clinical care. The success of a CPI project depends on the team covering each of the following five phases.

Project phase
The team members need to ask themselves what it is they wish to fix or achieve. They can do this by developing a mission statement or objective that describes what it is they wish to do in a few sentences. Patients should always be considered as team members. At this stage, the team should consider the type of measures they may use.

Diagnostic phase
Some problems are annoying yet may not be worth fixing because of the minimal benefits associated with their repair. Therefore, the team needs to ask whether the problem they have identified is worth solving. The team should establish the full extent of the problem by gathering as much information about the problem as possible. The team also needs to understand the expectations of the participants.
A brainstorming exercise by the team can generate possible changes that could lead to an improvement. A decision about how to measure any improvement needs to be made during this phase.

Intervention phase 

By now, the team will have worked out what the problems are and considered possible solutions. Each of the proposed solutions will have to be tested through a trial-and-error process, using the PDSA cycles to test changes, observe the results of these changes and keep the bits that work.

Impact and implementation phase 

This is the time to measure and record the results of the trials of the interventions. Did the interventions make any difference?

The effects of all changes need to be measured, so that the change can be said to truly have made a difference. Otherwise, we cannot rule out the possibilities that any positive developments were not the result of a coincidence or one-time events. The goal is to introduce a change that results in sustained improvement. The data showing the results of the change are displayed using run charts and appropriate statistical methods. Using the study habits of students as an example, we can say that the students have improved their study habits if they have maintained the changed study habits for a period of months and not returned to their old habits.

Sustaining and improvement phase 

The final phase requires the team to develop and agree upon a monitoring process and plans for continuous improvement. Improvements made now will become failures in the future if there are no plans for how they will be sustained.

This phase may involve standardization of existing processes and systems for work activities, as well as documentation of relevant policies, procedures, protocols and guidelines. This phase may also involve measurement and review to enable the change to become routine, as well as training and education of staff.

An example of a CPI project
The following example of a CPI project will help students understand this tool and how it is used in the improvement process. The case used below describes a project that was undertaken during the CPI programme conducted by the Northern Centre for Health-care Improvement (Sydney, New South Wales, Australia). The name of the hospital and the names of the participants have been removed. The title of the project is *Accelerated Recovery from Colectomy Surgery*.

The first thing the team did was to identify exactly what it was that needed fixing. Is the length of stay for patients having colectomy surgery longer than it should be? The following mission statement was agreed upon:

To reduce the length of stay for patients having colectomy surgery from 13 days to 4 days within six months at the base hospital.

The next step in the process was to make sure that the right team was selected to undertake this project. Team members must have the fundamental knowledge necessary for the task at hand.

Guidance team members:
- health service manager;
- executive officer of the hospital;
- director of nursing for the hospital;
- area clinical nurse consultant (pain management);
- visiting medical officer (surgeon).

Project team members:
- area clinical nurse consultant, pain management (team leader);
- general surgeon;
- anaesthetist;
- acute pain nurse;
- perioperative clinic;
- surgical ward registered nurse;
- pharmacist;
- physiotherapist;
- dietician;
- patient.

We will return to this example later in this chapter.

Root cause analysis

Many hospitals and health services are now using a process called *root cause analysis* (RCA) to determine the underlying causes of adverse events. RCA was first developed in engineering and is now used in many industries, including health care. A RCA is used after an incident has occurred to uncover the primary causes. As such, it focuses on the particular incident and the circumstances surrounding it. However, there are many lessons to be gained from this retrospective process that may prevent similar incidents in the future.

A RCA is a defined process that seeks to explore all of the possible factors associated with an incident by asking what happened, why it happened and what can be done to prevent it from happening again.

Health-care workers require training in this method, as they do in CPI methodology. Many countries have introduced training programmes to help health-care workers develop skills in conducting RCAs. The United States VA and hospitals in Australia have adapted RCA for the investigation of adverse events. The VA model has become a prototype for health-care organizations worldwide.

It is difficult for a team of health-care professionals to conduct a RCA without the support of their organization, including personnel, time and support from managers, clinicians, and the chief executive.

The VA has developed a guide for staff about the possible areas and questions they might ask to uncover the possible factors involved in an incident.

- *Communication*: Was the patient correctly identified? Was information from patient assessments shared by members of the treatment team on a timely basis?
- *Environment:* Was the work environment designed for its function? Had there been an environmental risk assessment?
- *Equipment:* Was equipment designed for its intended purpose? Had a documented safety review been performed on the equipment?
- *Barriers:* What barriers and controls were involved in this incident? Were they designed to protect patients, staff, equipment or environment?
- *Rules, policies and procedures:* Was there an overall management plan for addressing risk and assigning responsibility for risk? Had a previous audit been done for a similar event? If so, were the causes identified and were effective interventions developed and implemented on a timely basis?
- *Fatigue/scheduling*: Were the levels of vibration, noise and other environmental conditions appropriate? Did personnel have adequate sleep?

All recommendations should address the root cause of the problem. They should be specific, concrete and easily understood. Recommendations should be realistic; it must be possible to implement them. Roles and responsibilities for their implementation should be clearly defined, along with a timeframe for their implementation.

Failure mode and effect analysis

Background

The goal of FMEA is to prevent care-process problems before they occur. FMEA has its origins in the United States military under Military Procedure MIL-P-1629, and exists now as the Military Standard 1629a, Procedures for performing a failure mode effects and criticality analysis [10]. At its most basic level, FMEA seeks to identify the effect of a component failure. Since these failures have not yet occurred, they are expressed in probabilistic notation of likelihood and significance of impact. Teams then use this information to introduce quality improvements within their respective organizations. Implementation of FMEA-based quality improvements in health care started in earnest in the 1990s. Since then, use of FMEA has expanded, mostly in the inpatient setting. Growth in this health-care domain is due in large part to the fact that it is now used by organizations that accredit hospitals, as well as the translation of engineering-based FMEA language into language more accessible to health-care professionals.

FMEA: The big picture

FMEA is an approach that seeks to find and identify possible failures in the system and implement strategies to prevent the failures from occurring. FMEA is usually a component of larger quality-improvement efforts being undertaken by a health-care organization and involves a three-step process:

1. Risk assessment

(a) Hazard identification–involves weighing evidence that the process in question results in harm.

(b) Systems analysis–involves fully diagramming the existing care process and assessing any

associated potential risks of harm. It is in this step that FMEA is conducted.

(c) Risk characterization–the findings of the first two steps are integrated. In this step, assumptions, uncertainties and judgements are presented. Based on approvals, a list of actions to be taken to reduce risk is then developed.

2. Implementation

3. Evaluation.

Basic knowledge and skills

To understand the basics of FMEA, students need to understand the concept of process mapping and the role of team work.

Process mapping is a process used in all areas of production, but in health care it simply refers to the identification of all the steps involved in delivering care and gaining a clear picture of the way the health service is organized and operated.

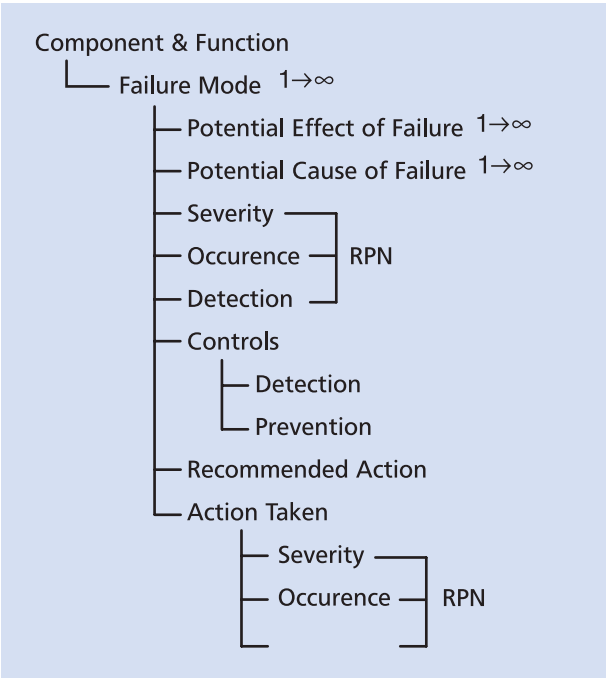
The goal of *problem-solving teams* is to brainstorm all the ways in which specific steps in a care process can fail. A particular feature of FMEAs is that teams can quantify failure modes by taking the product of the severity, occurrence and detection scores to produce a risk-priority number. Each of the three quantifiers is typically rated on a scale of 1–10. The risk priority number facilitates rank ordering, which aids problem-solving teams in directing their efforts to the process components that need to be most readily addressed.

Constructing a FMEA is a team-driven activity that can take multiple sessions and hours of deliberation. A critical element of this method (and others) is that problem-solving occurs within teams composed of persons with a diverse range of skills, backgrounds, and expertise. Groups are better problem-solvers than individuals, particularly when the tasks are complex and require the consideration and integration of many components. Furthermore, group decisions reached through cooperative and respectful deliberation are consistently superior to decisions made by individuals or groups operating via majority rule [11].

The issue to be explored begins in the orientation stage, followed by the team's evaluation or appraisal of the issue. Finally, a decision is made and agreement reached about the action to take. Effective problem-solving teams formulate the objective of their work, allow for an open expression of differences and examination a nd comparison of differences and alternatives. The members of effective teams listen to and support one another.

There are many FMEA templates and formats available, but they all follow the same basic structure shown in Figure B.7.3.

Figure B.7.3.
FMEA component and function



Source: FMEA [web site] http://www.fmea-fmeca.com/index.html [12].

Risk Priority Number (RPN) is a measure used when assessing risk to help identify critical failure modes associated with your design or process. The RPN values range from 1 (absolute best) to 1000 (absolute worst). The FMEA RPN is commonly used in the automotive industry and it is somewhat similar to the criticality numbers used in Mil-Std-1629A (United States Military Standard for performing FMEAs). The graphic above shows the factors that make up the RPN and how it is calculated for each failure mode [12].

Tools for assessing underlying problems and progress

The following tools for organizing and analysing data are commonly used in health-care quality-improvement efforts. They are all relatively simple

to use. Many health services, such as hospitals and clinics, routinely collect and use data about the services being delivered and statistically analyse the data to report to the local health authorities or the head of the health service. The following tools are commonly used in quality-improvement efforts: flowcharts; cause and effect diagrams (also known as Ishikawa or fishbone diagrams); Pareto charts; and run charts. A description of these tools is provided below.

Flowcharts

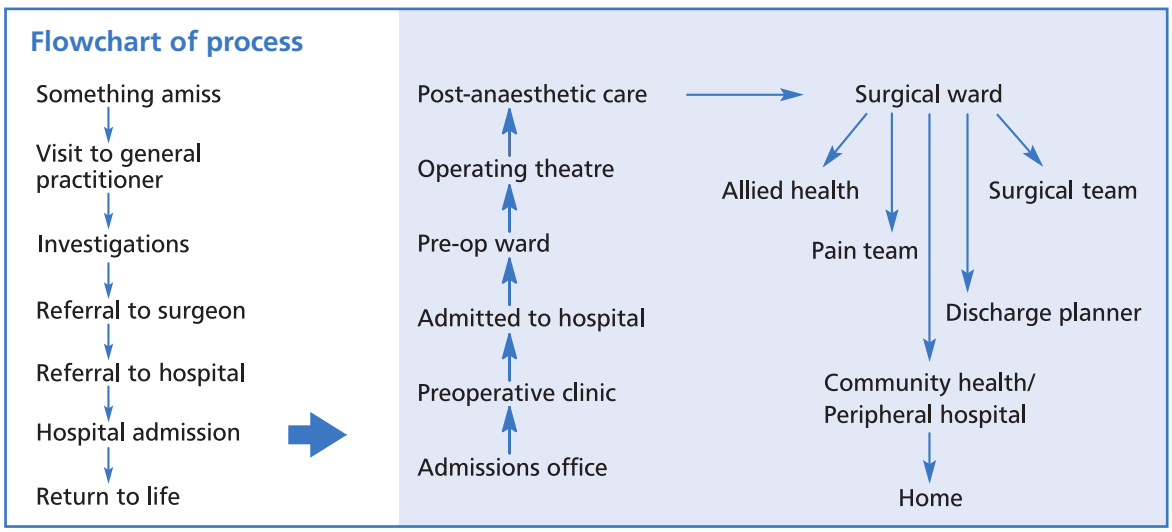
Flowcharts allow the team to understand the steps involved in the various health-care delivery services to patients, such as patients undergoing a particular treatment or procedure. A flowchart is a pictorial method of showing all the steps or parts of a process. Health-care systems are very complex and, before we can fix a problem, we need to understand how the different parts of the system in question fit together and function. Flowcharts are more accurate when a range of people construct and contribute to its development. It would be very difficult for only one person to construct an accurate flowchart because he/she may not be familiar with the wide range of actions that occur in a particular situation or have access to the documentation of the services provided. When multiple team members are involved in their construction, flowcharts are a good way to diagram what people actually do at work, rather than what others think they do.

Even though the actions described by team members may differ from the organization's official position, it is important that the flowchart depicts what actually happens. This flowchart can then provide a common reference point and language that all members of the team can share. Proper construction of a flowchart enables an accurate portrayal of the process. It describes what is the reality, rather than what one or others want.

There are two types of flowcharts, high-level flowcharts and detailed flowcharts, and they have a variety of benefits. They can be used to explain the processes involved in the delivery of health care. They can also be used to identify any steps that do not add value to the process, including delays, breakdowns in communication, needless storage and transportation, unnecessary work, duplication and other added expenses. Flowcharts can help health-care workers develop a shared understanding of the process and use this knowledge to collect data, identify problems, focus discussions and identify resources. These charts can serve as the basis for designing new ways to deliver health care. Health-care workers who document the process in question also gain a better understanding of each other's roles and functions.

Not all flowcharts look the same. Figure B.7.4 shows the flowchart developed by the team who want to reduce the amount of time that colectomy patients spend in hospital from 13 days to 4 days within six months.

Figure B.7.4. Example of a flowchart



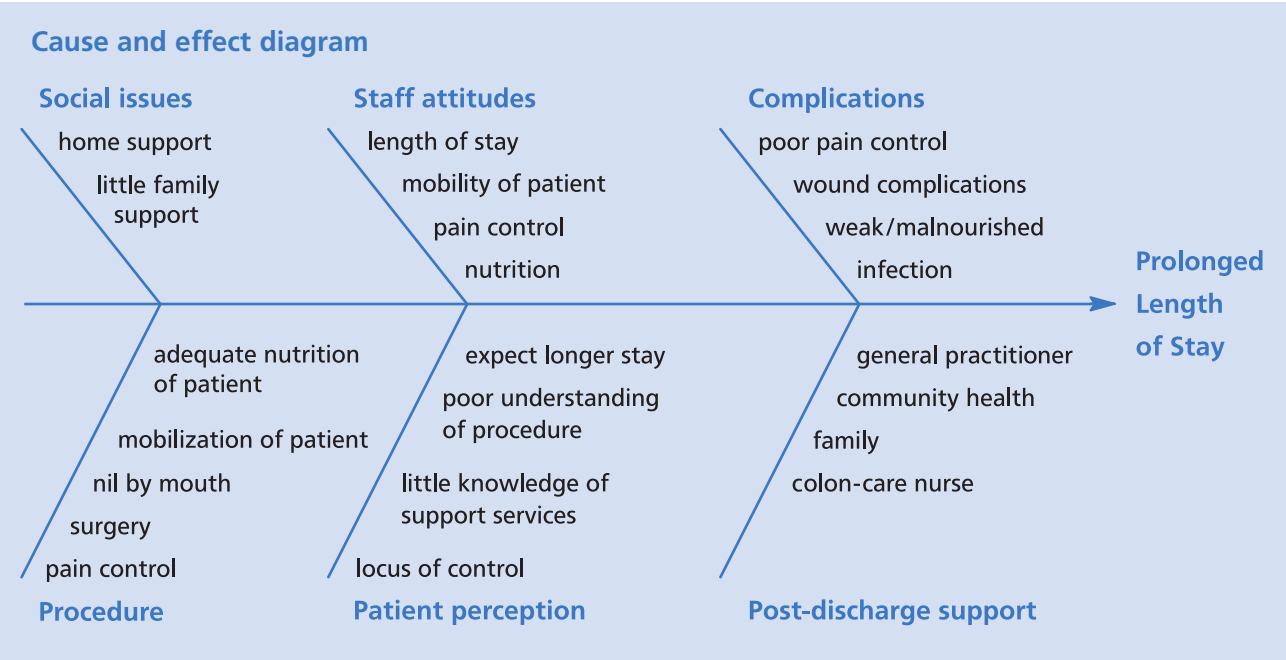
Source: Example of a flow chart from: Accelerated Recovery Colectomy Surgery (ARCS) North Coast Area Health Service, Australia.

Cause and effect diagrams

Cause and effect diagrams are used to explore and display all the possible causes of a certain effect. This type of diagram is also called an Ishikawa or fishbone diagram. A cause and effect diagram graphically displays the relationship of the causes to the effect and to each other. It can be used to identify multiple factors that may contribute to an effect. This type of diagram can help a team focus on areas for improvement. The content of each arm of the diagram is generated by members of the team as they brainstorm about possible causes. The fishbone diagram shown in Figure B.7.5 is the result of brainstorming by a team of health-care professionals working to reduce the length of time colectomy patients need to stay in hospital.

Continuing with the CPI project conducted by the team trying to reduce the amount of time colectomy patients needed to stay in hospital after surgery, a cause and effect diagram was used to identify factors that team members see as contributing to the length of time patients stay in hospital.

Figure B.7.5. Example of a cause and effect diagram



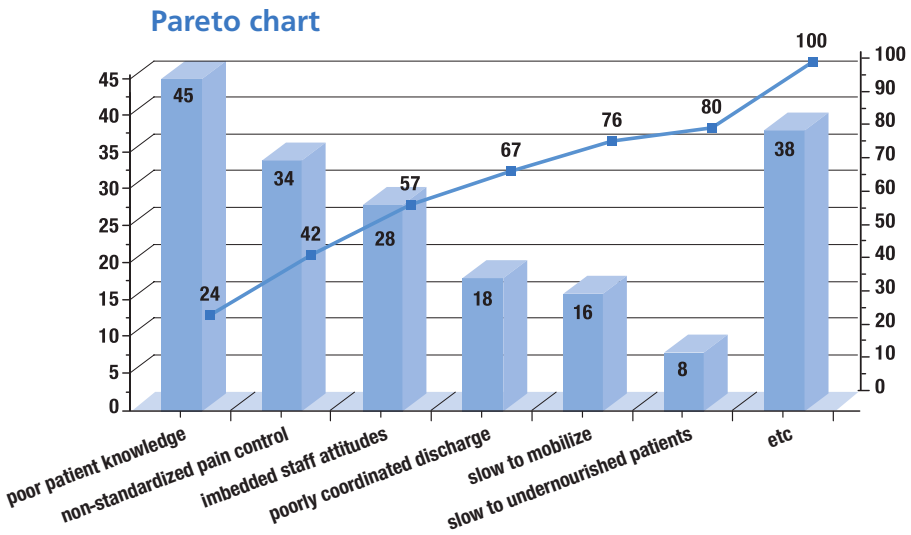
Source: Example of a flowchart from: Accelerated Recovery Colectomy Surgery (ARCS) North Coast Area Health Service, Australia.

Pareto charts

In the 1950s, Dr Joseph Juran [13] used the term *Pareto Principle* to describe a large proportion of quality problems being caused by a small number of causes. The principle that a few contributing factors account for most of an effect is used to focus the team's problem-solving efforts. This is done by prioritizing problems, highlighting the fact that most problems are affected by a few factors and indicating which problems to solve and in what order.

A Pareto diagram is a bar chart in which the multiple factors that contribute to the overall effect are arranged in descending order, according to the relative magnitude of their effect. The ordering of the factors is an important step because it helps the team concentrate its efforts on those factors that have the greatest impact. It also assists them to explain the rationale for concentrating on particular areas.

Figure B.7.6. Example of a Pareto chart



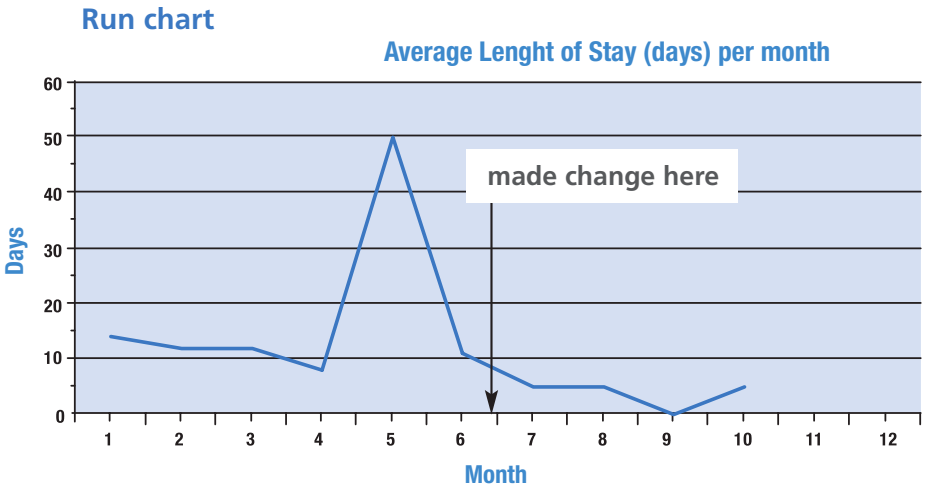
Source: Langley GJ, Nolan KM, Norman CL, Provost LP, Nolan TW. *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance*, 1996 [4].

Run charts

Figure B.7.7 shows a run chart produced by a base hospital team that tracks improvements over time. Run charts or time plots are graphs of data collected over time that can help the team determine whether a change has resulted in an improvement over time or whether the observed results represent a random fluctuation (that might be wrongly interpreted as a significant improvement). Run charts help identify whether there is a trend. A trend is formed when a series of consecutive points continually fall or rise.

Run charts can help teams judge how a particular process is performing and identify when a change has resulted in a true improvement.

Figure B.7.7. Example of a run chart



Source: Langley GJ, Nolan KM, Norman CL, Provost LP, Nolan TW. *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance*, 1996 [4].

Histograms

Histograms are a type of bar graph. A histogram is a graphical representation of the probability distribution of a variable, showing the frequencies of data points within discrete areas.

Strategies for sustaining improvements

Making the improvement is not the end of the process; the improvement needs to be sustained over time. This means continuous measuring and adjustment through PDSA cycles. The following strategies were identified by the team who wanted to reduce the amount of time colectomy patients needed to stay in hospital after surgery:

- document each patient's length of stay in hospital;
- calculate the average length of stay monthly;
- place an updated run chart in operating theatres monthly;
- hold bi-monthly team meetings to discuss positive and negative developments;
- continuously refine the clinical pathways;
- report outcomes to the local clinical governance group;
- spread these practices to all surgical teams in the hospital and throughout the region.

By implementing these strategies, the team successfully reduced the length of stay for patients having colectomy surgery at their hospital. In doing so, they have improved the quality of care for patients by significantly reducing the risks of infection and speeding up recovery. There was also a cost benefit. Even so, they need to sustain these improvements. The team planned to continue to monitor the length of time that these patients stay in the hospital and will analyse these data on a monthly basis.

Summary

There is overwhelming evidence that patient care improves and errors are minimized when health-care professionals use quality-improvement methods and tools. Only when these methods and tools are used will the efforts of the team be rewarded by real, sustained improvements in health care. This topic set out methods for quality improvement and described a range of tools that are used in quality improvement. These tools can be simply applied in any setting– a rural remote clinic or a busy operating theatre in a large city hospital.

Teaching strategies

Teaching quality-improvement methods to students can be challenging because it requires health professionals who have had real experience with the tools and are familiar with the benefits associated with their use. The best way to teach this topic is to have students use the quality-improvement tools and arrange for individualized coaching in quality-improvement methods. Students should also be encouraged to join existing projects to experience the teamwork involved in these projects and how patient outcomes are significantly improved when these methods are used.

This topic can be taught in a number of ways.

An interactive/didactic lecture

This topic contains a lot of theoretical and applied information that is suitable for an interactive didactic lecture. Use the accompanying slides which can be found on the WHO web site as a guide for covering the whole topic. PowerPoint slides can be used or the slides can be converted for use with an overhead projector.

Panel discussions

Invite a panel of health professionals who have used an improvement method (CPI, RCA or FMEA) to talk about the improvement process and whether these methods allowed them insights they would not otherwise have had. Patients should also be included on the panel to close the loop from their perspective. Some organizations are including patients in RCA and CPI teams as they have unique contributions to make.

Small group discussions

The class can be divided up into small groups. Three students in each group can then be asked to lead a discussion about quality improvement in general as well as the benefits of quality-improvement methods and when they might be used.

Simulation exercises

Different scenarios could be developed for the students, including practising the techniques of brainstorming and/or designing a run chart, cause and effect diagram or histogram.

Other teaching and learning activities

This topic is best taught by having the students practise using quality-improvement tools and techniques in their own personal self-improvement projects. The following are examples of self-improvement projects:

– develop better study habits;
– spend more time with family;
– give up smoking;
– lose or put on weight;
– perform more housework.

Students can implement the PDSA cycle to suit their own personal circumstances and obtain a better understanding of the process. The principles and method used will be relevant in their later professional work. Students can begin to experiment with the tools and see how to use them and whether they help them in their own projects.

One of the best learning occurs when students are able to participate or observe an actual quality-improvement process. This requires students asking their instructors, supervisors or other health-care professionals if their health-care facility undertakes regular quality-improvement projects. They could also seek out managers in a health service and ask if they can observe a quality-improvement activity.

After these activities, students should be asked to meet in pairs or small groups and discuss with a tutor or health professional what they observed, whether the features or techniques they learned about were present or absent, and whether they were effective.

Teaching failure mode and effect analysis
Before FMEA can be taught, students need to have exhibited basic proficiency in constructing process diagrams. The FMEA portion of this topic is intended to be taught in two parts. The first part is a lecture. The goals of the instructor during this lecture are to introduce the students to the basic principles of FMEA. The lecture should show how to construct a basic FMEA table based on a simple process diagram, as well as to emphasize how to identify multiple potential failure modes and causes per component or function. Examples of scales to determine severity and occurrence should also be emphasized.

The second part of the lesson is an actual case example. The students should be broken up into groups of no less than four; larger groups are actually better, because larger groups will include more divergent views and students will need to work harder to achieve consensus. The case study used should be relevant to the professional group. The goal of each student group is to construct a FMEA based on the case study. This should take no longer than 30 minutes. The goal is not the completion of the process, but rather for the students to practise what they have learned. Each group then presents their FMEA, with issues rank-ordered by RPN, from the most significant to least significant.

Tools and resource material

Langley GJ, Nolan KM, Norman CL, Provost LP, Nolan TW. *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance*. New York, NY; Jossey-Bass, 1996.

Reid PP et al,eds. *Building a better delivery system: a new engineering/health care partnership*. Washington, DC, National Academies Press, 2005 (http://www.nap.edu/catalog.php?record_id=11378; accessed 21 February 2011).

Bonnabry P et al. Use of a prospective risk analysis method to improve the safety of the cancer chemotherapy process. *International Journal for Quality in Health Care,* 2006; 18: 9–16.

Root cause analysis
Root cause analysis. Washington, DC, United States Department of Veterans Affairs National Center for Patient Safety, 2010 (http://www.va.gov/NCPS/rca.html; accessed 21 February 2011).

Clinical improvement guide
Easy guide to clinical practice improvement: a guide for health professionals. New South Wales Health Department, 2002 (http://www.health.nsw.gov.au/resources/quality/pdf/cpi_easyguide.pdf; accessed 21 February 2011).

Mozena JP, Anderson A. *Quality improvement handbook for health-care professionals*. Milwaukee, WI, ASQC Quality Press, 1993.

Daly M, Kermode S, Reilly D Evaluation of clinical practice improvement programs for nurses for the management of alcohol withdrawal in hospitals. *Contemporary Nurse*, 2009, 31:98-107.

Failure mode effects analysis
McDermott RE, Mikulak RJ, Beauregard MR. *The basics of FMEA*, 3rd ed. New York, CRC Press, 2009.

Assessing knowledge of this topic

A range of assessment methods are suitable for this topic. Students could be asked to complete a self-improvement project and report on the experience or write a reflective statement about an observation of an improvement activity they have observed or participated in.

Evaluating the teaching of this topic

Evaluation is important in reviewing how a teaching session went and how improvements can be made. See the Teacher's Guide (Part A) for a summary of important evaluation principles.

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5. Friedman RC, Kornfeld DS, Bigger TJ. Psychological problems associated with sleep deprivation in interns. *Journal of Medical Education*, 1973, 48:436-441.
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11. Bales, RF, Strodtbeck FL. Phases in group problem-solving. *Journal of Abnormal and Social Psychology*, 1951, 46, 485-495.
12. FMEA [web site] (http://www.fmea-fmeca.com/index.html; accessed 18 November 2010).
13. Juran J. *Managerial breakthrough*. New York, McGraw-Hill, 1964.

Slides for Topic 7: Introduction to quality-improvement methods

Didactic lectures are not usually the best way to teach students about patient safety. If a lecture is being considered, it is a good idea to plan for student interaction and discussion during the lecture. Using a case study is one way to generate group discussion. Another way is to ask students questions about different aspects of health care that will bring out the issues contained in this topic, such as change management principles and the importance of measurement.

The slides for Topic 7 are designed to help the instructor deliver the content of this topic. The slides can be changed to fit the local environment and culture. Instructors do not have to use all of the slides and it is best to tailor the slides to the areas being covered in the teaching session.

Topic 8

Engaging with patients and carers

A woman suffers from a ruptured ectopic pregnancy

Samantha was 6½ weeks pregnant (via donor insemination) when she was referred by her general practitioner for an urgent ultrasound. Trans-abdominal and trans-vaginal ultrasounds suggested a right-sided ectopic pregnancy. During the procedure the radiographer asked Samantha when she would be consulting her midwife or medical practitioner. She said that it would be midday on the following day. The only discussion that followed was whether she would take the films with her or whether the clinic would courier them to her named health-care provider. It was finally decided that she would take them with her.

Samantha was given the films in a sealed envelope marked "To be opened only by the referring doctor". At no time was she advised of the seriousness of her condition or to report to a doctor immediately. When Samantha arrived home she decided to open the envelope and read the ultrasound report. She immediately understood the gravity of her situation and urgently called a doctor who advised her that she needed to be admitted to hospital immediately.

At 9pm she was admitted to hospital and underwent major abdominal surgery for a ruptured ectopic pregnancy. This story highlights the importance of full engagement with patients and the need to communicate with them at all times.

Source: Case studies–investigations. *Health Care Complaints Commission Annual Report 1999–2000: 60.* Sydney, New South Wales, Australia.

A carer resolves issues about his mother's treatment

Maria, aged 82, sustained a minor fracture to her hip after a domestic fall and was admitted to hospital. Up to this time, Maria had been active and received care at home from her son, Nick. After two days, the hospital made an assessment of Maria that found her unsuitable for rehabilitation. Maria spoke little English and there was no interpreter to explain the hospital's assessment to her. Maria quickly lost confidence in the hospital. Nick thought that it was too early to forecast his mother's prognosis for recovery and was upset that the hospital refused to provide a copy of her X-ray report to her general practitioner. Nick contacted a patient support service when he learnt that the hospital planned to seek a guardianship order to facilitate Maria's transfer to a nursing home.

A meeting was planned between the patient support officer, Nick, and key members of the treating team. It was decided to do a trial to see if Maria responded to rehabilitation. The team also agreed to release the X-ray report. Maria was transferred to the rehabilitation unit and successfully undertook therapy. She was later discharged home to Nick's care with community-based support. This good outcome could not have happened without the involvement of Nick and his mother in the discussions about her treatment.

Source: Case studies. Health Care Complaints Commission, 2003, 1:11. Sydney, New South Wales, Australia.

Introduction–Why engaging with patients and families is important

Modern health care claims to be patient-centred, but the reality for many patients is a long way from this vision. Entrenched views about the level of involvement patients should have in their own care, is a major obstacle to patients and consumers. The tide is turning and, in many countries around the world, the consumer's voice in health care is not only being heard, but is being recognized by governments and health-care providers.

Any health-care intervention has an element of uncertainty as to whether it will improve the health of the patient. Every person has the right to receive helpful information about the quality of the care they will receive, especially if they are to have any type of invasive intervention. If the patient consents, family members or carers should also be included in the exchange of information. Informed consent allows consumers/patients, in collaboration with health-care professionals, to make decisions about interventions and the risks associated with those intervention. Such interventions might include a course of medication or an invasive procedure.

While most health-care treatments and interventions have good results, or at least do no harm, poor outcomes do occur and are often associated with random or systemic errors; nearly all involve humans. The quality of a health-care system can be judged by the way it handles those errors. The success of high-reliability organizations can be measured in terms of how well they plan for failures. When health-care organizations fail to integrate consumer involvement in managing systemic risk, they lose access to important patient knowledge that cannot be gained from any other source.

Open disclosure is a term used to describe honest communication with patients and carers after they have suffered harm. The use of open-disclosure processes in many health-care facilities reflects the importance of professionalism and honesty in communicating with patients and their carers. This, in turn, has increased the opportunities for partnerships with patients.

Many consumer organizations are now turning their attention to organizational activities that promote or support safe patient care. The WHO initiative Patients for Patient Safety [1] is directed at consumers and focuses on education about patient safety and the role played by the system of health care as a contributing factor to adverse events. When health professionals invite patients and carers to be partners in health care, the very act of doing so changes the nature of health care for that person and for the experience of the health-care professionals. Being in the journey together improves the patient experience and reduces the difference between the care and treatment provided and the actual experience of the patient. Less adverse events are likely to occur and, when they do, patients and carers are more likely to be understanding about the underlying causes.

Many patients undergoing treatment, particularly when hospitalized, are in a vulnerable psychological state, even when their treatment goes according to plan. Symptoms akin to post-traumatic stress disorder can occur even following procedures that providers think are routine. When a patient experiences a preventable adverse event, the emotional trauma may be particularly severe. Additionally, the trauma arising from how the patient and family are received and communicated with following an adverse event can occasionally be more damaging than the event itself. This topic will provide an overview of consumer engagement activities that naturally divides into two dimensions: (i) opportunities for learning and healing after an adverse event has occurred; and (ii) engagement of patients in preventing harm.

Keywords
Adverse event, open disclosure, apology, communication, complaints, cultural norms, disclosure, education, error, fear, informed decisions, liability, patient and family, patient-centred, patient empowerment, patient engagement, patient rights, partnership, reporting, questions.

Learning objective

The objective of this topic is for students to know and understand the ways in which patients and carers can work as partners in health care, both in preventing harm and in learning from adverse events.

Learning outcomes: knowledge and performance

Knowledge requirements

Students need to understand basic communication techniques, informed consent/choice procedures and the principles of open disclosure.

Performance requirements 
Students need to:

- actively encourage patients and carers to share information;
- actively share information with patients and carers;
- show empathy, honesty and respect for patients and carers;
- communicate effectively;
- appropriately inform patients and obtain informed consent for treatments and interventions, and support patients in making informed choices;
- show respect for each patient's differences, religious, cultural and personal beliefs and individual needs;
- describe and understand the basic steps in an open-disclosure process;
- meet patients' complaints with respect and openness;
- apply patient-engagement thinking in all clinical activities;
- demonstrate ability to recognize the importance of patient- and carer-engagement for good clinical management.

Basic communication techniques

Reviewing principles of good communication

Before getting into the details of open disclosure, it is useful to quickly review the principles of good communication and informed consent if these have not already been covered in the course.

Informed consent

There would be few occasions where consent is not an important aspect of the relationship between a health professional and a patient or client. The very act of giving advice, a medication or conducting an intervention raises the concept of *respect for autonomy*. Respect for autonomy refers to a person's right to make choices and act according to their own values and belief system. This means that it is unethical for a health professional to interfere with the choices patients make unless the person is unconscious or in a life-threatening situation. The consent process is a good barometer for judging how involved and engaged a patient is with his/her treatment. Much of health care is delivered by relying upon verbal consent rather than written consent, which is usually reserved for hospital treatment or procedures. But even verbal consent requires complete and accurate sharing of information with the patient. Some students and health professionals believe that consent requirements are fulfilled with the initial introduction of themself or the signing of a consent form, but consent is much more than a signature on a form or a cursory discussion.

The consent process enables the patients (or their carers) to consider all the options they have in relation to their care and treatment, including alternatives to the course of treatment proposed. Because this is such an important process, guidelines have been developed to assist health-care professionals competently complete this task. Unfortunately, time pressures and, sometimes, attitudes toward patients shorten this process. The consent process has been developed over time, paying attention to local laws. Essentially, the consent process has two main phases [2], elements that inform the patient and elements that enable the patient's decision-making process. The elements which inform the patient include information provided by the health-care practitioner and comprehension of that information by the patient. Elements that enable the patient to make a decision include time to absorb the information disclosed and perhaps consult with family/carers, the opportunity to make a free and voluntary choice and the competence of the care providers.

Students in many health fields will observe the consent process when they are assigned to hospitals, dentist rooms, pharmacies or clinics. Some will observe excellent examples of professionals and patients discussing treatment options and patients consenting to or declining the intervention or treatment, but many will also see patients giving consent with minimal information about the proposed action. It is not uncommon for patients to discuss consent with pharmacists, nurses and other health professionals before or after they have spoken with their dentist or doctor. Nurses should communicate any concerns patients have with the treating clinician to ensure that communication is open and patient needs are met effectively. The person responsible for performing the procedure or treatment should ensure that the patient fully understands the nature of the treatment or procedure and has been fully informed about the associated risks and benefits.

Many students might be concerned about how much and what type of information should be disclosed and how well it must be understood before it can be said that the patient has been appropriately informed. How can the practitioner know that a patient's decision is intellectually unimpaired and voluntary, as well as free of intrinsic (stress, grief) and extrinsic (money, threat) pressures?

Financial considerations are extremely important for patients who may not have health insurance or other financial resources.

What patients should know 

Health-care professionals are widely encouraged to use evidence-based health care. For many treatments, there is a body of evidence on the likelihood of success and the likelihood of harm. If the information is available, it is important that such information be communicated to patients in a way that they can understand. When there are printed resources to aid decision-making, these should be used. Before individual patients can decide whether or not to accept care or have a treatment, they need to have information about the following issues.

The diagnosis or the main problem
This includes test results and procedures. Without a diagnosis or assessment of what the problem is, it is difficult for a patient to come to a decision about whether the treatment or solutions will be beneficial. If a treatment is exploratory, that should be disclosed.

The degree of uncertainty in the diagnosis or problem
Health-care delivery is inherently error-prone. As more symptoms appear and more information is provided, a diagnosis may be confirmed or changed, or a problem reformulated. Disclosing uncertainty is essential.

Risks involved in the treatment or solution
In order for patients to make decisions that suit them, they need to know about any side-effects or complications associated with the treatment or procedure, as well as any potential outcome that might affect their physical/mental well-being. Patients need to know the nature of any risks involved in the treatment or planned solution, as well as the likely consequences of not having the treatment.

One way to communicate the risks and benefits of a treatment is to move from a discussion of general information about the treatment or procedure to specific information about the known risks and benefits (and uncertainties) associated with the specific treatment or procedure, and then to address the particular concerns and informational needs of the patient or caregiver.

Patients need to know the range of options, not just the one favoured by the practitioner. In particular, they need to know:

- the proposed treatment;
- expected benefits;
- when treatment would start;
- length of treatment;
- the costs involved;
- whether there is an alternative treatment that they might consider;
- the benefits of the treatment; and
- the risks of not having the treatment.

Some treatments, notwithstanding certain risks, are better than no treatment because of the likely consequences of not taking these actions.

Information on expected recovery time
The type of treatment or the decision to go ahead with a treatment or procedure may be influenced by other factors in the patient's life, such as employment, family responsibilities, financial concerns and the location of the treatment.

Name, position, qualifications and experience of the health-care workers who are providing the care and treatment
Patients are entitled to know the level of training and experience of the health-care professionals they are working with. If a practitioner is inexperienced, then supervision becomes more important and information about supervision may become part of the information exchanged.

Availability and costs of any service or medications required
Patients may require the services of additional health-care providers. In some cases, patients may require non-medical assistance as they recover, ranging from a ride home from an outpatient treatment involving anaesthesia to obtaining medications, or help with daily tasks as they recover from major surgery. Certain treatments may also require a series of follow-up treatments.

A tool for good communication 

Several tools have been developed to enhance good communication. One of these is the SEGUE framework developed by Northwestern University (Chicago, IL, USA) [3]:

Set the stage
Elicit information
Give information
Understand the patient's perspective
End the encounter.

Cultural competence 

The Australian Patient Safety Education Framework (APSEF), describes the meaning of the term *cultural competence* as the knowledge,

skills and attitudes that a health-care worker needs in order to provide adequate and appropriate health-care services to all people in a way that respects and honours their particular culturally-based understandings and approaches to health and illness [4].

Culture is a broad term that includes language and customs, as well as values, beliefs, behaviours, practices, institutions and the ways in which people communicate. Students may observe different approaches to dress and food habits among their classmates that may be related to culture or religion. Less obvious to them will be the underlying belief systems that their classmates adhere to.

In many countries around the world, health-care providers and patients are only just beginning to think about patient safety and patient engagement. There are many debates about how this transformation will affect health-care services. While health-care professionals should be culturally competent, it should also be recognized that, in many countries, the patient safety movement is about a cultural change in the health-care system.

Cultural competence [5] in providing health services requires students to:

- be aware of and accept cultural differences;
- be aware of their own cultural values;
- recognize that people from different cultural backgrounds have different ways of communicating, behaving, interpreting information and solving problems;
- recognize that cultural beliefs affect how patients perceive their health, how they seek help, how they interact with health practitioners, and how they adhere to the treatments or care plans;
- be aware of the patient's (health) literacy;
- be able and willing to change the way they work to fit in with the patient's cultural or ethnic background, in order to provide he patient with optimal care;
- be aware that cultural competence includes people from low socio-economic backgrounds–marginalized citizens tend to be more passive and are reluctant to voice their opinions or preferences and may be less willing to trust their own judgement.

Patient and carer engagement

Compared with the health professions and other health-care providers, health-care consumers are the least represented stakeholder in health-care safety and quality-improvement efforts. Bearing in mind that the patient and family are the entity that is present throughout the full continuum of care and sees the full process through a different lens, the absence of engagement with patients and their caregivers can deprive health care of a rich source of real data and real life experience, which can reveal the gap between the patient safety measures available and the levels of safety being experienced by patients.

Because patients and their families are not as organized as other stakeholder groups, their interests and needs have not been well captured or well integrated into research activities, policy development, patient safety educational curricula, patient education, or error/near miss reporting systems. Recently, patient safety leaders have observed that lack of progress in this area may be due, at least in part, to a failure to effectively engage consumers of care as partners in ensuring the safety of care.

Effects of patient engagement

While there are many ethical statements about the importance of partnerships with patients, there is little research about the extent to which partnerships with patients reduce the incidence of errors. A study by Gallagher et al. [6] indicated a strong willingness by hospitalized patients (91%) to be involved in error-prevention activities. Their comfort levels differed for different issues. Patients were comfortable (85%) asking about a medication's purpose, though nearly half (46%) were very uncomfortable asking health-care workers whether they had washed their hands.

In a 2005 article by Gallagher and Lucas [7] about disclosing medical errors to patients, the authors noted seven studies that had assessed patients' attitudes to disclosure. These studies reported a gap between patients' preferences and health professionals' fears that sharing information with patients would expose them to medico-legal actions. Fortunately, a lot of effort has been put into developing open-isclosure policies and, since 2005,many hospitals have instituted open-disclosure policies without any obvious negative effects.

How patients can be engaged in their care

The patient and family comprise the entity that is present throughout the full continuum of care, while a variety of professionals come and go at intervals, offering and practising their particular expertise. We also know that there can be a lack of integration of these interventions and care plans with the result that the goal of seamless

continuity of care is not always achieved. The continuous presence of the patient, together with a recognition of the patient as a repository of information and as a valuable resource in the care plan, are compelling arguments in favour of patient and family involvement in safe health care.

Continuity of care

Most health professionals have contact with patients when the patients are being cared for in the professional's work environment–the ward, the pharmacy, the dentist's room, the clinic. But patients move through many health-care environments–from their homes to clinics, to hospitals, to outpatient clinics, to doctor's rooms. Health professional students need to understand how poor communication and teamwork can impact on continuity of care for patients. Inaccurate or incomplete information can lead to the patient being incorrectly treated, either because the information was not available or the information that was provided was wrong. Patients are the only constants in the transitions of care from one professional to another and from one care environment to another. Including the patient in the information exchange at all times will help the accuracy of these communications. Accurate information is important at all times but particularly during handovers and shift changes.

In order to enhance the quality of the patient's transition from one professional to another students are required to:

- provide information to the right people at the right time to ensure that patients receive continuous care and treatment;
- record information clearly and legibly;
- document patient records to show patient progress;
- accurately transfer information about a patient's status and care plan to another team member or health-care team;
- communicate clinical findings clearly to other members of the health-care team;
- handover a patient's care to a treating health-care worker or relieving member of the health-care team;
- ensure the coordination of continuous care for all patients;
- effectively manage medications.

Patients' stories are inspiring

Human factors experts have expressed considerable caution about assigning responsibilities to the patient or family without a clearer understanding of what role they play in preventing harm. We have yet to seriously research the role of patients in minimizing errors or indeed whether there is such a role for them in this process. Nevertheless, many stories told by patients who have suffered adverse events suggest that had health-care providers listened to their concerns, adverse events might have been avoided. These stories carry powerful messages for health providers. Students cannot fail to engage with these stories, reflect on the experiences of these patients and incorporate new understandings into their own professional practice. Patients' stories can also be a powerful tool in supporting and reinforcing material from textbooks and lectures.

Patients' experiences can teach us

We have not traditionally viewed the patient's experience as a source of learning for students. There is increasing evidence that patients' stories and experiences of their illnesses/conditions teach students and practising professionals a lot, including the key roles patients can play: (i) in helping with the diagnosis; (ii) in deciding about appropriate treatments; (iii) in choosing an experienced and safe provider; (iv) in ensuring that treatments are appropriately administered; and (v) in identifying adverse events and letting people know about them as soon as possible [8].

Many students remember what they learn from patients because of the authenticity of the patient's voice and their role in promoting patient-centred care. There is also anecdotal material highlighting unaddressed patients' concerns and questions leading to adverse events.

Currently, the health-care system underutilizes the expertise patients can bring to the health-care partnership. In addition to knowledge about their own symptoms, preferences and attitudes toward risk, they are an additional pair of eyes if something unexpected happens [9].

What is open disclosure and what must be disclosed?

Open disclosure is a term used to describe the process of informing patients and their families of bad outcomes of treatment, as distinguished from bad outcomes that are expected from the disease or injury being treated. A number of definitions exist, reflecting the discussions surrounding the open-disclosure guidelines being developed and implemented in many countries.
In Australia, open disclosure is:

The process of providing an open, consistent approach to communicating with the patient and their support person following a patient-related incident. This includes expressing regret for what has happened, keeping the patient informed and providing feedback on investigations, including the steps taken to prevent a similar incident occurring in the future. It is also about providing any information arising from the incident or its investigation relevant to changing systems of care in order to improve patient safety [10].

Open disclosure is honest communication with patients and/or their families after an adverse event; it is not about apportioning blame. The requirement to be honest is an ethical obligation and is documented in most ethical codes of practice. However, many countries have yet to develop open-disclosure guidelines for health-care professionals. Basic questions to be addressed by these guidelines include: "What is the right thing to do in this situation?"; "What would I want in a similar situation?" and "What would I want if my loved one suffered an adverse event?"

Do patients want disclosure of adverse events or errors that produce near misses?

A landmark study by Vincent et al. published in 1994 [11] examined the impact of medical injury on patients and their relatives and their reasons for taking legal action after such incidents. The findings of this study gave impetus to consideration of the role and experience of patients. These researchers interviewed 227 (out of a sample population of 466 or 48.7%) patients and patient relatives who were taking legal action (in 1992) through five firms of plaintiff medical negligence solicitors. They found that over 70% of respondents had been seriously affected by the incidents that caused them to sue, with long-term effects on their work, social lives and family relationships. The survey results showed that these events aroused intense emotions, which persisted for a long time. Decisions to take legal action were based on the original injury and were influenced by insensitive handling and poor communication after the original event. When explanations were given, less than 15% were considered satisfactory.

Four main themes emerged from the analysis of reasons for litigation [11]:

- concern with standards of care–both patients and relatives wanted to prevent similar incidents in the future;
- the need for an explanation–to know how the injury happened and why;
- compensation–for actual losses, pain and suffering or to provide future care for an injured person;
- accountability–a belief that the staff or organization should have to account for their actions–patients wanted greater honesty, an appreciation of the severity of the trauma they had suffered and assurances that lessons had been learned from their experiences.

After an adverse event, patients want an explanation of what happened, an admission of responsibility, an apology, the assurance of prevention of similar events affecting others in the future and, in some cases, punishment and compensation.

Common barriers to honesty with patients after an adverse event

Health-care providers may want to provide accurate and timely information to patients about an adverse event, yet fear that such communication may result in legal action or, at a minimum, confrontation with an angry patient or family member. Targeted education about the disclosure process may better prepare health-care professionals for such an event. Health-care providers may also be ashamed and/or fear causing more distress to patients, as well as the loss of reputation, job and/or insurance coverage. Disclosure is not about accepting or apportioning blame, it is about integrity and being truly professional.

Key principles of open disclosure 

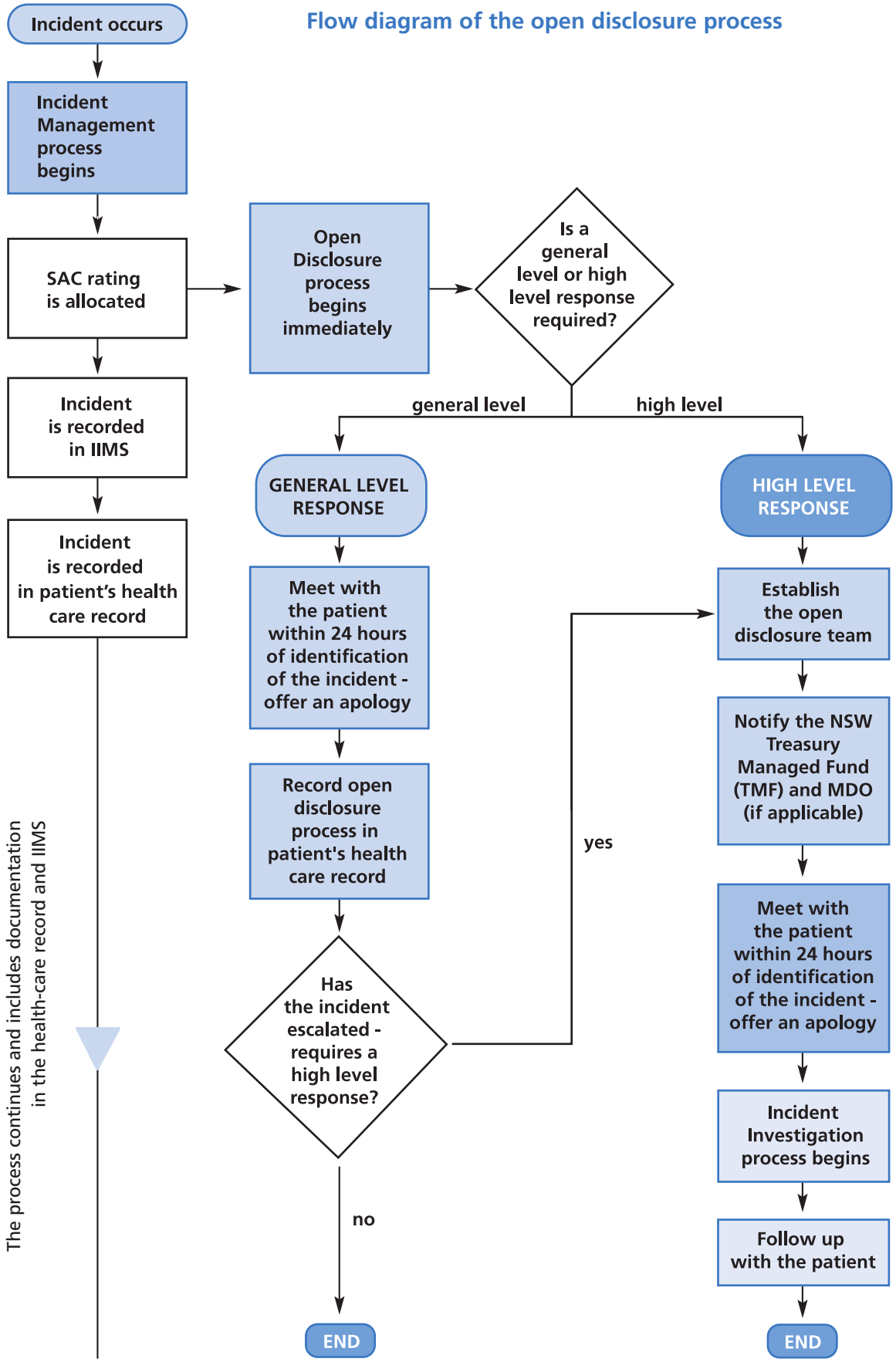
The following are key principles of open disclosure [12]:

- openness and timeliness of communication;
- acknowledgement of the incident;
- expression of regret/apology;
- recognition of the reasonable expectations of the patient and his/her support person;
- support for staff;
- confidentiality.

The open disclosure process 

includes many steps. Senior health professionals are responsible for this process and students should never be left with the responsibility for telling patients and families about an adverse event. They should try to observe and sit in on interviews with patients in order to learn about the process and its value for patients and their families. Figure B.8.1 is a flowchart of the open-disclosure process used in New South Wales (Australia) that commenced in 2007.

Figure B.8.1. Open-disclosure process, New South Wales, Australia



Source: Adapted from flow diagram of the open disclosure process http://www.health.nsw.gov.au/policies/gl/2007/pdf/GL2007_007.pdf [12].

The Harvard Framework for disclosure [13]
includes seven steps: preparation; initiating a conversation; presenting the facts; active listening; acknowledging what has been said; concluding the conversation; and documenting the conversation. Before the disclosure conversation, it is important to review all of the facts involved. The appropriate participants |for the conversation need to be identified and involved and an appropriate setting should be chosen for the discussion.

At the start of the discussion, it is important to determine the patient's and/or family's readiness to participate in the discussion and to assess their health literacy and ability to understand, as well as their general level of understanding. The health professional leading the discussion should provide a description of what happened, avoiding technical and medically-related jargon. It is important to neither overwhelm the patient or their carer with information nor oversimplify things. The health professional should be careful to speak slowly and clearly and be mindful of body language. Once the events have been recounted, it is important to explain what is currently known of the outcome and describe any future steps to be taken. The health professional should sincerely acknowledge the patient's and family's suffering.

It is important for the health-care professional to listen carefully and respectfully to the patient and family. The health-care professional should be careful to not monopolize the conversation by leaving the time and opportunity for patients and their families to ask questions and have their questions answered as completely as possible.

At the end of the conversation, the discussion should be summarized and key questions raised in the discussion should be repeated. A follow-up plan should be established at that point. Afterwards, the conversation (and the events leading up to it) should be properly documented.

Advanced communication techniques and open disclosure
It is important to note that there is a strong emotional context to adverse events. Patients are often frightened and may feel vulnerable, angry or frustrated. Students are required to build on their basic communication skills in order to develop confidence in dealing with emotionally charged situations.

There are many tools and training programmes to assist health-care students and professionals in communicating with patients and carers. Communication teaching sessions usually include coaching students on asking the right questions, avoiding being seen as "too defensive", and showing patients how their concerns have been listened to and understood.

Ways to engage patients and their carers
When students work with patients, they should:
- actively encourage patients and carers to share information;
- show empathy, honesty and respect for patients and carers;
- communicate effectively;
- obtain informed consent in an appropriate manner;
- remember that information exchange is a process not an event–students should always leave open the opportunity for patients to return with more questions;
- show respect for each patient's differences, religious and cultural beliefs and individual needs;
- understand and describe the basic steps in an open-disclosure process;
- apply patient engagement thinking in all clinical activities;
- demonstrate ability to recognize the place of patient and carer engagement in good clinical management.

SPIKES: a communication tool
The communication tool 'Setting, Perception, Information, Knowledge, Empathy, Strategy and Summary' (SPIKES) [14] is used to assist health professionals to communicate bad news in situations where the patients are at the end of their life. But SPIKES can be used more generally to assist communication with patients and their caregivers in a wide range of situations–managing conflict, the elderly patient, difficult patients or those from different socio-cultural backgrounds. Students can start practising some or all of the techniques listed below. In addition to the simple checklist below, students can reflect and ask themselves: "Is this how I would like my family member to be treated?".

Step 1: setting (S)
Privacy
Students will observe that in many hospitals, dental clinics, pharmacies and other care settings, privacy aspects of a patient's care and treatment may not be optimal. The setting is important if sensitive material is to be discussed. The patient must be able to listen and ask questions

with minimal disruptions. It is very important that the health professional and the patient be fully engaged with each other. For example, if a television or radio is on, politely ask the patient to turn it off. This will help everyone focus on the discussion at hand.

Involve significant others
Patients should always be asked if they want to have a family member present to support them and help with information. Some patients, particularly the frail and vulnerable, may need a person to help them make sense of the information. It is particularly important to let patients know that they can have someone with them if they wish.

Sit down
Students are often alert to the problems caused by health professionals standing over a patient or sitting behind a desk and will often comment on it in the early part of their training. However, with time, they come to accept that this is normal and how things are done. Students should practise asking the patient's permission to sit down before doing so. Patients appreciate a health practitioner sitting down because it allows for direct communication and conveys to the patient that the person is not going to rush off.

It is important to always appear calm and maintain eye contact if this is culturally appropriate. Sometimes, if a patient is crying, it is best to look away and allow the patient some privacy and time to compose himself/herself.

Listening mode
An important role of a health-care provider is listening to patients and not interrupting them when they are talking. Maintaining good eye contact and remaining quiet is a good way to show the patient your concern and interest.

Step 2: perception (P)
It is often helpful to first ask the patient what he/she thinks is going on. This can help the care provider to understand where the patient is in relation to their understanding of their situation.

Step 3: information (I)
Many students worry about how much information they should disclose to the patient. Different countries will have different rules for this process. A general rule that probably applies to most countries and cultures is to focus on each individual patient's informational needs. Patients are as varied as humanity and will differ in how much information they want or can cope with. Students should be guided by their supervisors in this area. Different teachers and supervisors will provide more or less information. Observing the approaches of different health professionals is a good opportunity for the student to observe what works for different sorts of patients. Remember that the patient is the main person; students need to concentrate on each patient to find out what they want to know and how well informed they want to be. Students must not assume that patients do not want to know.

The informational needs of patients differ. If a patient has a family history of heart failure, the doctor may spend more time talking about the related risks of particular treatment plans and paying attention to any anxieties the patient may have.

A simple rule to remember about risks is that all patients should be given information about treatments whenever there is potential for significant harm, even if the risk is tiny, and when side-effects, although minor, occur frequently. The application of this rule will help most practitioners to match the information provided with the patient's informational needs. This approach enhances communication between the patient and the health provider by encouraging discussion.

Students will also observe that too much information at once can confuse patients. The delivery of information should be carefully paced and appropriate for the individual patient's situation. Information overload can be avoided by asking some simple questions or making some simple statements at the beginning of the consultation, for example:

I will check with you to make sure that I have given you sufficient information about your diagnosis and/or treatment.

Or: *If, at any point, you feel you have sufficient information for now, please tell me.*

Students will quickly learn that patients will not retain important information given at a time of high anxiety, particularly if a difficult (for the patient) diagnosis is made. Some patients may not want a lot of information or to make the decision about their treatment. However, discussion, explanations and answering questions are still necessary to maintain respect for the patient's autonomy. Some patients may have a list of questions they wish to discuss with their

health-care provider. Students should not feel threatened by this and calmly go through each of the questions, preferably with an instructor or supervisor present. If no instructor is available, advise the patient that you will be checking the questions with your instructor or supervisor.

Step 4: knowledge (K)
Effective communicators will always foreshadow to the patient that they will be covering some disturbing information. This gives the patient time to prepare, even if it is only a few moments, for example: *Mr. Smith, unfortunately, I have some bad news for you.*

Step 5: empathy (E)
The following four steps will help students pay attention to the emotional needs of their patient.

- Listen for and identify the patient's emotion(s). If you are unsure of the emotions being expressed or experienced, ask questions such as: *How does that make you feel?*
- Identify the source of the emotion. "*This is difficult news. Do you want to talk about what you are feeling? If you like, I can come back later and we can talk again when you will have had a chance to take it all in. I will do my best to answer any questions you may have*".
- Show the patient that you recognize his/her emotion and where it is coming from.
- Be quiet–sometimes just being there and letting the patient absorb the information and giving them a chance to formulate any questions is important.

It is inevitable that there will be some patients who are more difficult to treat than others. Students will observe that some patients and family members are easier to communicate with than others who may be more demanding and perceived to be difficult. This could be because they have had previous bad health experiences and are angry. They could be frustrated because they have had to wait for treatment. They may be affected by drugs or alcohol or have a mental illness. When students come across such patients, they should try to remember the dangers of stereotyping or being judgemental.

It is not uncommon for specific groups to be discriminated against in a busy facility. When a patient or patient group (for example, injecting drug users) is stereotyped by the health-care team, it is crucial that students are aware of how their own prejudices or preferences may interfere with their objectivity and decision making. Indeed, more care is required in these cases, not least because personal opinions and attitudes may cloud objective clinical judgement, which may result in the wrong treatment or misdiagnosis.

Step 6: strategy and summary (S)
It is always a good idea to summarize the information discussed at the end of a consultation. Patients may ask additional questions or remember something important. If new issues come up at this last minute, set a time for another meeting.

Students should be encouraged to practise these activities as soon as they begin working with patients. Collecting a history from a patient or asking them about their main concerns is a prime opportunity to actively engage by listening, asking closed- and open-ended questions, and asking patients if they understand their condition or situation. Encouraging patients to ask questions is a first step.

Promoting patients' involvement in their own care
Patients who play active roles in the management of chronic health conditions seem to enjoy better outcomes than patients who play a more passive role in their care [15-17]. Patients and their families can be made aware of opportunities to engage in the prevention of adverse events through awareness-raising activities and education about the risks of preventable harm. They should be encouraged to speak up to providers about safety concerns.

Teaching strategies and activities

This topic can be broken up into sections to be included in existing curricula or can be taught as a stand-alone learning activity. If the topic is being taught as a stand-alone session, it can be delivered in a number of ways as listed below.

An interactive/didactic lecture 
Use the accompanying slides as a guide for covering the whole topic. PowerPoint slides can be used or converted for use with an overhead projector. Start the session with a case study and ask the students to identify some of the issues presented in the story.

Small group discussion 
One or more students could be presented with the topic and asked to lead a discussion about the areas covered in the topic. The students could follow the headings as outlined above and present the material. The tutor facilitating this session should also be familiar with

the content, so information can be added about the local health system and clinical environment.

Simulation exercises

Different scenarios could be developed concerning adverse events and the need to report and analyse errors. Role plays involving discussions between patients and student in different situations could include situations in which there is a conflict in information, situations in which the student does not have the information the patient wants or situations in which a patient complains about a student. Role plays could also be based on debriefing a student who has received a complaint.

Other teaching activities

There are a number of different methods for generating discussion about the areas in this topic. It is extremely valuable to have a patient come speak with students about his/her experiences with the health-care system, particularly as they relate to specific issues raised in this Curriculum Guide. Other teaching activities focused on specific issues discussed in this topic are outlined below.

Learning about legal and ethical issues associated with disclosure following adverse events

Most of the examples in this Curriculum Guide are from Australia, the UK and the USA. However, laws and cultural expectations regarding disclosure may vary by country.

- Look at the ethics statements of your national professional association. What does it say about disclosure? Compare this with the position of your professional colleges or associations.
- Find out about consumer representation bodies in your country.
- Look at your local media for stories of patients championing their rights.
- Invite a member of an agency that provides professional liability insurance in your field to talk about common errors and strategies to reduce them.

Learning about procedures for responding to patients' complaints. (See Topic 6).

- Invite respected senior clinicians to talk about how complaints are handled in their own practices.
- Using the case studies in this topic or real cases that have happened in your area, ask students to write a letter of apology.
- Look at one of the case histories. Work out the possible costs that one of the patients subjected to error would need to recover from an insurer or that would be placed upon his/her family. For example, loss of a job, ongoing treatments or even death.
- Informally ask health professionals what they think about patients being helped to make complaints. Rehearse the arguments with a fellow student as to why listening to the consumer's voice can be a good thing.
- Invite patients who have been involved in a complaint process to talk about their experiences.

Learning about communication and disclosure

With students working in either in pairs or small groups, have one student to take the part of one of the patients in the cases where a serious error has happened. Let the other student take the part of the doctor communicating the error. After this role-playing exercise, brief the students to see how they felt and what they learnt. Another approach would be to ask the students for examples of patient and carer engagement that they or their families have experienced. An effective teaching method involves a patient or family member who has been involved in an adverse event talking to students. Patients make very good patient safety teachers.

Learning about patient empowerment

Ask students in pairs or small groups to gather information from patients about what aspects of their care make them feel safe and, conversely, what aspects make them feel unsafe. Alternatively, pairs of students could talk to patients about ways they feel they could contribute to their own safety (e.g. checking medication). Let the students come back as a group and present their findings.

Learning about cultural competence

In small groups, ask the students to consider how health-care providers should communicate with patients from different cultural groups. Present an example of a situation in which a patient has a life-threatening illness (e.g. cancer). Discuss with students any cultural differences that might affect what the patient should be told.

Repeat the exercise in which a patient experiences an adverse event. Discuss with the students whether there are cultural differences in the way patients might react to such an event.

Activities for students in their professional placements

- Follow a patient on his/her journey through the health-care service.
- Follow the health-care provider who is consenting patients for a surgical procedure and reflect on that practice in relation to the framework for informed consent.

- Ask students to spend a day with another health professional (doctor, nurse, physiotherapist, dental therapist, social worker, pharmacist, dietician, interpreter) and explore some of the ways those particular professions engage with patients and carers.
- Ask students who interact with patients to routinely seek information about the illness or condition from the patient's perspective.
- Ask students who interact with patients to routinely ask: *What are the three things that were/are most helpful and the three things that you would change in relation to the care you received/are receiving?*
- Ask students to make inquiries of their institution or health service as to whether there are processes or teams to investigate and report on adverse events. Where possible, ask the students to seek permission from the relevant supervisor to observe or take part in these activities.
- Ask students to find out whether the institution conducts mortality and morbidity meetings or other peer-review forums in which adverse events are reviewed.
- Require students to talk among themselves about errors they have observed in the health-care facility, using a no-blame approach.
- Ask the students to inquire about a main protocol used by the staff in the treatment setting in which they are working. Have students ask how the guideline was written and how staff members know about it, know how to use it and know when to deviate from it.
- Ask students to write a reflective essay about the impact of adverse events on patients.

Case studies

Acknowledgment of a medication error

This case study describes the response to a medication error in a care facility for the elderly. (See Topic 6). → T6

Frank is a resident of an aged-care facility. One night, a nurse mistakenly gave Frank insulin, even though he does not have diabetes. The nurse immediately recognised his error and brought it the attention of the other staff, who in turn informed Frank and his family. The facility took immediate action to help Frank and arranged his transfer to a hospital where he was admitted and observed before being returned to the aged-care facility. The nurse was commended for fully and immediately disclosing the incorrect administration of the insulin. Following this incident, the nurse undertook further training to minimize the possibility of a similar error occurring in the future.

Discussion

– Ask students to read the case and discuss the benefits of honest actions of the nurse from the perspective of the patient and his family, the aged-care facility, the nurse involved and the management.

Source: Open disclosure. Case studies. Health Care Complaints Commission, 2003, 1:16–18. Sydney, New South Wales, Australia.

The importance of listening to a mother

This case illustrates the importance of treating each patient as an individual and listening to the concerns of patients and their families.

Rachel, a single mother, gave birth to her first child. He was a healthy newborn of 37 weeks gestation, weighing 2700 grams. The birth was normal and mother and baby were stable one hour after delivery. She was informed by the nurse that everything was OK with both of them.

Breastfeeding started six hours after delivery. The nurse verbally told the doctor about some difficulties with the mother's breast and that the baby looked too sleepy. The hospital rules required mothers to be discharged 36 hours after birth, so the mother was prepared for discharge.

Rachel was told by Doctor A that everything was OK and that the baby had mild jaundice that would clear up in a couple of days because there was no incompatibility between the baby's and mother's blood types. Doctor A told Rachael that breastfeeding should improve the next few days in this "healthy baby".

Another doctor (B) told her to return to the hospital in a week. While staying at home, breastfeeding difficulties continued and the baby's jaundice symptoms became more severe. Rachel was afraid and took the baby to the emergency room when he was 72 hours old. The doctor in the emergency room did not check the baby's weight, but requested a test of the baby's serum bilirubin level. The result was 13.5 mg/dl (231 µmol/l). The doctor said that this was high for a 3-day-old baby, but nothing to worry about. He advised Rachel to return in a week from that day and said, laughing: "Your baby is OK, don't worry. I know what I'm saying, I'm the doctor".

Over the next few days, the baby required breastfeeding every hour and a half and Rachel's breasts looked empty. Rachel's friends, who do not have children, told her, "If the doctor

said everything is OK, everything must be OK. Don't worry".

When the baby was 10 days old, Rachel took him to the hospital, as she had been instructed by Doctor B. By this point, his weight had decreased 20% and his bilirubin test was 35 mg/dl. During clinical examination, the baby presented clear signs of bilirubin encephalopathy.

The hospital advisory board tried to understand how this preventable situation developed.

Question

– Ask students to analyse this case. What happened and at what point? What could have been done to prevent this and when?

Unpicking the concerns of patients and their carers, even when not fully expressed verbally, is a key skill that needs to be mastered. Patients and family members can be sometimes be dismissed as over-anxious. However, we should never ignore or fail to give full consideration to parents' concerns and we should always take them and their concerns seriously. We should never make patients or their carers feel that their concerns are inappropriate.

Source: WHO Patient Safety Curriculum Guide for Medical Schools working group. Case supplied by Professor Jorge Martinez, Project Leader and Functional Analyst, Universidad Del Salvador, Buenos Aires, Argentina.

A letter from a patient

This letter presents a patient's perspective of her own hospital experience.

I'm Alice, 25 years old. I had abdominal pain for six days and I was really frightened because, a year ago, my sister came down with similar symptoms and now has intestinal cancer and is undergoing very aggressive treatment.

I decided to go alone to the hospital in order not to scare the whole family. I arrived at the hospital early in the morning. I didn't know exactly what to do or who to see; it was my first time at the hospital. Everybody looked like they were in a hurry and they did not look very friendly. Some of them looked as frightened as I was.

I took a deep breath and asked a young lady, who looked at me and smiled, if she knew where the gastrointestinal department was located. She laughed a little and said, "I'm a student and I'm lost, too. Let's try to find it together. I have to go to the same place." She said, "Why don't we go to the information office?".

I thought this was a good idea and, all of sudden I started to feel in some way protected. A person I considered to be a health-care professional was with me.

We arrived at the information office to find it crowded with a lot of people shouting, some of them angry. There was only one person providing information. Lucy, the student, said, "I don't think we will get anywhere if we try to get information here". I suggested that we follow the signs I had seen at the main entrance.

After walking through the crowd, we arrived at the main entrance. We finally arrived at the gastrointestinal department. Lucy said, "Oh, yes, this is the place, ask the nurse over there. I should go to my class, good luck.".

The nurse told me that I shouldn't have come directly to the gastrointestinal department. She said I should go to the emergency department, where they would decide about my condition. So, I had to return to the emergency room. When I arrived, plenty of people were waiting. They told me I would have to wait. "You should have come earlier," the nurse said. (I arrived early!!)

A general practitioner eventually saw me and ordered X-rays and lab tests. Nobody said anything and no explanations were provided to me. At that moment, I was more scared than when I woke up with the pain.

I was at the hospital all day, going from one place to another. At the end of the day, a doctor came and told me, in few words, that I was OK and that I had nothing to worry about, and then I started "breathing" again.

I would like to say to the hospital authorities that they should realize that every person coming to the hospital, even if they do not have any important disease, is feeling stressed and often unwell. We need friendly people taking care of us, who try to understand our story and why we feel so bad. We need clear communication between health-care workers and patients. We need clear information on how we should use the hospital facilities. I understand that you cannot cure everybody–unfortunately, you are not gods–but I am sure that you could be friendlier to patients. Doctors and nurses have the incredible power in that, with their words,

gestures and comprehension of the patient's situation, they can make a patient feel secure and relieved.

Please do not forget this power which is so incredibly useful for those human beings who enter your hospital.

With all my respect,

Alice

Discussion

– Ask students to discuss how they can address patients' anxieties.

Source: WHO Patient Safety Curriculum Guide for Medical Schools working group. Case supplied by Professor Jorge Martinez, Project Leader and Functional Analyst, Universidad Del Salvador, Buenos Aires, Argentina.

Language barrier

This case study involves a language barrier in a dentist's office. In this example, poor communication between the clinician and patient (due to a language barrier) led to emotional distress for the patient.

An 18-year-old man had gone with his mother to the dentist to get a cavity filled. The dentist diagnosed the lower right first molar as being excessively decayed and, after taking X-rays, told the patient in English that the tooth needed a root-canal treatment.

The dentist initiated the access cavity procedure to locate the exact location of the canals. Apparently, the patient was under the impression that he would have a regular cavity filled. As soon as the dentist reached the highly sensitive pulp tissue, the patient jerked in pain. The patient then started to accuse the dentist of treating him badly. The patient refused further treatment and left the dental surgery to register a formal complaint with the dental administration of the facility. It was then discovered that the patient did not speak English aside from a few words like "OK" and "thank you".

The patient and his mother continued to complain that the dentist did not effectively communicate with him, as well as not clearly explaining the procedure.

Questions

– What factors may have prevented the dentist from establishing whether the patient understood English?

– What factors prevented the patient and his mother from speaking up before the treatment began?

Source: This case study was provided by Shan Ellahi, Patient Safety Consultant, Ealing and Harrow Community Services, National Health Service, London, UK.

Giving birth at home

This case describes incorporating important family members in health-care decisions.

Marie was pregnant with her second child. Her first child was born in the local hospital without any complications. During this pregnancy, antenatal care had been provided by a midwife. All the check-ups indicated a healthy pregnancy and, at 36 weeks, Marie and her midwife discussed the birthing plan. Marie said she would like a home birth, but her husband felt a bit uncertain about it. Her midwife explained that home birth was an option as everything was OK with the pregnancy and Marie had experienced an uncomplicated birth the first time.

When Marie reached 39 weeks of pregnancy, her contractions began and she called her midwife, who visited her at home. The birth progressed quickly and within two hours she was fully dilated. When Marie started to push, the midwife heard that the baby's heart rate was dropping. She moved Marie onto her left side and asked her not to push. Within five minutes, the heart rate had improved and the head of the baby was crowning. One minute later, a healthy baby girl was born. Mother and baby were doing well in the first hours after birth.

The next day, the midwife visited Marie and her husband at home. They talked about the birth. Marie's husband said he found the midwife very experienced, but he was still shaken up by what had happened with the baby's heart rate. He had not wanted a home birth.

Questions

– How could the midwife had ensured and checked Marie was well informed about a home birth?

– How can relatives (in this example the husband) be involved in choices and decisions?

– What would have been a good way for the midwife to address the husband's concerns?

Source: Case supplied by Marianne Nieuwenhuijze, RM MPH, Head, Research Department, Midwifery Science, Faculty of Midwifery Education and Studies, Zuyd University, Maastricht, The Netherlands.

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Assessing knowledge of this topic

Details of patient safety assessment are given in the Teacher's Guide (Part A). However, a range of assessment methods are suitable for this topic including essay, multiple-choice questions, short best-answer questions, case-based discussion and self-assessment. Students can be encouraged to develop a portfolio approach to patient safety learning. The benefit of a portfolio approach is that at the end of the students' training they will have a collection of all their patient safety activities. Students will be able to use this to assist job applications and their future careers.

The assessment of knowledge about patient engagement and open disclosure can include the use of:

- portfolios;
- case-based discussion;
- an OSCE station;
- written observations about the health system (in general) and the potential for error;
- reflective statements about the role patients play in hospitals or clinics, consequences of paternalism, the role of senior clinicians in open-disclosure processes, and/or the role of patients as teachers.

The assessment can be either formative or summative; rankings can range from satisfactory/unsatisfactory to giving a mark. (See the forms in Part B, Annex 2).

It would be important to include a patient representative in the assessment team.

Evaluating the teaching of this topic

Evaluation is important in reviewing how a teaching session went and how improvements can be made. See the Teacher's Guide (Part A) for a summary of important evaluation principles.

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Slides for Topic 8: Engaging with patients and carers

Didactic lectures are not usually the best way to teach students about patient safety. If a lecture is being considered, it is a good idea to plan for student interaction and discussion during the lecture. Using a case study is one way to generate group discussion. Another way is to ask the students questions about different aspects of health care that will bring out the issues contained in this topic, such as the blame culture, the nature of error and how errors are managed in other industries.

The slides for Topic 8 are designed to help the instructor deliver the content of this topic. The slides can be adapted for the local environment and culture. Instructors do not have to use all of the slides and it is best to tailor the slides to the areas being covered in the teaching session.

Introduction to Topics 9-11

Putting knowledge into practice: infection control, invasive procedures and medication safety

The following three topics are best taught when students are training in their practice environment, such as a hospital, clinic or community setting.

Much of this Curriculum Guide will be new knowledge for students. However, unless they apply this new knowledge in the practice setting, there will be little change in the quality of the health care being provided by students and health professionals or received by patients. Students need to practise the techniques and behaviours described in this Curriculum Guide. The following three topics of infection control, invasive procedures and medication safety have been developed from a patient-safety perspective and the latest evidence-based guidelines. The topics are designed to maximize the student's ability to apply safety concepts and principles while at work in the community, hospital, clinic or other health-care setting. Before teaching one or more of these topics, it would be helpful for students to have had some exposure to the concepts presented in the earlier topics, particularly the topics on teamwork, systems thinking and errors.

Topic 4: *Being an effective team player* is essential prior learning for each of the following topics. The proper responses to the issues presented in each of these topics depend on every member of the health-care team (including students) knowing the relevance and importance of accurate and complete written and verbal communication with others, including patients and their families. Students should become familiar with techniques, such as checking, checklists, briefings, debriefings, feedback and timely hand-over/hand-off during their time with patients and their families. When students see the relevance of such techniques, they are more likely to use them.

The following three topics rely heavily upon the implementation of appropriate and authorized guidelines. As students come to understand the role of guidelines and why they are important to health care, they will understand how positive patient outcomes are dependent on all the members of the health-care team following the same treatment plans. Guidelines are designed to assist patient management using the best evidence available. Evidence-informed practice uses the best evidence available to lessen variations in practice and reduce risks to patients. There is plenty of evidence to show that the appropriate use of clinical guidelines can minimize adverse events [1, 2].

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Topic 9
Infection prevention and control

This topic acknowledges the work of WHO's First Global Patient Safety Challenge: Clean Care is Safer Care, Geneva, Switzerland.

Hepatitis C: reusing needles

This case shows how easy it is to inadvertently reuse a syringe.

Sam, a 42-year-old man, was booked for an endoscopy at a local clinic. Prior to the procedure, he was injected with sedatives. However, after several minutes, the nurse noticed that Sam seemed uncomfortable and required additional sedation. She used the same syringe, dipped it in the open sedative vial and re-injected him. The procedure continued as normal. Several months later, Sam, suffering from swelling of the liver, stomach pain, fatigue and jaundice, was diagnosed with hepatitis C.

The Centers for Disease Control and Prevention (CDC) was contacted as 84 other cases of liver disease were linked to the same clinic. It was believed that the sedative vial may have been contaminated from the backflow into the syringe and that the virus may have been passed on from the contaminated vial. Several health-care workers commented that reusing the syringe on the same patient (and thus dipping a used syringe into a common vial) was common practice.

Source: Sonner S. *CDC: syringe reuse linked to hepatitis C outbreak.* Reno, NV, The Associated Press, 16 May 2008.

Introduction–Infection control is important for patient safety

Infectious diseases are dynamic in nature and keep emerging and re-emerging from time to time. Now, due to serious illnesses like human immunodeficiency virus (HIV) and hepatitis B, C and D, the focus of infection control has changed. In the past, infection control was mainly focused on protecting patients, especially during surgery, but it is now equally important to protect health-care providers and others in the community. The spread of infection in health-care settings affects hundreds of millions of people worldwide. These infections increase patients' suffering and can prolong the length of hospital stay. Many of these infected patients suffer permanent disability and a significant number die. Increasing numbers of infections are being caused by microbes resistant to conventional treatments. Health care-associated infections (HCAIs) also increase the costs to patients and hospitals. Longer hospital stays and the need for a higher level of care can stress health systems. This alarming trend has led health-care providers, managers, institutions and governments to pay increased attention to preventing infections.

WHO [1] defines a health care-associated (also called *hospital acquired*) infection as an infection acquired in hospital by a patient who was admitted for a reason other than that infection and/or an infection [2] occurring in a patient in a hospital or other health-care facility in whom the infection was not present or incubating at the time of admission. This includes infections that are acquired in the hospital, but appear only after discharge, as well as occupational infections among health-care facility staff.

Some WHO statistics about the incidence of HCAI throughout the world are presented in the box below. Everybody, health-care professionals, patients and other community members alike, has a responsibility to decrease the opportunities for contamination of hands and equipment. In addition, medical and other health-care students need to know instrument sterilization methods and technologies to enable them to make instruments safe for use on patients. Prevention of infection must always be the priority of all health-care workers and, as such, is a key component of patient safety programmes. This topic sets out the main areas in which cross-infection occurs and identifies the activities and behaviours that would lead to the reduced incidence of HCAI if routinely practised by everyone.

Box B.9.1.

Health care-associated infection: scale and cost

- In developed countries, HCAI concerns 5-15% of hospitalized patients and can affect 9-37% of those admitted to intensive care units (ICU) [3].
- Approximately 5 million HCAIs are estimated to occur in acute care hospitals in Europe annually, resulting in 25 million extra days in hospital [3].
- In England, more than 100 000 cases of HCAI lead to over 5000 deaths directly attributed to infection each year [3].
- The estimated HCAI incidence rate in the USA was 4.5% in 2002; approximately 100.000 deaths were attributed to HCAI [3].
- There are no similar overall figures for developing countries. There is an increased risk of HCAI in developing countries. Pooled data from a limited number of studies in hospitals showed the prevalence of HCAI to be 15.5% and as high as 47.9 per 1000 patient-days in adult ICUs [4].
- The risk of surgical site infections (SSI) in developing countries is significantly higher than in the developed world. Pooled cumulative incidence of SSI was 5.6 per 100 surgical procedures, which was the leading infection in hospitals [4].
- Data from Europe show that HCAI represents an economic burden of 13–24 billion Euros annually [3]
- The annual economic cost of HCAI in the USA in 2004 was approximately US$ 6.5 billion [3].

Keywords
Infection prevention and control, hand hygiene, transmission, cross-infection, health care-associated infection (HCAI), antimicrobial resistance (AMR), multidrug-resistant organisms, MRSA (methicillin-resistant *Staphylococcus aureus*) infection, aseptic technique, standard precautions.

Learning objective

Demonstrate the devastating effects of inadequate infection prevention and control in health-care settings to show students how they as individual members of the health-care team can help minimize the risks of contamination and infection to improve patient safety.

Learning outcomes: knowledge and performance

Infection prevention and control is the application of microbiology in clinical practice and its success relies on a sound theoretical knowledge of the microbiology underpinning safe clinical practices and prudent antimicrobial prescribing.

Knowledge requirements

Students need to know:

- the extent of the problem;
- the main causes and types of HCAI;
- the modes of infection transmission in health-care settings;
- the main principles and methods for HCAI prevention and control.

Performance requirements

Students need to:

- apply standard precautions;
- ensure adherence to other infection prevention and control measures as required;
- apply principles of asepsis;
- be immunized against hepatitis B;
- use and dispose of protective clothing and equipment appropriately;
- know what to do if exposed to blood or other bodily fluids;
- use and dispose of sharps properly;
- act as a role model for other health-care staff;
- educate community members as to how they can help to prevent infections;
- encourage others to use standard precautions to prevent and control HCAI;
- understand the potential social, economic and emotional burden of HCAI on patients, and act accordingly;
- be able to discuss HCAI with patients and relatives with sensitivity and clarity.

The extent of the problem

The urgency

As described earlier, HCAI is a major threat to patient safety worldwide, the impact of which can be felt by families, societies and health systems. HCAI rates remain high despite an increase in awareness and actions to reduce these infections. These infections are most often caused by different types of bacteria, including those that cause tuberculosis, or fungi and viruses (e.g. HIV, hepatitis B). The increased rate of HCAI observed in developing and developed countries over the past 20 years has thrown up new challenges for modern health care. Today, antibiotics are often ineffective and more than 70% of bacterial HCAIs are resistant to at least one of the drugs commonly used to treat them. A number of AMR organisms found in hospital settings, such as MRSA and vancomycin-resistant *Enterococcus* (VRE), are extremely difficult to treat. This means that a large group of infected patients stay in hospitals longer and are treated with less effective drugs that are more toxic and/or more expensive. Some of these infected individuals do not recover and others develop long-term complications because of the wrong choice of treatment or delays in starting the correct treatment. The overall burden of all of these aspects of the problem is not fully known, but is definitely very high.

Multidrug-resistant tuberculosis (TB) is a significant problem because the standard drugs that have been used to treat this disease are no longer effective. HCAIs are a problem in primary and community settings.

Practical solutions are available. There are several practices that should be used to avoid contamination, eliminate microorganisms from equipment and the environment, and prevent cross-transmission. The use of several of these methods together is required for effective prevention and control of HCAI. However, increasingly complex health-care interventions make infection control a challenge.

Health-care professionals have to be vigilant in applying a range of preventive methods to control a variety of pathogens in all health-care environments, not just hospitals. When students work on the wards, visit a clinic or make a home visit, they are as capable of transmitting an infection as all other health-care workers. AMR organisms do not discriminate and while they are mainly found in acute-care settings, these microbes may emerge or be transmitted in any setting in which patients are treated.

The link between hand hygiene and the spread of disease was established about 200 years ago. Several lines of evidence have shown that hand hygiene is a simple and effective method that can contribute to reducing HCAI.

The economic burden

The costs associated with caring for and treating patients suffering from HCAI are significant and add substantially to the health-care budgets of all countries, as well as the economic burden borne by patients and families. The annual economic impact of HCAI in the USA was approximately US$ 6.5 billion in 2004 [5]. Costs associated with catheter-related bloodstream infections (CR-BSI), surgical site infections and ventilator associated pneumonia were estimated to be usually above US$ 5500 per episode. CR-BSI caused by MRSA may cost as much as US$ 38 000 per episode [6]. Studies also show that for every UK£ 1 spent on alcohol-based hand rub, UK£ 9–20 could be saved on teicoplanin expenditure [7]. These costs can represent a significant percentage of these countries' total health budgets and, again, are likely to be higher in developing countries [4].

The global response

Recognizing this worldwide crisis, WHO established the campaign *SAVE LIVES: Clean Your Hands* to address high HCAI rates globally. The primary focus of this campaign is on improving hand hygiene in all types of health-care facilities worldwide through the implementation of the recommendations presented in the *WHO Guidelines on Hand Hygiene in Health Care* [1]. Several other materials offering practical guidance have also been developed by WHO to facilitate the implementation of the different recommendations.

The United States CDC is conducting a campaign to prevent AMR. This campaign is aimed at preventing the development of AMR in health-care settings through the use of a range of strategies for preventing infection, diagnosing and treating infection, using antimicrobials wisely, and preventing the transmission of infections. This campaign is targeted at clinicians who treat particular patient groups, such as hospitalized adults, dialysis patients, surgical patients, hospitalized children and long-term care patients [8].

The Institute of Healthcare Improvement (IHI) campaign, *5 Million Lives* [9], aimed to reduce

MRSA infections through the implementation of five key intervention strategies:

1. hand hygiene;
2. decontamination of the treatment environment and equipment;
3. active surveillance of cultures;
4. contact precautions for infected and colonized patients;
5. compliance with protocols for appropriate use of central venous catheters and ventilator bundles.

As of June 2011, 124 countries had signed a statement with WHO, pledging to address HCAI [10], and 43 national and sub-national hand hygiene campaigns in different countries had initiated actions to incorporate HCAI prevention measures into their national and hospital-level campaigns [11].

Precautions

A set of *universal precautions* or universal blood and body fluid precautions were published by the CDC to protect health-care workers from occupational exposure to HIV. This set of precautions was designed to prevent transmission of HIV, hepatitis B virus (HBV), and other bloodborne pathogens during the administration of first aid or health care. Under universal precautions, blood and certain bodily fluids of all patients are considered as potentially infectious for HIV, HBV and other bloodborne diseases [12]. These precautions include the use of personal protective equipment (PPE), such as gloves, mask, gown and eyewear appropriate for the anticipated risk, and hand hygiene, as well as precautions to avoid needle-stick injuries to both patients and health-care workers.

Recent recommendations include two levels of precautions–standard and transmission-based precautions.

Standard precautions

Standard precautions are intended to be applied to the care of all patients in all health-care settings, regardless of the suspected or confirmed presence of an infectious agent. These precautions constitute the primary strategy for infection prevention. They are based on the principle that all blood and other bodily fluids, secretions and excretions, excluding perspiration, may contain transmissible infectious agents. These precautions include: hand hygiene; the use of gloves, a gown, a mask, eye protection or a face shield, depending on the anticipated exposure; and safe injection practices. Also, equipment or items in the patient environment likely to have been contaminated with infectious bodily fluids must be handled appropriately to prevent transmission of infectious agents. Respiratory hygiene/cough etiquette (described later in this topic) could also be part of the set of standard precautions.

Transmission-based precautions

Transmission-based precautions should be used when treating patients who are known or suspected to be infected or colonized with infectious agents. In these situations, additional control measures are necessary to effectively prevent transmission. Since the infecting agent often is not known at the time of admission to a health-care facility, these precautions are applied according to the clinical syndrome and the likely etiologic agents, and then modified based on test results. There are three categories of transmission-based precautions: contact precautions; droplet precautions; and airborne precautions. These different precautions are discussed in more detail later in this topic.

Health care-associated infections–causes of infection and transmission routes

HCAIs are caused by bacteria, viruses and fungi. These may come from human or environmental sources. Human sources of infectious agents include patients, health-care workers and visitors. Individuals who have active infections, asymptomatic infections, are in the incubation period of an infection, or are colonized with certain types of microorganisms can all act as sources of HCAI. Endogenous flora of patients can also cause HCAIs. Environmental sources include contaminated food, water or medications (e.g. IV fluids). These usually cause outbreaks, as opposed to infecting only a few individuals.

For an infection to take place, infectious microorganisms need to be transferred from a source to an entry site on a susceptible host, where they are able to multiply and either colonize or cause disease.

Microorganisms can be transmitted in many different ways in health-care settings. Some examples are listed below:

Transmission through direct contact

Person-to-person transmission can occur when microbes present in blood or other bodily fluids of a patient enter a health-care worker (or vice versa) through contact with a mucous membrane or breaks (cuts, abrasions) in the skin.

Indirect transmission

Infections can be transmitted indirectly through

devices such as thermometers, other inadequately decontaminated equipment, medical devices or toys, which health-care workers pass from one patient to another. This is probably the most common mode of transmission in health-care settings.

Droplet transmission
Respiratory droplets carrying infectious pathogens are generated when an infected person coughs, sneezes or talks, as well as during procedures such as suctioning and endotracheal intubation. These droplets travel directly from the respiratory tract of the infected individual to susceptible mucosal surfaces of the recipient, over short distances. Facial masks can prevent droplet transmission.

Airborne transmission
Airborne transmission of infectious diseases occurs through the dissemination of either airborne droplet nuclei (particles arising from desiccation of suspended droplets) or small particles in the respirable-size range containing infectious agents that remain infective over time and distance (e.g. spores of *Aspergillus* spp. and *Mycobacterium tuberculosis*). These may be dispersed over long distances by air currents and may be inhaled by individuals who have not had direct contact with the source.

Percutaneous exposure
Percutaneous exposure occurs through contaminated sharps.

Patient populations who are particularly susceptible to health care-associated infection
Patients particularly vulnerable to colonization and infection include those with severe underlying medical disease, recent surgery or indwelling devices, such as urinary catheters or endotracheal tubes.

The following four types of infections account for about 80% of all HCAI: urinary tract infections, usually associated with catheters; surgical site infections; bloodstream infections associated with the use of an intravascular device; and pneumonia associated with ventilators. Catheter-associated urinary tract infections are the most frequent, accounting for about 36% of all HCAIs [13]. Surgical site infections are second in frequency, accounting for about 20% of all HCAIs. Bloodstream infections associated with the use of an intravascular device and pneumonia associated with ventilators each account for an additional 11% of HCAIs.

Evidence shows that infection rates can be reduced if health-care workers comply with infection prevention and control guidelines and patients leave hospital as soon as possible. Many HCAI patients (about 25%) are in ICUs and more than 70% of the infections in these patients are due to microorganisms resistant to one or more antibiotics [13].

Preventing health care-associated infection–five priority training areas for students
Over the course of their training, students will work in many environments in which there is a risk of transmission of infection. Students should approach every situation as having the potential to lead to the infection of a patient or health-care workers, including themselves. This means that students will need to routinely undertake activities to prevent infection, such as using correct hand hygiene techniques, using PPE (e.g. gloves and gowns) appropriately, ensuring that instruments and devices have undergone recommended sterilization procedures, and adhering to policies and recommendations to prevent infections in specific situations, including the use of proper aseptic technique and practising safe waste management, especially concerning the disposal of sharps.

Priority areas in which all health-care workers, including students, need to take action are described below.

Environmental cleanliness
Environmental cleanliness in the hospital is essential for minimizing infections. Health-care facilities should be visibly clean. Increased cleaning is essential when there are outbreaks in which environmental sources play a role. The choice of cleaning and disinfecting agent will depend on many factors and each facility should have existing policies and procedures on these issues. Students should familiarize themselves with procedures for cleaning up spills and contamination with vomit, urine, etc. Students should seek advice and information about the different disinfectants and their application from pharmacists or other appropriate professionals.

Sterilization/disinfection of equipment, devices and instruments
Equipment, devices and instruments must be properly sterilized/disinfected, strictly following recommendations. Students need to know the basic principles regarding these procedures and also how to verify whether these recommendations have been followed for items they use for patient care.

Medical devices labelled "for single use"
Devices labelled "for single use" are designed by manufacturers with the intention that they will not be re-used. For example, single-use injection syringes should never be re-used because the risk of infection is very high. Field data from developing countries revealed that the re-use of injection syringes/needles is a major source of HIV and hepatitis infection [14].

Injections are the most common health-care procedure worldwide and students need to know that the single use of injection devices is critical for patient care. Sterile, single-use injection devices include sterile hypodermic syringes, sterile hypodermic needles, auto-disable syringes for immunization purpose, syringes with a re-use prevention feature for general purpose, and syringes with needlestick prevention features (e.g. safety syringes) for general purposes. Students should familiarize themselves with the regulations and recommendations on single-use injection devices promoted by WHO [14,15].

Hand hygiene 

Everyone working in health care, whether in a hospital, clinic or patient's home, needs to be aware of hand hygiene. Hand hygiene is the single most important intervention that every health-care worker can practise to prevent HCAI. Health-care workers should advise patients and their families of the importance of hand hygiene and give them permission to remind the staff. At the same time, staff and students should not feel threatened when a patient or family member asks or reminds them about hand hygiene.

What students need to know about hand hygiene
Students need to know:
- the rationale for performing hand hygiene;
- indications for hand hygiene according to WHO recommendations;
- methods for performing hand hygiene in different situations;
- techniques for hand hygiene;
- how to protect hands from adverse effects;
- how to promote adherence to hand hygiene recommendations and guidelines.

Institutions should provide alcohol-based hand rubs at the bedside. Alcohol-based rubs rapidly kill pathogens and have few side-effects for the staff. However, when hands are visibly soiled, hand rubbing is not a substitute for washing hands with soap and water. For this reason, infrastructures for handwashing should also be easily accessible.

Why should one practise hand hygiene?
Many studies have confirmed that pathogens implicated in HCAI can be isolated from the normal intact skin of hands. These can be microbes present on the skin as resident flora, which live long term under the superficial cells of the epidermis. More commonly, they are part of the transient flora on the skin surfaces, which include bacteria, viruses and fungi that are acquired through direct skin contact or contact with contaminated environmental surfaces. These microorganisms can be easily transmitted from the hands of health-care workers to patients or their environment. These microorganisms can also be removed from the skin if adequate hand hygiene is practised. There is evidence to show that hand hygiene can break the chain of transmission of pathogens in health-care settings and can reduce the incidence of HCAI, as well as colonization rates.

When should one perform hand hygiene?
The purpose of hand hygiene is to prevent colonization and infection of patients and health-care workers, as well as contamination of the environment. Therefore, an indication for hand hygiene arises every time that there is a possibility of microorganism transfer from one skin or inanimate surface to another surface.

To easily identify moments when hand hygiene should be performed, WHO has developed the *My 5 Moments for Hand Hygiene* model [16]. These moments are:
1. before touching a patient;
2. before a clean/aseptic procedure;
3. after bodily fluid exposure risk;
4. after touching a patient;
5. after touching patient surroundings.

Hand rubbing or hand washing?
Hand rubbing with an alcohol-based hand rub is the preferred method in most routine clinical situations. This is because alcohol acts more quickly than soaps to inactivate microorganisms, its effect lasts longer, and the cleaning procedure takes less time to perform. On repeated use, as is required in health-care settings, adverse effects, such as drying and scaling, are less severe if correct formulations of hand rubs are used, as compared to repeated hand washing with soap and water. Another advantage is that hand rubbing is more easily done at the point of care since it is not dependent on the availability of clean water, soap and towels. However, there are specific situations in which hand washing is recommended.

WHO Guidelines on Hand Hygiene in Health Care

The recommendations in the *WHO Guidelines on Hand Hygiene in Health Care* [2] are as follows: Before routine clinical work begins, remove all wrist and hand jewellery and cover cuts and abrasions with waterproof dressings. Fingernails should be kept short and false nails should not be worn.

Wash hands with soap and water whenever they are visibly dirty or visibly soiled with blood or other bodily fluids and after using the toilet. When exposure to potential spore-forming pathogens is strongly suspected or proven, including during outbreaks of *Clostridium difficile*, hand washing with soap and water is the preferred method.

Use an alcohol-based hand rub as the preferred means for routine hand antisepsis when hands are not visibly soiled. If an alcohol-based hand rub is not available, wash hands with soap and water.

Promoting best practices is everyone's business. Students are encouraged to refer to the *WHO Guidelines on Hand Hygiene in Health Care*, especially the consensus recommendations found on pages 152–154, and to incorporate these guidelines into their daily practice and encourage others to do the same.

Hand hygiene techniques

Adherence to recommended techniques, such as the volume of product to be used, hand surfaces to clean and duration of hand washing and hand rubbing, is important for effectiveness. Soap and alcohol-based rubs are not recommended for concomitant use.

Hand rubbing

Apply a palmful of alcohol-based hand rub and cover all surfaces of the hands. Rub hands until dry. Illustrations of this technique are available in the WHO-published brochure *Hand hygiene: why, how and when*, which is also available online [17].

Hand washing

Wet hands with water and apply the amount of product necessary to cover all surfaces. Rinse hands with water and dry thoroughly with a single-use towel. Avoid using hot water, as repeated exposure to hot water may increase the risk of dermatitis. Use a towel to turn off the tap/faucet. Illustrations of this technique are available in the WHO-published brochure *Hand hygiene: why, how and when* [17].

Because wet hands can readily acquire and spread microorganisms, proper drying of hands is essential. Make sure towels are not used multiple times or by multiple people. Care must be taken to avoid recontamination of hands while drying and turning off the tap/faucet. Liquid, bar, leaf or powdered soaps are acceptable. When bar soap is used, small bars of soap and racks that facilitate drainage should be used to allow the bars to dry.

How to protect skin

Hands with cracks and areas of roughness caused by dryness are an open gateway for bacteria to enter the body. Irritation and dryness related to hand hygiene can be reduced by selecting a product that contains humectants and has proven to be well-tolerated by health-care workers. The need and use of moisturizing skin care products for hand dermatitis can vary according to health-care settings, countries, and climatic conditions. Certain practices, such as donning gloves when hands are wet or using alcohol-based hand rub on wet hands, can increase the likelihood of irritation [18].

The use of personal protective equipment

Personal protective equipment (PPE) includes gowns, gloves, aprons, eye protection, shoe covers and face masks. The use of PPE is usually based on an assessment of the risk of the transmission of a microorganism from a patient to a caregiver and vice versa. Student uniforms should be clean with attention to personal hygiene.

Gloves

Gloves are now an everyday part of clinical practice and are an important component of the set of standard precautions. The types of gloves include**:** surgical gloves; single-use examination gloves; utility; or heavy-duty household gloves.

Appropriate glove use is essential as inappropriate use undermines all efforts to sustain hand hygiene. Patients are at risk of infection if gloves are not changed between tasks or patients. (WHO guidelines for glove use are presented in Table B.9.1.)

There are two main indications for wearing gloves in the clinical setting: to protect hands from contamination with organic matter and microorganisms and to reduce the risk of transmitting infectious microorganisms to patients, staff and others.

Wearing gloves does not replace the need for hand hygiene. Gloves are not free from defects and sometimes leak. Studies show that even when gloves are worn, hands may become contaminated. If a glove tears, is damaged in any way or leaks, the student should remove the gloves, perform hand hygiene and then put on new gloves. Gloves must be discarded appropriately (into the correct waste stream) after each task and the hands should then be cleansed. This is because gloves are made to be used only once and can carry microorganisms on their surface, like hands.

Health-care professionals need to assess whether gloves are needed in a given situation. Gloves must be worn for invasive procedures, contact requiring sterile conditions, and contact with non-intact skin or mucous membranes, as well as activities in which there is a risk of exposure to blood, bodily fluids, secretions and excretions (except for perspiration), and/or which involve handling sharps or contaminated instruments. Gloves should be worn only once and should be put on immediately before the care activity, removed immediately afterwards and changed between patients and episodes of care. Gloves must be disposed of as clinical waste and hand hygiene must be performed after gloves are removed.

Gloves may be recommended in other situations as well. For example, contact with patients who are known to be colonized or infected with pathogens transmitted through direct physical contact (e.g. VRE, MRSA) may require gloves. Students should be aware that such infection-specific recommendations exist and new recommendations can be made based on changes in the existing situation.

Different types of gloves are available. Sterile gloves are required for invasive procedures and for any other task that requires sterile conditions. For most other procedures, examination gloves may suffice. Utility or heavy-duty gloves should be worn when dealing with sharps, processing instruments and when handling certain contaminated waste.

Table B.9.1. WHO guidelines for the use of gloves

Sterile gloves indicated	Any surgical procedure; vaginal delivery; invasive radiological procedures; vascular access and procedures (central lines); preparation of total parenteral nutrition and chemotherapeutic agents.
Clean gloves indicated	Potential for touching blood, bodily fluids, secretions, excretions and items visibly soiled by bodily fluids. *Direct patient exposure*: contact with blood; contact with mucous membrane and non-intact skin; potential presence of a highly infectious and dangerous organism; epidemic or emergency situations; IV insertion and removal; drawing blood; discontinuation of a venous line; pelvic and vaginal examinations; suctioning non-closed systems of endotracheal tubes. *Indirect patient exposure*: emptying emesis basins; handling/cleaning instruments; handling waste; cleaning up spills of body fluids.
Gloves not indicated (except for contact precautions)	*Direct patient exposure*: taking blood pressure, temperature and pulse; performing subcutaneous and intramuscular injections; bathing and dressing a patient; transporting a patient; caring for eyes and ears (without secretions); any vascular line manipulation in absence of blood leakage. *Indirect patient exposure*: using the telephone; writing in the patient chart; giving oral medications; distributing or collecting patient dietary trays; removing and replacing linen for a patient's bed; placing non-invasive ventilation equipment and oxygen cannula; moving patient furniture. No potential for exposure to blood or bodily fluids, or contaminated environment. Gloves must be worn according to standard and contact precautions. Hand hygiene should be performed when appropriate, regardless of indications for glove use.

Source: *Glove use information leaflet*. World Health Organization, 2009 [20].

The WHO Glove Use Information Leaflet recommends the following behaviours for glove use [19]:

- The use of gloves does not replace the need for hand hygiene by either hand rubbing or hand washing.
- Wear gloves when it can be reasonably anticipated that contact with blood or other potentially infectious materials, mucous membranes, or non-intact skin will occur.
- Remove gloves after caring for a patient. Do not wear the same pair of gloves for the care of more than one patient.
- When wearing gloves, change or remove gloves during patient care if moving from a contaminated body site to either another body site (including non-intact skin, mucous membrane or medical device) within the same patient or the environment.
- The reuse of gloves is not recommended. In the case of glove reuse, implement the safest reprocessing method.

Gowns and face masks

These can be part of standard and transmission-based precautions and protect the health-care worker's otherwise exposed body areas. Gowns prevent contamination of clothing with blood, bodily fluids and other potentially infectious material. The need for and type of gown is based on the nature of the patient interaction and the potential for blood and body fluid penetration. Students should be guided on this aspect by the existing policies in their work setting and by their clinical instructors. Local policies should always be adhered to.

Guidelines suggest that health-care professionals and students should:

- wear disposable plastic aprons when in close contact with patients, material or equipment, or when there is a risk that clothing may become contaminated;
- dispose of plastic aprons after each episode of care or procedure. Non-disposable protective clothing should be sent for laundering;
- wear full-body, fluid-repellent gowns when there is a risk of extensive splashing of blood, bodily fluids, secretions or excretions, with the exception of perspiration (e.g. trauma, operating theatres, obstetrics). In situations in which the splashing of blood or fluid is likely or expected (e.g. in a labour room during delivery), shoe covers should also be worn;
- face masks and eye protection should be worn when there is a risk of blood, bodily fluids, secretions and/or excretions splashing into the face and eyes.

Steps in respiratory hygiene/cough etiquette

Anyone with signs and symptoms of a respiratory infection, regardless of the cause, should follow or be instructed to follow respiratory hygiene/cough etiquette as follows:

- cover the nose/mouth when coughing or sneezing;
- use tissues to contain respiratory secretions;
- dispose of tissues in the nearest waste receptacle after use;
- if no tissues are available, cough or sneeze into the inner elbow rather than the hand;
- practise hand hygiene after contact with respiratory secretions and contaminated objects/materials.

The safe use and disposal of sharps 

Students should be aware of the significant problem of needle-stick injuries among health-care workers. Needle-stick injuries are as prevalent as injuries from falls and exposure to hazardous substances. Many health-care workers continue to be infected by bloodborne viruses, even though these infections can be largely prevented through the use of the following practices:

- keep handling of sharps to a minimum;
- do not recap, bend or break needles after use;
- discard each needle directly into a sharps' container (puncture-proof box) at the point of use immediately after use. (*Always take a sharps' bin to the patient to assist this.*);
- do not overload a sharps' bin if full;
- do not leave a sharps' bin where children can reach it;
- needles collected from patients should be placed in a sharps' container inside a safe box to minimize the risk to community pharmacists;
- always report injuries from needles in line with local policy.

The person using the sharp must be responsible for disposing of it safely. These safety measures are repeated below in the checklist for standard precautions.

Tuberculosis (TB)

TB can spread within health-care facilities. This disease is spread by coughing, sneezing, talking or spitting, which send the TB bacilli into the air. People then breathe in these bacilli. Some people will not develop an infection because their immune system is able to keep the pathogen dormant. When the immune system fails a person, the disease can become active and the infected person then becomes infectious. Students should apply standard precautions at all times. These precautions are described later in this topic. If TB is a major

problem in your country, it would be appropriate to cover additional information about the prevalence of TB in your country and strategies for containing the spread of TB during health care. The WHO web site presents numerous reports that describe the prevalence of TB and the devastating effects and suffering caused by this disease.

The use of effective sterilization procedures
The United States CDC advises that "in general, reusable medical devices or patient-care equipment that enters normally sterile tissue or the vascular system or through which blood flows should be sterilized before each use".

Sterilization means the use of a physical or chemical procedure to destroy all microbial life, including highly-resistant bacterial endospores. Health-care students should know how to use diverse instrument sterilization methods and technologies to enable them to make instruments safe for use on patients [21].

Prophylactic antibiotics
Students will observe that some patients of doctors and dentists are given prophylactic antibiotics when they are to have a surgical or dental procedure. The use of appropriate antibiotics is known to prevent surgical or dental postoperative infections, but unless the antibiotics are given correctly they can also create harm. Antibiotics that are given at the wrong time, given too often, or not given enough or inappropriately, occur in a percentage of cases. Incorrect or prolonged courses of prophylactic antibiotics puts all patients at even greater health risks due to the development of antibiotic-resistant pathogens.

What students need to do

Students have a responsibility to make every effort to minimize the spread of infection and to encourage patients and other health-care workers to actively engage in practices that minimize the spread of infection both in the community and in hospitals and clinics.

Students need to:
- practise standard precautions, including hand hygiene;
- be immunized against hepatitis B;
- know what to do if they have a sharps' injury or are exposed to blood or bodily fluids, or have other exposure to a potential pathogen;
- take appropriate precautions when they themselves are ill to avoid infecting patients and/or contaminating the working environment;
- act as role models for good clinical practice and patient safety and encourage others to use appropriate precautions;
- be proficient in the use of diverse instrument sterilization methods and technologies.

Practise standard precautions, including hand hygiene
In order to practise standard precautions, students must not be at risk themselves. Therefore, to perform hand hygiene when required, it is important that they report and seek treatment for any skin conditions, particularly those affecting the hands. Hand hygiene, either hand washing or the use of alcohol-based rubs, cannot be undertaken if certain skin conditions (e.g. dermatitis or eczema) are present, and this places both the health-care worker and patients at risk of infection. Gloves are not a substitute in these circumstances and any student with any such skin condition should be referred to the occupational health department for treatment and remain on non-patient contact duties until the condition is resolved.

Hand hygiene before touching a patient
This is important to protect the patient against harmful microorganisms carried on the hands. Students can acquire microorganisms from touching contaminated surfaces, other patients or friends.

Hand hygiene before a clean/aseptic procedure
It is essential that students practise hand hygiene immediately before performing any clean/aseptic task, including preparing sterile medications. This is necessary to prevent harmful microorganisms, including the patient's own resident microorganisms, from entering the patient's body. Students must protect against transmission through contact with mucous membranes, such as oral/dental care, giving eye drops and secretion aspiration. Any contact with non-intact skin, including skin lesion care, wound dressing and any type of injection, is an opportunity for transmission. Contact with devices, such as inserting a catheter or opening a vascular access system or a drainage system, must be done with careful preparation, because these devices are well-known for harbouring potentially harmful microorganisms. Students should also be diligent about hand hygiene when preparing food, medications and dressings.

Some students will inevitably come into contact with mucous membranes and non-intact skin. Understanding the risks involved will help students to practise safe health care. They may

also have contact with devices or clinical samples, for example, drawing or manipulating any fluid sample, opening a draining system, inserting or removing an endotracheal tube or suctioning.

Hand hygiene after bodily fluid exposure risk
Students should habitually cleanse their hands immediately after any exposure risk to bodily fluids and after removing a pair of gloves. This is essential to limit the chance of the student becoming infected. It is also necessary for the maintenance of a safe health-care environment. Cases of transmission have been to know to occur even with gloving.

At times, students may be required to clean up a patient's urine, faeces or vomit. Students may find themselves handling waste (bandages, sanitary napkins, incontinence pads) or cleaning contaminated and visibly-soiled material or areas (lavatories, instruments). They need to be particularly aware of the importance of cleansing hands immediately after such activities, as well as the importance of appropriate waste-disposal methods.

Hand hygiene after touching a patient
All students should practise hand hygiene after touching a patient. Activities that involve direct physical contact, in addition to those mentioned above, include helping a patient to move around or get washed and giving a massage. Clinical examinations, such as taking a patient's pulse or blood pressure, chest auscultation and abdominal palpation, are all opportunities for the transmission of infectious microorganisms.

Hand hygiene after touching patient surroundings
Microorganisms are also known to survive on inanimate objects. For this reason, it is important to cleanse hands after touching any object or piece of furniture in the patient's immediate surroundings when leaving that patient, even if the patient was not touched. Students may find themselves helping other staff, changing bed linen, adjusting perfusion speed, monitoring an alarm, holding a bed rail or moving objects on a bedside table for a patient. After any of these tasks, hands must be cleansed.

Forgetting to practise hand hygiene can lead to patients becoming colonized and infected, to students becoming colonized and infected, and to the increased likelihood of microorganisms spreading throughout the environment.

Personal protection methods
Students should:
- follow guidelines for and seek training in the use of personal protection procedures and equipment;
- use gloves when in contact with bodily fluids, non-intact skin and mucous membranes;
- wear a face mask, eye protection, shoe covers and a gown if there is the potential for blood or other bodily fluids to splash;
- let the appropriate people know if supplies of PPE/materials are running low;
- model their practice on that of respected and safe senior health-care providers;
- regularly perform self-assessments of their own use of PPE and note whether there has been any inappropriate use;
- cover all cuts and abrasions;
- always clean up spills of blood and other bodily fluids following recommendations for the same;
- be aware of how their health-care practice setting's waste-management system works.

Be immunized against hepatitis B
Students, like all health-care workers, are at risk of becoming infected with bloodborne viruses. The risk of infection to both staff and patients depends on the prevalence of the disease in the patient population and the nature of the frequencies of exposure. Students should be immunized as soon as they start seeing patients in institutions, clinics or community settings, including patients' homes, and have a post-vaccination test, if possible.

Know what to do if you are exposed
If a student is inadvertently exposed to or becomes infected with a bloodborne pathogen, that student should immediately notify the appropriate staff in the practice setting, as well as a supervisor. It is important that students receive appropriate medical attention as soon as possible.

Know what to do if you are symptomatic with nausea, vomiting or diarrhoea
Students must report incidents of diarrhoea and vomiting, particularly if they themselves are affected. Outbreaks of diarrhoea and vomiting (norovirus) are common in hospitals and can be perpetuated by affected staff working while they have symptoms. Students must be aware that if they have symptoms, they can pass the infection on to vulnerable patients and other staff and, therefore, should not be working. Students must comply with local policies.

Adhere to other infection prevention and control measures as required
Students should ensure that the instruments and devices that they use are appropriately sterilized/disinfected. They should also make sure that guidelines for specific procedures are followed, for example, while inserting a urinary catheter.

Encourage others to participate in infection control 

Students can encourage others to use correct hand hygiene techniques by doing so themselves. Students can be role models and leaders in this area. Sometimes people only need to be reminded to be jolted out of a false sense of security.

Students can also teach patients about the importance of clean hands as they will often have more time with patients than their fully qualified colleagues. This is also a good opportunity to practise educating patients about health care and infection prevention and control. Students may also have the opportunity to educate other community members (e.g. patients' relatives and visitors) about how they can help to prevent and control infection through proper hand hygiene.

Influencing the behaviour of health-care professionals
Students may find themselves working in an environment in which health-care professionals do not follow institutional or professional guidelines for infection prevention and control. They may even observe senior staff not cleansing their hands or failing to maintain sterile environments. It can be very difficult for students to speak up on such occasions. Culturally, it may be difficult for a junior member of staff to challenge a more senior staff member. However, this can be done in a sensitive manner. Students can speak to their local infection prevention teams or senior staff in infection prevention for advice.

Students may observe staff members who fail to cleanse their hands
How a student deals with this situation will depend on the relationship of the student to those staff members, the culture of the particular health-care setting and the culture of the surrounding society. It may be helpful to explore and understand possible reasons for the omission. It could be that a health-care worker was so busy that he/she inadvertently forgot to wash his/her hands. If the student knows the person to be very attentive generally, then it may be appropriate to raise the issue with that person or assist them by handing them the alcohol-based hand rub or other cleanser in use.

Students may observe staff members who ignore correct infection control procedures
Students may wish to ask the supervisor or team leader to put the issue of infection prevention and control on the agenda for discussion. Alternatively, they could ask the department head whether an expert could come and talk to the staff to help ensure that everyone is aware of the infection control guidelines.

Summary 

In order to minimize the incidence of HCAI:
- know the main guidelines each of the clinical environments in which you are working;
- accept responsibility for minimizing opportunities for infection transmission;
- apply standard and transmission-based precautions;
- let staff know if supplies are inadequate or depleted;
- educate patients and their families/visitors about clean hands and infection transmission.

Some of these actions, such as alerting staff to shortage of supplies, may be difficult to implement in settings where funds may not be available and supplies are generally in short supply. Some hospital policies may also exclude providing PPE to students when they are practising in a hospital. In these cases, students should seek advice from their supervisors.

Teaching strategies and formats
This topic can be delivered in a number of ways, but the best way to teach this material is to have the students practise infection prevention and control techniques in a simulated environment.

Simulation exercises 
Different scenarios could be written to emphasize the educational components of infection prevention and control. For example, students attending the Israel Center for Medical Simulation practise washing their hands and their hands are then covered with a special blue gel and put under an ultraviolet light. This light reveals the areas that were missed when the hands were washed. Students are surprised at how much surface area they miss.

Different scenarios could be developed to emphasize the educational components of infection prevention and control. For example,

students could practise techniques of assertiveness in different situations, such as:

- patient–professional interactions in which the professional fails to perform hand hygiene;
- student–patient interactions in which the student fails to perform hand hygiene;
- student–supervisor interactions in which the supervisor fails to perform hand hygiene.

For each of these scenarios, students can role play using a person approach and then a systems approach in response to a breach of infection protocols. (These approaches are described in detail in Topic 3). → T3

An interactive/didactic lecture

Use the accompanying slides as a guide covering the whole topic. The slides can be in a PowerPoint format or converted for use with an overhead projector. Start the session with a case study selected from the *Case Study Bank* and have the students identify some of the issues presented in the case study.

Panel discussions

Invite a panel of respected professionals to present a summary of their efforts to minimize the transmission of infection. Students could have a pre-prepared list of questions about the prevention and management of infections.

Problem-based learning

Several aspects of this topic can be developed to suit a problem-based learning approach. For example, a patient who has developed surgical site infection could be used as the presenting trigger.

Small group discussion

The class can be divided up into small groups and three students in each group can then be asked to lead a discussion about the causes and types of infection. Another student in the group could focus on the reasons why some health-care facilities promote hand hygiene more than others.

The tutor facilitating this session should also be familiar with the content, so that information can be added about the local health system and practice environment.

Other teaching activities

This topic offers many opportunities for integrated activities during the time that students are assigned to a particular practice setting. These activities can start from the very first years in the practice environment.

– Students could visit a patient who became infected as a result of his/her dental or health-care experience. They could talk with the patient about the impact of the infection on his/her health and well-being. The meeting would not be to discuss how or why the patient was infected, but rather to discuss the impact of the infection.

– Students could attend an infection prevention and control meeting and observe and record what activities are undertaken by the team to ensure that everyone complies with the infection control guidelines.

– Students could observe a team treating patients who are known to have HCAIs.

– Students could follow a patient through the perioperative process and observe the activities aimed at minimizing the transmission of infection.

– Students could examine and critique the protocol used for infection prevention and control for a specific procedure, including observations of a team's knowledge of and adherence to the protocol.

– Pharmacy students could also meet with patients as part of their clinical pharmacy practical lectures.

– After these activities, students should be asked to meet in pairs or small groups and discuss with a tutor or clinician what they observed, whether the features or techniques being taught were present or absent, and whether they were effective.

Case studies

Bloody cuffs

This case illustrates the importance of adhering to infection control guidelines. It also illustrates why people should always adopt procedures that assume the possibility of disease transmission.

Jack, 28 years, and Sarah, 24 years, were involved in a severe motor vehicle collision in which Jack's car slammed into a cement pillar. They were brought into the emergency department with Jack suffering massive injuries and Sarah with severe cuts to her upper body from the shattered glass of the car. Jack was bleeding profusely when he was placed in the trauma bay. His blood pressure was taken and the cuff (made of nylon and fabric) became completely saturated with

blood, so much so that it could not be wrung out. He was taken to surgery, but later died.

Sarah, with cuts to her upper body, was placed in the same trauma bay where Jack had been treated. The same unwashed, blood-saturated cuff that was used on Jack was placed on her arm.

One nurse noted that the blood-soaked cuff had been used on both patients. However, other staff members shrugged off the incident.

A letter from the medical examiner, received weeks later, revealed that Jack was HIV- and HBV-positive and that the crash had been a suicide.

Discussion

– Use the case study to prompt a discussion about the implications of this incident and identify the processes that could have prevented the reuse of the blood pressure cuff.

Source: Agency for Healthcare, Research and Quality. Web M&M: mortality and morbidity rounds on the web (http://www.webmm.ahrq.gov/caseArchive.aspxa; accessed 3 March 2011).

A failure to check a child's intravenous drip site

This case illustrates the ramifications that health care-associated infection can have on patients.

A father brought his two-year-old daughter, Chloe, into the emergency department of a regional hospital on a Friday evening. Chloe had a recent history of a "chest cold" and had already been seen as an outpatient. The medical officer admitted Chloe for treatment of pneumonia. An IV cannula was inserted in her left upper foot and a bandage applied. Chloe was admitted to the unit and was under the care of nursing staff, a general practitioner and a visiting medical officer over the weekend.

The IV cannula site was not inspected until early on Sunday evening (nearly 48 hours later), despite the fact that damage to the skin is a known risk factor in infants that can occur within 8 to 12 hours. There was an area of necrosis noted on the left heel and ulcers developed later on the left upper foot. After discharge and outpatient treatment, Chloe was eventually admitted to a major children's hospital where she required ongoing treatment. She also developed behavioural problems as a result of her experience.

Discussion

– Use the case study to prompt a discussion about cannula site infections and how such infections may be minimized.

Source: Case studies–investigations. Sydney, New South Wales, Australia, Health Care Complaints Commission Annual Report 1999–2000: 59.

Tools and resource material

Hand hygiene

WHO Guidelines on Hand Hygiene in Health Care: a summary. Geneva, World Health Organization, 2009 (http://whqlibdoc.who.int/hq/2009/WHO_IER_PSP_2009.07_eng.pdf; accessed 21 February 2011).

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Infection prevention and control

Clean care is safer care: tools and resources. Geneva, World Health Organization, 2010 (http://www.who.int/gpsc/5may/tools/en/index.html; accessed 21 February 2011).

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Surgical infections

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Tools. Surgical site infections. Boston, MA, Institute for Healthcare Improvement, 2006 (http://www.ihi.org/IHI/Topics/PatientSafety/SurgicalSiteInfections/Tools/; accessed 21 February 2011).

National strategy

National strategy to address health care-associated infections operational template. Australian Commission on Safety and Quality in Health Care, June 2005 (www.health.gov.au/internet/safety/publishing.../addprecautionsjun05.pdf; accessed 21 February 2011).

Additional resources

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Pratt RJ et al. Epic 2: national evidence-based guidelines for preventing health care-associated infections in NHS hospitals in England. *Journal of Hospital Infection*, 2007, 65 (Suppl.):S1–S64.

Burke JP. Patient safety: infection control, a problem for patient safety. *New England Journal of Medicine*, 2003, 348:651–656.

Assessing knowledge of this topic

Students' knowledge concerning infection control can be assessed using any of the following methods:

- portfolio;
- case-based discussion;
- an OSCE station;
- written observations about how a health-care facility practises infection prevention and control;
- MCQ, essay and/or short best answer (SBA) questions;
- observation of the following:
  - student performing hand hygiene using the WHO Guidelines (7 steps);
  - student donning gloves for single use examination;
  - student donning gloves for sterile technique (for surgical procedures).

Students' knowledge could also be assessed by asking them to write reflective statements about how a health-care facility educates staff about infection prevention and control, how the hierarchy in the workplace influences infection prevention and control practices, the systems in place for reporting breaches of infection prevention and control policies, the role of patients in minimizing the transmission of infection, and/or the effectiveness of infection prevention and control guidelines.

The assessment can be either formative or summative; rankings can range from satisfactory/unsatisfactory to giving a mark. (See the forms in Part B, Annex 2).

Evaluating the teaching of this topic

Evaluation is important in reviewing how a teaching session went and how improvements can be made. See the Teacher's Guide (Part A) for a summary of important evaluation principles.

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Slides for Topic 9: Infection prevention and control

Didactic lectures are not usually the best way to teach students about patient safety. If a lecture is being considered, it is a good idea to plan for student interaction and discussion during the lecture. Using a case study is one way to generate group discussion. Another way is to ask the students questions about different aspects of health care that will bring out the issues contained in this topic, such as blame culture, the nature of errors and how errors are managed in other industries.

The slides for Topic 9 are designed to assist the teacher in delivering the content of this topic. The slides can be adapted to fit the local environment and culture. Teachers do not have to use all of the slides and it is best to tailor the slides to the areas being covered in the teaching session.

Topic 10
Patient safety and invasive procedures

Arthroscopy performed on wrong knee

Brian injured his left knee while exercising and was referred by his local doctor to an orthopaedic surgeon. The orthopaedic surgeon obtained consent to perform an examination of the left knee under anaesthetic as a day surgery procedure. As part of the ordinary preoperative process, two registered nurses confirmed that his signature appeared on the consent form for an elective examination on his left knee.

The surgeon talked to Brian before he entered the operating theatre, but did not confirm which knee was to be operated on. Brian was taken into the operating theatre and anaesthetised. The anaesthetic nurse saw a tourniquet draped over his right leg and applied it. She and another staff member applied a bandage to limit blood flow. The enrolled nurse checked the intended side on the theatre list so that she could set up. When she saw the orthopaedic surgeon preparing the right leg, she told him that she thought the other leg was the intended operative site. The doctor was heard by both the enrolled nurse and scrub nurse to disagree and the right (incorrect) knee was operated on.

Source: Case studies–professional standards committees. *Health Care Complaints Commission Annual Report* 1999–2000:64. Sydney, New South Wales, Australia.

Introduction–Patient safety and invasive procedures

Over 230 million major operations are carried out worldwide every year [1]. Evidence suggests that in 0.4–0.8% of these cases, people die as a direct consequence of the surgical procedure and patients experience complications following 3–16% of these procedures. This equates to 1 million deaths and a further 6 million disabilities each year worldwide [2–5]. This is not because surgeons, proceduralists or health-care professionals are careless or incompetent; rather it is because there are many opportunities for things to go wrong in the course of the many steps involved in such procedures. Additionally, problems caused by surgical site infections account for a significant proportion of all HCAIs. This topic will help students understand how patient safety principles can assist in minimizing adverse events associated with invasive procedures. There are many validated tools now available to assist health-care teams in delivering safe surgical care. These include the WHO Surgical Safety Checklist, which is currently being rolled out worldwide [6]. Apart from nursing and medical students there may not be many opportunities for other health professional students to implement many of these steps to improve surgical outcomes during their training programmes. Nonetheless, they can observe how health professionals communicate with one another and what techniques they use to make sure they are treating the right person with the right treatment or performing the procedure on the correct body part. They may also observe what happens when health-care professionals appear not to follow a protocol.

Keywords
Surgical and procedural site infections, surgical/procedural errors, guidelines, communication failures, verification processes, teamwork.

Learning objectives 
To understand the main causes of adverse events in surgical and invasive procedural care and how the use of guidelines, verification processes and teamwork can facilitate the correct patient receiving the correct treatment at the appropriate time and place.

Although the principles described in this topic are important for both surgical and other invasive procedures, most of the evidence in the literature relates to surgical care.

Learning outcomes: knowledge and performance

Knowledge requirements 
Students need to know the main types of adverse events associated with invasive procedures and be familiar with verification processes that can be used to improve surgical and invasive procedures' care.

Performance requirements 
Students should demonstrate their ability to:
- follow verification processes to avoid wrong patient, wrong side and wrong procedure errors (e.g. a surgical checklist);
- practise techniques that reduce risks and errors (e.g. time-outs, briefings, debriefings, stating concerns);
- participate in an educational process for reviewing mortality and morbidity;
- actively engage as a team member;
- actively engage with the patient at all times.

Causes of adverse events associated the surgical and other invasive procedures 

Students need to know the main types of adverse events associated with surgical and invasive procedural care. The traditional way of explaining adverse events associated with surgery and other invasive procedures is usually related to the skills of the surgeon or person performing the procedure and the age and physical condition of the patient. Vincent et al. [4] argued that adverse surgical (and other procedural) outcomes are associated with many other factors, such as the design of the workplace and its interface with the people who work there, teamwork and organizational culture. Students can learnt about the use of a systems approach in Topic 3, as well as the competencies described in the topics on teamwork and infection control, all of which are particularly relevant to this topic. → T3

Safe surgery requires effective team work–this means that the doctors, nurses and other staff all have clearly defined roles and responsibilities and that each member of the team knows the roles of other members of the team.

A systems approach to surgical and procedural adverse events requires us to examine both latent factors, such as teamwork and inadequate leadership, and sharp-end factors (the point of care), such as communication during hand-offs and poor history taking. (See Topic 4). → T4

The three main causes of adverse events in procedural care are described below.

Poor infection control

The Harvard Medical Practice Study II [5] found that surgical wound infections constituted the second-largest category of adverse events and confirmed the long-held belief that hospital-based *Staphylococcal* infections constituted a great risk for hospitalized patients, particularly those receiving surgical care. The implementation of better infection control practices, such as the appropriate administration of prophylactic antibiotics, has reduced the incidence of postoperative infections. In addition, efforts to raise awareness of and attention paid to the risks of transmission show health-care workers how they can minimize the risks of cross-infection.

Everyone has a responsibility to decrease the opportunities for the contamination of clothing, hands and equipment that has been associated with the transmission of pathogens. (Infection control is discussed in more detail in Topic 9). → T9

During their training, many students will be present during an operation or invasive procedure or be near patients who are vulnerable to infection. They must comply at all times with infection control guidelines and practise standard precautions. Effective teams encourage all members of the team, irrespective of their profession or their level of experience, to be responsible for safe practice; they do this by giving permission to individual members to speak up if there are concerns about safety–even when they may be the most junior member of the team.

Inadequate patient management

The operating room and environment involve

intensely complex activities involving a range of health professionals and should always include the patient when conscious. This may explain why more adverse events are associated with surgical departments than with other hospital departments.

The main adverse events associated with surgical care include infections and postoperative sepsis, cardiovascular complications, respiratory complications and thromboembolic complications. When these events have been analysed, a range of pre-existing conditions (latent factors) have been identified. Latent factors include:

- inadequate implementation of protocols or guidelines;
- poor leadership;
- poor teamwork;
- conflict between different departments/groups within the organization;
- inadequate training and preparation of staff;
- inadequate resources;
- lack of evidence-based practice;
- poor work culture;
- overwork;
- lack of a system for managing performance.

In addition to latent factors, individuals working at the sharp end (point of delivery) of perioperative care are prone to the following types of errors known to cause adverse events:

- failure to take precautions to prevent accidental injury;
- avoidable delays in treatment;
- failure to take adequate history or physical examination;
- failure to employ indicated tests;
- failure to act upon the results of findings or tests;
- practising outside an area of expertise (e.g. failure to consult, refer, seek assistance, transfer);
- communication failures.

Communication failures include situations where information is provided too late to be effective, information is inconsistent or inaccurate, and key people do not receive the necessary information, as well as situations in which there are unresolved issues in the team. Including the patient as part of the team is essential; health-care professionals should constantly be sharing and checking information with them where possible. In addition, students need to check that each of their patients understands what they are having by asking them to repeat back to the health-care professionals the information provided.

Failure of health-care providers to communicate effectively before, during and after procedures

Miscommunication is one of the biggest problems in the operating environment. Miscommunication has been responsible for the wrong patients having surgery, patients having operations on the wrong side or site, and the wrong procedure being performed. Failure to communicate changes in the patient's condition and failure to administer prophylactic antibiotics have also resulted in adverse events. In addition, disagreements about stopping procedures and incidents in which errors were not properly reported have been documented.

In the operating theatre, health professionals are often required to deal with many competing tasks. A surgical team comprising doctors and nurses is viewed by most trainees and students as a very busy team. In addition to high workloads, the perioperative environment is characterized by staff with varying levels of experience and abilities. This combination of factors can seriously affect the team's ability to communicate accurately and timely. Communication problems occur at all stages. But they are particularly problematic when they occur as patients are being transferred from one phase of care to another. An additional layer of complexity is added when a patient suffers an adverse event during a procedure or treatment. It is important not to forget about the patient's need to be fully informed about what has occurred and how the patient will be cared for. A patient may need to talk about the experience. In the aftermath of an adverse event, staff may be reluctant to sit and listen to such a patient, but it is important they do so. There is more on the impact of adverse events in Topic 8: *Engaging with patients and carers*.

Many countries now collect data about the wrong patient receiving an invasive procedure. It has been established that one of the best ways to reduce misidentification errors is to use best-practice guidelines for ensuring that the correct patient receives the correct treatment. The evidence convincingly demonstrates that when health-care professionals follow endorsed guidelines and are familiar with the underlying principles supporting a uniform approach to treating and caring for patients, patient outcomes significantly improve.

The complexity of the surgical environment is a major factor underpinning communication errors and these errors occur at all levels. A study by Lingard et al. [7] described different types of communication failures concerning doctors.

In this study, 36% of communication failures resulted in a visible effect, such as team tension, inefficiency, wasted resources, procedural error and inconvenience to patients. (Examples of different types of communication failures are presented in Table B.10.1).

Table B.10.1.
Types of communication failure associated with doctors: illustrative examples and notes

Type of Failure	Definition	Illustrative example and analytical note (*in italics*)
Occasion	Problems in the situation or context of the communication event	The staff surgeon asks the anaesthesiologist whether antibiotics have been administered. At this point, the procedure has been under way for over an hour. *Since antibiotics are optimally given within 30 minutes of incision, the timing of this enquiry is ineffective both as a prompt and as a safety redundancy measure.*
Content	Insufficiency or inaccuracy apparent in the information being transferred	As they are preparing for the procedure, the anaesthesia fellow asks the staff surgeon if an ICU bed has been reserved for the patient. The staff surgeon replies that the "bed is probably not needed, and there is not likely one available anyway, so we'll just go ahead". *Relevant information is missing and questions are left unresolved: has an ICU bed been requested, and what will the plan be if the patient does need critical care and an ICU bed is not available? (Note: his example was classified as both a content and a purpose failure.)*
Audience	Gaps in the composition of the group engaged in the communication	The nurses and the anaesthesiologist discuss how the patient should be positioned for surgery without the participation of a surgical representative. *Surgeons have particular positioning needs, so they should be participants in this discussion. Decisions made in the absence of the surgeon may lead to the need for repositioning.*
Purpose	Communication events in which purpose is unclear, not achieved or inappropriate	During a living donor liver resection, two nurses discuss whether ice is needed in the basin they are preparing for the liver. Neither knows. No further discussion ensues. *The purpose of this communication–to find out whether ice is required–is not achieved. No plan to achieve it is articulated.*

Source: Lingard L et al. Communication failures in the operating room: an observational classification of recurrent types and effects. *Quality & Safety in Health Care,* 2004 [7].

Verification processes for improving surgical care: guidelines, protocols and checklists

Effective methods for improving patient care include the implementation of evidence-based guidelines, protocols or checklists. Although all three of these tools assist the health professional in managing most conditions, there are subtle differences between them. A guideline gives recommendations about a certain topic, whereas a protocol is a set of sequential steps that should be followed in a particular order, enabling the task to be completed. The purpose of a checklist is to make sure certain mandatory items are not forgotten. These evidence-based tools are often developed by groups of multidisciplinary experts using the latest evidence and may be endorsed at a national or international level.

Good guidelines are easily disseminated and designed to influence professional practice on a broad scale. Good guidelines share a number of characteristics. Guidelines define the most important questions relating to practice in

a particular field and attempt to identify all possible decision options and the known consequences of those decisions. They identify each decision point followed by the respective courses of action according to the reasoning, judgement and experience of the health professionals. Such guidelines are based on values that encourage identifying the least invasive/risky intervention that is appropriate under the circumstances and allowing for and respecting patient choice when there are choices (i.e. the patient is a partner in the decision making process). Guidelines should be reviewed and revised as necessary, or at least every three years.

The extent of variation in the practice of health care has been identified as a major problem by the Institute of Medicine (IOM) [8]. Variation caused by overuse, underuse and misuse of health care can be addressed by evidence-based practice, which uses the best evidence available with the goal of lessening variation and reducing risks to patients. Health professionals working in hospitals and clinics do not have the time, resources or the available expertise to each produce their own set of guidelines. Instead, clinicians are encouraged to adopt already established guidelines and then modify them to suit their own practice and their local environment.

Guidelines are necessary because the complexity of health care and the level of specialization, together with the range of health professionals involved, have made personal opinion or professional and organizational subjective preferences redundant and unsafe. There are now hundreds of validated guidelines to help health professionals practise safely, preventing wrong site, wrong procedure and wrong person treatment, as well as procedural site infections.

Students are not always told about the guidelines that are used in a particular area of care. Nonetheless, they should be aware that, in many areas of practice, particularly those associated with the management of chronic illness, there are established guidelines that identify the best way(s) to treat patients. Guidelines may not be accessible to the team that is required to use them; the team may not even be aware of them. It is not unusual for a health-care organization to publish a guideline, but not ensure that everyone knows about it. Sometimes, with so many guidelines to follow, people tune out and do not see the relevance or importance of them. Training students to be aware of the importance of using appropriate guidelines is a first step toward their asking about and then using them. The most effective guidelines take into account the local environment and profile of patients and their recommendations can be easily adapted to fit the local workplace. Evidence-based guidelines exist for most procedures that involve significant risks, such as the use of safe blood products. The failure to use safe blood products or the failure to ensure that the patient receives the right blood can be catastrophic for patients.

Safe care requires that all team members know what is expected of them when they are to implement a guideline. The guidelines, protocols or checklists need to be accessible. (Are they on paper or are they online?) They also need to be applicable to the workplace in which they are to be used. (Do they acknowledge the differences in resources and the readily available health professionals?) For a tool to be effective, the staff must know about it, trust it, be able to access it easily and be able to implement it.

For various reasons having to do with resources, local conditions and types of patients, some steps in a particular verification process may be impractical or inappropriate in a particular situation. In such cases, the multidisciplinary team may need to adapt the tool to fit the environment or circumstances. When this occurs, everyone needs to know about the changes so they can apply them.

If a tool is not followed consistently by the entire team or if people routinely skip steps, the tool will not protect patients from adverse events. It is important that everybody, including students, abide by the tool. Commitment by the leader and the whole team is necessary for the successful implementation of a guideline, protocol or checklist.

Some clinicians may question the value of a verification process, particularly when they believer that their professional autonomy is being compromised and questioned. They may also feel their discretion is being removed when a team approach is introduced. Sharing knowledge and information and being open to input from other team members is absolutely necessary for continuity of care, safe decision making, and achieving the best outcomes for the patients.

A ground-breaking global study was carried out in 2007/2008, looking at the effects of a simple surgical checklist in eight different countries. Independent of the resource setting, it was found that postoperative complications and death were

reduced by more than one third when the checklist was used [9]. Central to the success of checklists is improved communication to ensure that the correct person is having the correct procedure in the correct place and that the procedure is being performed by the correct health-care team.

A quick review of the processes involved in surgery shows the many steps requiring active face-to-face conversations, particularly for consent and marking and/or identifying the appropriate drugs and equipment to be used. The operating team–surgeons, assistants, anaesthetists, scrub nurses, circulating nurses (scout nurses), respiratory therapists, midwives (as applicable) and others in the operating room–all have to know the nature of the planned procedure, so that everyone is aware of the management plans, the expectations of the different team members and anticipated outcomes for the patient. For this reason, scheduled "pauses" that take place in the operating room where the procedure will be performed just before the procedure is scheduled to begin are integral to the surgical checklist [6].

Safe surgery requires that every member of the surgical team know the main checklist(s) or protocol(s) used in an area of practice. If no verification process is in place, then a member of the team could request a discussion at a team meeting about whether a protocol or checklist could be used.

There is universal agreement that the best approach to minimizing errors caused by misidentification of patients is the implementation of best-practice tools for ensuring the correct patient receives the correct treatment. A number of protocols and checklists have been developed to address this issue.

Box B.10.1. WHO: Safe Surgery Saves Lives

Ten essential objectives for safe surgery	
Objective 1:	The team will operate on the correct patient at the correct site.
Objective 2:	The team will use methods known to prevent harm from anaesthetic administration, while protecting the patient from pain.
Objective 3:	The team will recognize and effectively prepare for life-threatening loss of airway or respiratory function.
Objective 4:	The team will recognize and effectively prepare for risk of high blood loss.
Objective 5:	The team will avoid inducing an allergic or adverse drug reaction known to be a significant risk to the patient.
Objective 6:	The team will consistently use methods known to minimize risk of surgical site infection.
Objective 7:	The team will prevent inadvertent retention of sponges or instruments in surgical wounds.
Objective 8:	The team will secure and accurately identify all surgical specimens.
Objective 9:	The team will effectively communicate and exchange critical patient information for the safe conduct of the operation.
Objective 10:	Hospitals and public health systems will establish routine surveillance of surgical capacity, volume and results.

Source: *WHO Guidelines for Safe Surgery*, 2009 http://www.who.int/patientsafety/safesurgery/tools_resources/en/index.html [10].

Figure B.10.1. WHO: Surgical Safety Checklist

Surgical Safety Checklist

World Health Organization | Patient Safety
A World Alliance for Safer Health Care

Before induction of anaesthesia →	Before skin incision →	Before patient leaves operating room
(with at least nurse and anaesthetist)	(with nurse, anaesthetist and surgeon)	(with nurse, anaesthetist and surgeon)
Has the patient confirmed his/her identity, site, procedure, and consent? ☐ Yes	☐ Confirm all team members have introduced themselves by name and role	**Nurse Verbally Confirms** ☐ The name of the procedure
Is the site marked? ☐ Yes ☐ Not applicable	☐ Confirm the patient´s name, procedure, and where the incision will be made.	☐ Completion of instrument, sponge and needle counts
Is the anaesthesia machine and medication check complete? ☐ Yes	Has antibiotic prophylaxis been given within the last 60 minutes? ☐ Yes ☐ Not applicable	☐ Specimen labelling (read specimen labels aloud, including patient name)
Is the pulse oximeter on the patient and functioning? ☐ Yes	Anticipated Critical Events **To Surgeon:** ☐ What are the critical or non-routine steps?	☐ Whether there are any equipment problems to be addressed
Does the paient have a: Known allergy? ☐ No ☐ Yes	☐ How long will the case take? ☐ What is the anticipated blood loss?	**To Surgeon, Anaesthetist and Nurse** ☐ What are the key concerns for recovery and management of this patient?
Difficult airway or aspiration risk? ☐ No ☐ Yes, and equipment/assistance available	**To Anaesthetist:** ☐ Are there any patient-specific concerns?	
Risk of >500ml blood loss (7ml/kg in children)? ☐ No ☐ Yes, and two IVs/central access and fluids planned	**To Nursing Team:** ☐ Has sterility (including indicator results) been confirmed? ☐ Are there equipment issues or any concerns?	
	Is essential emaging displayed?: ☐ Yes ☐ Not applicable	

This checklist is not intended to be comprehensive. Additions and modifications to fit local practice are encouraged.

Revised 1/2009 ©WHO, 2009

Source: *WHO Safe Surgery Saves Lives*, 2006 http://www.who.int/patientsafety/safesurgery/en/index.html [6].

What students need to do

Follow a verification process to eliminate wrong patient, wrong site and wrong procedure incidents

Students in some fields will have an opportunity to visit operating rooms and observe how surgical teams work together. They will also observe how the team manages processes before, during and after surgery. During a surgical rotation or other appropriate term, students should:

- locate the main protocols and checklists used in a particular surgical or treatment unit;
- share and check information with the patient or their carer;
- understand how the protocols/checklists in use were developed and know whether they align with evidence-based practice;

- understand why the protocol/checklist is necessary;
- be able to identify the steps in the verification process, including selection of the correct patient, correct site and correct procedure;
- be able to identify the steps in the WHO Surgical Safety Checklist;
- know the role of every member of the team;
- identify how conflicts are resolved within the team. (See Topic 4). → T4

Practise operating room techniques that reduce risks and errors (time-outs/pauses, briefings, debriefings, stating concerns) 7

Topic 4 on teamwork provides a detailed analysis of how effective teams work together and the actions that team members can take to effectively contribute to improved performance and safety. In the surgical environment, particular attributes and actions are known to improve teamwork. If students are not able to directly participate in team activities, then they can at least observe how the team functions. Students should actively try to become part of the team. They can respectfully ask the leader of the team if they can be a part of the team even if they do not have any specific function or role. Being included allows the students to better see and hear how the team members communicate with one another. If possible, students should practise participating in team briefings and debriefings. During these meetings, students should observe and record how health-care professionals participate in the processes designed to keep the patient safe. For example, do they use checklists?

Students should evaluate their own contributions to team discussions about the status of the patient, including identity, site of surgery, condition of the patient and plans for recovery.

Students need to learn how to appropriately share information. It is very important that all information that relates to the assessment and treatment of the patient be shared verbally with all members of the health-care team. Students should know the main characteristics of the procedure and plans for managing the patient's care, including relevant protocols.

Students should actively question members of the team in an appropriate and respectful manner, including making an assessment about timing and when it is appropriate to ask uestions. Students should participate in and take the opportunity to ask questions when the team meets to go over the planned procedure. If the student thinks something is not right, he/she should raise the matter with a senior instructor or supervisor at the time.

It is important that students learn to speak up and assert themselves appropriately. Students should be able to express an opinion or ask for an opinion from any member of the team through questions or statements of opinion during critical periods. Students should understand that assertion does *not* include routine statements or questions about a patient's heart rate, tone, colour, and respirations (these form part of information sharing or inquiry). Students should learn how to "speak up the chain of command" when they become practitioners, particularly if a patient might be harmed through a potential error. For example, a nurse may feel intimidated about reminding a surgeon to check something (e.g. whether the correct patient is having the scheduled procedure). If the surgeon dismisses the nurse's reminder, the health-care organization should support the nurse as he/she speaks up the chain of command.

Students should practise sharing information about intentions with team members and seek feedback before deviating from the norm. This is important because it alerts the rest of the team about planned actions that are not routine.

Students should be aware that teaching is an integral part of surgical care. Teaching can be in a variety of formats–short or informal information exchanges, as well as guided hands-on learning by doing. Students should be prepared to learn from each of the different team members. Students should also appreciate that tasks are distributed among team members according to professional expertise, level of knowledge and skill.

Participate in an educational process for reviewing mortality and morbidity 8

Health-care students should ask their health-care facility if there is a peer-review system for discussing cases so that lessons can be learnt and shared. Many hospitals will have surgical review meetings, often called *mortality and morbidity meetings*. These are well-established forums for discussing incidents and difficult cases and are the main peer-review method for improving future patient care. Such meetings usually provide a confidential forum for auditing surgical complications and are necessary for improving practice in a surgical department. These meetings may be held weekly, fortnightly or monthly and provide a good opportunity for

learning about errors in surgery. Because patient safety is a relatively new discipline, many of these meetings have yet to adopt a blame-free systems approach for discussing errors. Instead, some remain focused on the person who made an error and use a punitive approach to discussing adverse events. When meetings adopt a person approach to discussions about errors, they are often closed to other members of the operating team, such as junior doctors, nurses, respiratory technologists and students, and only include surgeons.

Notwithstanding the potential blame element, mortality and morbidity meetings are excellent places to learn about errors and discuss ways to prevent them in the future. Students should find out whether the health-care facility in which they are training has such meetings and ask the appropriate senior professional if they can attend as an observer. If this is possible, students should observe to see whether the following basic patient safety principles are demonstrated:

- is the meeting structured so that the underlying issues and factors associated with the adverse event are the focus of discussion, rather then the individuals involved?
- is there an emphasis on education and understanding, rather than apportioning blame to individuals?
- is the goal of the discussion the prevention of similar events occurring in the future? This requires a timely discussion of the event when memories are still fresh;
- are these meetings considered a core activity for the entire surgical team, including technicians and managers, as well as clinicians (medical, nursing, pharmacy, allied health)?
- does everyone who had any involvement with the incident/area have the ability to attend these meetings?
- are juniors, including students, encouraged to attend and participate? These sessions provide an excellent opportunity for students to learn about errors and the processes for improving particular treatments and procedures;
- are all deaths involving a surgical procedure at the facility identified and discussed?
- is a written summary of the discussions kept, including any recommendations made for improvement or review?

Summary

This topic outlines the value of guidelines in reducing errors and minimizing adverse events. But a guideline is only useful if the people using it trust it and understand why its use leads to better patient care. Protocols can prevent the wrong patient from receiving the wrong treatment, as well as facilitate better communication among team members, including the patient.

Teaching strategies and formats

An interactive/didactic lecture

Use the accompanying slides as a guide for covering the whole topic. PowerPoint slides can be used or slides can be converted for use with an overhead projector. Start the session with one of the case studies and have the students to identify some of the issues presented in that case.

Panel discussions

Invite a panel of appropriate health professionals for the area of professional practice to give a summary of their efforts to improve patient safety and talk about their roles and responsibilities. This can help students appreciate the role of teamwork in procedures. Students could also have a pre-prepared list of questions about preventing and managing adverse events, with time scheduled for their questions.

Small group discussion

The class can be divided up into small groups and three students in each group be asked to lead a discussion about one category of adverse events associated with procedures. Another student can focus on the tools and techniques available to minimize opportunities for errors and another could look at the role of mortality and morbidity meetings. Holding these sessions with students of various disciplines adds an important real life perspective and assists each profession in understanding and respecting the others.

The tutor facilitating this session should also be familiar with the content so that information can be added about the local health system and clinical environment.

Simulation exercises

Different scenarios could be developed concerning adverse events in particular treatments and procedures, such as the wrong patient receiving the treatment or the wrong route being proposed for administering a medication, and the techniques for minimizing the opportunities for errors. These could mainly involve junior staff having to speak up to more senior staff, allied health or nursing staff speaking up to a physician to avert an incident, or a pharmacist speaking to a senior doctor or nurse.

Different scenarios could be developed for the students. Students could practise briefing, debriefing and assertiveness to improve communication in theatres using a formalized system of imparting relevant patient information (such as ISBAR) in urgent situations, such as transfers. Role play is also a valuable tool. Students could role play mortality and morbidity meetings using a person approach and then a systems approach, or a situation in an operating theatre in which a student notices something is wrong and needs to speak up.

Operating theatre and ward activities

This topic offers many opportunities for integrated activities during the time when students have opportunities to observe procedures being performed. This will often be in the later part of their training programme. Nevertheless, there is no reason why students could not be exposed to these activities from their very first year of study. Students could:

- attend a procedure and observe and record the activities undertaken by the team to ensure that the patient being operated on or having the procedure is the correct patient and that he/she is having the correct procedure performed at the correct time;
- observe a surgical or procedural team, identifying the team members, how they function, and how they interact with each other and with the patient;
- attend a mortality and morbidity meeting and write a brief report describing whether basic patient safety principles were applied during the meeting, taking a systems approach rather than a blaming approach;
- follow a patient through the perioperative process and observe the activities or tasks that focused on the patient's safety;
- examine and critique the protocol/checklist used for the patient verification process, including observations of the team's knowledge of the protocol/checklist and adherence to it;
- observe how patient information is communicated from the wards to the operating rooms and back to the wards.

After these activities, students should be asked to meet in pairs or small groups and discuss with a tutor or health professional what they observed and whether the features or techniques being observed were present or absent, and whether they were effective. Doing this with an interdisciplinary group of students has added benefit for learning about the roles of each profession and gaining respect for the other professions.

Case studies

A routine operation resulting in an adverse event

The case illustrates the risks of anaesthetics.

A 37-year-old woman in good health was scheduled for non-emergency sinus surgery under general anaesthesia. The consultant anaesthetist had 16 years of experience, the ear, nose and throat surgeon had 30 years experience, and three of the four theatre nurses were also very experienced. The operating room was very well equipped.

Anaesthesia was induced at 08:35, but it was not possible to insert the laryngeal mask airway. Two minutes later, the patient's oxygenation began to deteriorate and she looked cyanosed (was turning blue). Her oxygen saturation at this time was 75% (anything less than 90% is significantly low) and her heart rate was raised.

By 08:39, her oxygen saturation had deteriorated to 40% (a very low level). Attempts to ventilate the lungs with 100% oxygen using a face mask and oral airway proved extremely difficult. The anaesthetist, who was joined by a consultant colleague, tried unsuccessfully to achieve tracheal intubation to overcome the problems with the airway. By 08:45, there was still no airway access and the situation had become "cannot intubate, cannot ventilate", a recognized emergency in anaesthetic practice for which guidelines are available. The nurses present appeared to have recognized the severity of the situation; one brought a tracheotomy tray and another went to arrange a bed in the ICU.

The doctors' intubation attempts continued using different laryngoscopes, but these were also unsuccessful and the procedure was abandoned with the patient transferred to the recovery room. Her oxygen saturation had remained at less than 40% for 20 minutes. Despite being subsequently transferred to ICU, she never regained consciousness and died 13 days later as a result of severe brain damage.

Questions

– What techniques might be available to the team prior to the patient being given a general anaesthetic?

– What are the benefits of checklists?

Source: Bromiley M. Have you ever made a mistake? Bulletin of the Royal College of Anaesthetists, 2008, 48:2442–2445. DVD available from the Clinical

Human Factors Group web site (www.chfg.org; accessed 21 February 2011).

Wrong kidney removed despite a student's warning

This case demonstrates the importance of using a protocol to ensure correct patient, correct site and correct procedure. It also demonstrates the important principle of "speaking up the chain of command". There needs to be agreement that any member of a team is important when it comes to safety, even students.

A male patient aged 69 years was admitted for removal of his chronically diseased right kidney (nephrectomy). Due to a clerical error, the admission slip stated "left". The operating list was transcribed from the admission slips.
The patient was not woken from sleep to check the correct side on the preoperative ward round. The side was not checked with the notes or the consent form. The error was compounded in the operating theatre when the patient was positioned for a left nephrectomy and the consultant surgeon put the correctly labelled X-rays on the viewing box back to front.
The senior registrar surgeon began to remove the left kidney.

A medical student observing the operation suggested to the surgeon that he was removing the wrong kidney, but was ignored. The mistake was not discovered until two hours after the operation when the patient had not produced any urine. He later died.

Questions

– Identify the opportunities for checking the site of surgery.

– Why do you think the surgeon ignored the medical student?

– Discuss whether the surgeon's actions were a violation or a system error.

Source: Dyer O. Doctor suspended for removing wrong kidney. British Medical Journal, 2004, 328, 246.

A failure to administer preoperative antibiotic prophylaxis in a timely manner according to protocol

This case illustrates the importance of preplanning and checking prior to a procedure and how the use of protocols can minimize the risk of infection.

An anaesthetist and surgeon were discussing the preoperative antibiotics required for the laparoscopic cholecystectomy that was about to begin. The anaesthetist informed the surgeon of the patient's allergy to penicillin and the surgeon suggested an alternative preoperative antibiotic. The anaesthetist went into the sterile corridor to retrieve the antibiotics, but returned and explained to the circulating nurse that he could not find any suitable antibiotics in the sterile corridor. The circulating nurse got on the phone to request the preoperative antibiotics.
The anaesthetist explained that he could not order them because there were no order forms (he looked through a file folder of forms).
The circulating nurse confirmed that the requested antibiotics were on their way.

The surgical incision was performed. Six minutes later, the antibiotics were delivered to the operating room and immediately injected into the patient. This injection happened after the time of incision, which was counter to protocol that requires antibiotics to be administered prior to the surgical incision in order to avoid surgical site infections. Subsequently, a nurse raised her concern, which led to a change in operative planning.

Questions

– What factors may have existed that contributed to the delay in administering the antibiotics?

– What could the team do to avoid this happening again?

Source: WHO Patient Safety Curriculum Guide for Medical Schools working group. Case supplied by Lorelei Lingard, Associate Professor, University of Toronto, Toronto, Canada.

A case of wrong-side surgical tooth and cyst extraction

This case illustrates how wrong-side surgery undertaken without supervision of a senior resident or a consultant oral surgeon resulted in pain and anxiety for the patient.

A 38-year-old female with a long-standing problem of infected gums surrounding the third molar and associated pain on her left side presented to a primary-care physician. The pain was associated with a salty-tasting discharge from the infected site. Imaging showed a decayed, horizontally impacted tooth and a cyst.

The patient was referred to an oral surgeon who recommended the surgical extraction of the impacted tooth and the cyst under general anaesthesia. On the day of surgery, the attending oral surgeon was discussing the procedure with

senior and junior surgery trainees. The surgeons were unaware that the X-rays had not been viewed correctly and were being viewed backwards.

The junior resident started the procedure on the right side without reviewing the medical notes. At the same time, the attending surgeon left the room and the senior resident was called away for an emergency. The junior resident continued removing a flap and extracted the tooth from the right side. He was trying to locate the cyst to be removed when the attending surgeon returned and noticed that the junior resident was operating on the wrong side and was not being supervised.

The resident and surgeon closed the wound on the right side and then incised and successfully extracted the tooth and the cyst from the left side.

Immediately after surgery, the patient began to report pain on the right side of her mouth. The surgeon informed the patient that they had separated tissue and bone on the left side, as well as the right side. She asked if her new symptoms were related to the operation. The surgeon downplayed the possibility. The patient visited the surgeon's office twice after the surgery for her postoperative pain, but was not satisfied by the surgeon's response.

The patient requested compensation, asserting that the attending surgeon and the senior and junior residents performed the surgery improperly.

Questions

– What were the factors underlying this error, and how could it have been prevented?

– What might be the consequences, for the patient and the surgeon, of not being open about the error and the cause of her pain?

Source: This case was provided by Shan Ellahi, Patient Safety Consultant, Ealing and Harrow Community Services, National Health Service, London, UK.

Communicating about oxytocin

This case highlights communication issues and need for procedures for the safe administration of a potentially dangerous drug.

A midwife was supervising a student midwife during a repair of a second-degree laceration after a birth. A nurse came into the room to ask the midwife if she could increase the oxytocin for a different woman, Mrs M, because her uterine contractions, although coming every two to three minutes, did not feel very strong; she had been at 4 cm dilation for the last three hours. The nurse stated that the oxytocin was running at 10 mu/min and had not been increased for the last two hours. The midwife replied that this seemed like a reasonable plan.

After the nurse left, the student midwife who was inexperienced and had been focusing on her suturing, asked the midwife what the nurse wanted. She replied that she had wanted to increase Mrs M's oxytocin due to inadequate contraction intensity and lack of cervical dilation. The student said, "Oh, I checked Mrs M right before this birth and she had progressed to 6cm but because I had to rush to this birth, I did not have time to write my notes." Nevertheless, the midwife trusted the nurse's judgement and she stayed with the student midwife to finish the repair and care for the patient.

When they went to see Mrs M 30 minutes later, a doctor and two nurses were in the room and the fetal heart rate was in the 70s. The midwife looked at the infusion pump and found it was set at 20 mu/min, instead of the 12 mu/min that she had expected to see. Measures to increase the fetal heart rate were not successful and Mrs M underwent an emergency caesarean section. A baby boy was born with an Apgar score of 3 at one minute, 6 at five minutes, and 8 at ten minutes.

Questions

– What system errors that led to this woman having an unnecessary caesarean?

– Would the routine use of a checklist protocol for increasing oxytocin have eliminated many of these errors?

– If so, what key elements should be part of an oxytocin-infusion checklist?

Further resource

Clark S et al. Implementation of a conservative checklist-based protocol for oxytocin administration: maternal and neonatal outcomes. *American Journal of Obstetrics and Gynecology*, 2007, 197:480e1-e5.

Source: This case was supplied by Mary Barger, Assistant Professor, Department of Family Health Care Nursing, University of California, San Francisco, CA, USA.

Tools and resource material

WHO guidelines for safe surgery 2009. Safe surgery saves lives. Geneva, World Health Organization, 2009 (http://whqlibdoc.who.int/publications/2009/9789241598552_eng.pdf; accessed 21 February 2011).

Universal protocol for preventing wrong-site, wrong-procedure, wrong-person surgery™
Carayon P, Schultz K, Hundt AS. Righting wrong-site surgery. *Journal on Quality & Safety*, 2004, 30:405–10.

Real life example of how errors can occur in surgical procedures
http://www.gapscenter.va.gov/stories/WillieDesc.asp; accessed 21 February 2011.

Correct site surgery tool kit
Association of Perioperative Registered Nurses (AORN) (http://www.aorn.org/PracticeResources/ToolKits/CorrectSiteSurgeryToolKit/; accessed 21 February 2011).

Perioperative patient "hand-off' tool kit
Association of Perioperative Registered Nurses (AORN) and the United States Department of Defense Patient Safety Program (http://www.aorn.org/PracticeResources/ToolKits/PatientHandOffToolKit/; accessed 21 February 2011).

WHO Safe Surgery Saves Lives
The Second Global Patient Safety Challenge (http://www.who.int/patientsafety/safesurgery/en/index.html; accessed 21 February 2011).

Haynes AB et al. A surgical safety checklist to reduce morbidity and mortality in a global population. *New England Journal of Medicine*, 2009, 360:491-499.

Additional resources
Calland JF et al. Systems approach to surgical safety. *Surgical Endoscopy*, 2002, 16:1005–1014.

Cuschieri A. Nature of human error: implications for surgical practice. *Annals of Surgery*, 2006, 244:642–648.

Assessing knowledge of this topic

A range of methods are suitable for assessing students' understanding of this topic, including observational reports, reflective statements about surgical errors, essays, multiple-choice questions, short best-answer questions, case-based discussion and self-assessment. Students can be encouraged to develop a portfolio approach to patient safety learning. The benefit of a portfolio approach is that at the end of the students' training they will have a collection of all their patient safety activities. Students will be able to use this to assist job applications and in their future careers.

The assessment of knowledge about procedural care and the potential harm to patients, use of a systems approach for improving outcomes and techniques for minimizing opportunities for procedural and surgical errors can all be assessed using any of the following methods:

- portfolio;
- CBD;
- OSCE station;
- written observations of the perioperative environment and the potential for error.

Students could also be asked to write reflective statements about theatres and the role of teamwork in minimizing errors, the role of hierarchy in the theatre and its effect on patient safety, systems in place for reporting surgical errors, the role of patients in the surgical process, the effectiveness of mortality and morbidity meetings and/or methods of communication that contribute to safe care.

The assessment can be either formative or summative; rankings can range from satisfactory/unsatisfactory to giving a mark. See the forms in Part B, Annex 2.

Evaluating the teaching of this topic

Evaluation is important for reviewing how a teaching session went and how improvements can be made. See the Teacher's Guide (Part A) for a summary of important evaluation principles.

References

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Medical Practice Study II. *New England Journal of Medicine*, 1991, 323:377–384.

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8. *Crossing the quality chasm: a new health system for the 21st century*. Washington, DC, National Academies Press, 2001.
9. Haynes et al. A surgical safety checklist to reduce morbidity and mortality in a global population. *New England Journal of Medicine*, 2009, 360:491–499.
10. *WHO Guidelines for Safe Surgery*, 2009, 10 (http://www.who.int/patientsafety/safesurgery/tools_resources/en/index.html; accessed 24 May 2011).

Slides for Topic 10: Patient safety and invasive procedures

Didactic lectures are not usually the best way to teach students about patient safety. If a lecture is being considered, it is a good idea to plan for student interaction and discussion during the lecture. Using a case study is one way to generate group discussion. Another way is to ask the students questions about different aspects of health care that will bring out the issues contained in this topic, such as the blame culture, the nature of error and how errors are managed in other industries.

The slides for Topic 10 are designed to help instructors deliver the content of this topic. The slides can be changed to fit the local environment and culture. Instructors do not have to use all of the slides and it is best to tailor the slides to the areas being covered in the teaching session.

Topic 11
Improving medication safety

Inappropriate medications for a child with nausea

While on holiday, Heather's 8-year-old daughter, Jane, was unwell and started vomiting. Heather took her to the local health clinic and saw a doctor who said her daughter as suffering from asthma and required a nebulizer. The doctor diagnosed nausea secondary to an ear infection and prescribed an antibiotic. He injected chlorpromazine, metoclopramide, and atropine to treat the nausea.

Jane later suffered diminished consciousness and was admitted to the small local hospital. She was subsequently transferred to a larger hospital because of her respiratory symptoms.

The clinic doctor thought he was doing the right thing, having learnt about this cocktail of medications while training as an intern. However, the drugs weren't appropriate for nausea in children because of the potential for adverse reactions and the difficulty in monitoring the child's subsequent condition. The doctor also didn't give adequate information about the drugs to Heather.

Source: Walton M. *Well being: how to get the best treatment from your doctor*. Sydney, New South Wales, Australia, Pluto Press, 2002:51.

Methadone overdose

When Matthew presented himself at the methadone clinic, there were three nurses on duty. Two of the nurses failed to identify Matthew properly and administered methadone without paying proper attention to the dose.

The dose of methadone given was 150 mg when it should have been 40 mg. The nurses also failed to notify the treating doctor when they became aware of the excessive dose. They then instructed the third nurse to give Matthew a take-home dose of 20 mg, despite being aware of the excessive dosage and without the authorization of the medical practitioner. Matthew died in the early hours of the following morning of methadone poisoning.

Source: Case studies. *Health Care Complaints Commission Annual Report* 1995–1996:38. Sydney, New South Wales, Australia.

Introduction–Why focus on medications?

Medicines have proven to be very beneficial for treating illness and preventing disease. This success has resulted in a dramatic increase in the use of medication. Unfortunately, this increase in use has brought with it an increase in hazards, errors and adverse events associated with medication use.

For a number of reasons, the use of medication has also become increasingly complex. There has been a massive increase in the number and variety of medications available. These medications have different routes of delivery and variable actions (long-acting, short-acting). Sometimes the same formulation of a particular drug is sold under more than one trade name, and this can cause confusion.

Although improved treatments for chronic disease are now available, more patients are now taking multiple medications and there are more patients with multiple co-morbidities. This increases the likelihood of drug interactions, side-effects and mistakes in administration.

The process of delivering medications to patients often involves a range of health-care professionals. Communication failures can lead to gaps in the continuity of the process. Health professionals are prescribing a larger range of medications, so there are more medicines they need to be familiar with. There is just too much information for a health professional to be able to remember in a reliable way without the help of reference materials. Nurses, pharmacists, dentists and doctors look after patients who are taking medications often prescribed by other clinicians (often specialists) and, hence, they may not be familiar with the effects of all the medications a patient is taking.

In addition to pharmacists, professionals who prescribe play a major role in the use of medicine. Their role includes prescribing and administering medications, monitoring for side-effects and working in a team. Health professionals play potentially fulfilling leadership roles in the workplace, in relation to medication use and improving patient care.

As future health-care professionals, students need to understand the nature of medication error, learn what hazards are associated with their use and learn what can be done to make medication use safer. Pharmacists, doctors and nurses play a leading role in reducing medication errors, but everyone involved in the use of medication has a responsibility to work together to minimize the harm caused to patients by medications.

Keywords
Side-effect, adverse reaction, error, adverse event, adverse drug event, medication error, prescribing, administration and monitoring.

Learning objective

This topic provides an overview of medication safety. It is designed to encourage students to continue to learn and practise ways to improve the safety of medication use.

Learning outcomes: knowledge and performance

Knowledge requirements

Students should know:

- the scale of medication error;
- that the use of medications is associated with risks;
- common sources of error;
- where in the process errors can occur;
- the responsibilities associated with prescribing and administering medication;
- how to recognize common hazardous situations;
- ways to make medication use safer;
- the benefits of a multidisciplinary approach to medication safety.

Performance requirements

Medication safety is a vast topic. A health professional who understands the issues and risks involved in the use of medication will:

- use generic names;
- tailor prescribing for each patient;
- practise taking thorough medication histories;
- know which medications are high-risk;
- be very familiar with the medications he/she prescribes and/or dispenses;
- use memory aids;
- communicate clearly;
- develop checking habits;
- encourage patients to be actively involved in the medication process;
- report and learn from errors;
- understand and practise drug calculations, including adjustments based on clinical parameters (e.g. renal clearance);
- detect potential/actual drug–drug and drug–food interactions.

Definitions

Side-effect

A side-effect is a known effect, other than that primarily intended, relating to the pharmacological properties of a medication [1]. For example, a common side-effect of opiate analgesics is nausea.

Adverse reaction

An adverse reaction occurs when unexpected harm results from a justified action, when the correct process was followed for the context in which the medication was used [1]. An example of this would be an unexpected allergic reaction in a patient taking a medication for the first time.

Error

An error is a failure to carry out a planned action as intended or the application of an incorrect plan [1].

Adverse event

An incident in which a patient is harmed [1].

Adverse drug event

An adverse event involving medication (an adverse drug event) may be preventable (e.g. the result of an error) or may not be preventable (e.g. an unexpected allergic reaction in a patient taking a medication for the first time, as described above).

Adverse drug reaction

Any response to a medication that is noxious and unintended. This WHO definition includes injuries that are judged to be caused by the drug and excludes injuries due to drugs that are caused by error.

Medication error

Any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health-care professional, patient or consumer [2]. Such events may be related to professional practice, health-care products, procedures and systems, including: prescribing; order communication; product labelling, packaging and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use.

Prescribing

A *prescription* is an order to take certain medications. In many countries, the prescriber has legal responsibility for the clinical care of the patient, as well as a role in monitoring the safety and efficacy of the drug(s). The prescribing of a medication requires the health professional to make a decision about the drug, the drug regimen, the documentation of the drug in the health-care records, and ordering. Health professionals are assisted in medication prescribing by evidenced-based practices that ensure the right drug is given appropriately to the right patient. But in addition, health professionals are also required to take into account the patient's preferences, values and economic circumstances. In some settings, there may be also limited resources and restrictions on what can and cannot be supplied to patients.

Errors are known to occur in the prescribing stage and are often associated with a health professional's inexperience and lack of knowledge about the medication, failure to follow an agreed upon protocol, or other factors such as tiredness and lapse of memory.

In addition to prescription drugs, consumers self-prescribe and take drugs they buy over the counter. Sometimes these drugs can cause adverse events particularly when taken with other medications. Consumers should always seek advice from pharmacists when they intend to mix over-the-counter drugs with their prescription medications.

Medication error

A medication error may result in:

- an adverse event, in which a patient is harmed;
- a near miss, in which a patient is nearly harmed;
- neither harm nor potential for harm.

Medication error is a common cause of preventable patient harm. The IOM estimates that in the USA there is one medication error per hospitalized patient per day [3], 1.5 million preventable adverse drug events per year [3], and 7000 deaths per year from medication errors in hospitals in that country [4].

Researchers in other countries around the world in which the incidence of medication error and adverse drug events have been investigated have reported similarly worrying statistics [5]. Only 15% of the prescribing errors that are made reach patients; the others are caught in time by pharmacists and other health-care workers. This fact underscores the importance of teamwork. By working together, health-care providers can prevent many adverse events.

Manufacturing, distribution and marketing

Before drugs can be used on humans, they must be tested to make sure they are safe. The development and manufacturing of drugs is highly regulated in most countries.

Steps in using medication

There are a number of discrete steps in using medication: prescribing, dispensing, administering and monitoring are the main four. Doctors, pharmacists, patients and other health-care professionals all play major roles in this process. For example, some patients may self-prescribe over-the-counter medication, administer this medication on their own and self-monitor to see if there has been any therapeutic effect. Alternatively, for example, in the hospital setting, when a doctor prescribes a medication, a pharmacist will then dispense the medication, a nurse will administer the medication and a nurse and a different doctor may end up monitoring the patient's progress and making decisions about the ongoing drug regimen. In a collaborative practice, a pharmacist may adjust the dose.

The main components of each of the four steps mentioned above are outlined below.

Prescribing

The prescribing health-care professional must choose an appropriate medication for a given clinical situation, taking individual patient factors into account, such as allergies. The prescriber also needs to select the most appropriate administration route, dose, time and regimen. This plan must be communicated to whoever will administer the medication (this communication may be written, verbal or both) and the full plan must be properly documented.

Dispensing

A pharmacist will transcribe the prescription written by the prescribing health professional and check the transcription. The pharmacist will then pick the medication, checking it against the prescription, and document his/her work.

Administering

Administering a medication may include obtaining the medication and having it in a ready-to-use form. This may involve counting, calculating, mixing, labelling or preparing the drug in some way. Anyone administering medication must always check for allergies and check that they are giving the correct dose of the correct medication to the correct patient via the correct route at the correct time. The person who administers the medication must document what he/she has done.

Monitoring

Monitoring involves observing the patient to determine whether the medication is working, being used correctly and not causing harm. Monitoring activities must also be documented, just like all the other steps in the medication process.

There is potential for error at every step of the process. There are a variety of ways that errors can occur at each step.

The use of medication carries risks

The use of medication involves certain risks. Different risks and opportunities for error are associated with different steps in the medication process.

Prescribing

Inadequate knowledge about drug indications, contraindications and drug interactions can lead to prescribing errors. This has become an increasing problem as the number of medicines in use has increased. It is not possible for an individual health-care professional to remember all the relevant details necessary for safe prescribing, without referring to reference materials. Alternative ways of accessing drug information are required. Failure to consider physical, cognitive, emotional and social factors that might alter prescribing, such as allergies, pregnancy, co-morbidities, health literacy and other medications the patient may be taking is another source of errors.

Errors may involve prescribing for the wrong patient, prescribing the wrong dose, prescribing the wrong drug, prescribing the wrong route or the wrong time for drug administration. These errors can sometimes occur due to lack of knowledge, but more commonly are a result of a "silly mistake" or "simple mistake", referred to as a slip or a lapse. These are the sorts of errors that are more likely to occur at 04:00, or if the prescribing clinician is rushing, bored or tired, and not fully concentrating on the task at hand.

Inadequate communication is another source of prescribing errors. Communication that is ambiguous can be misinterpreted (e.g. certain abbreviations). Errors may result from illegible writing or a simple misunderstanding in verbal communication.

Mathematical errors made in calculating doses can cause medication errors. These errors can be a result of carelessness or fatigue,

but can also be the result of a lack of training and unfamiliarity with how to manipulate volumes, amounts, concentrations and units and/or a lack of access to updated parameters. Calculation errors involving medications with narrow therapeutic windows can cause major adverse events. Not uncommonly, a calculation error can occur when transposing units (e.g. from micrograms to milligrams). This type of miscalculation may result in a 1000 times error. Competence with dose calculations is particularly important in paediatrics, where most doses are determined according to the weight of the child.

Dispensing

A 2007 study showed that higher pharmacy workload, defined as the number of prescriptions dispensed per pharmacist work hour, led to increased risk of dispensing a potentially unsafe medication. The following steps [6] can be taken by pharmacists to decrease the risk of a dispensing error:

- ensure correct entry of the prescription;
- confirm that the prescription is correct and complete;
- beware of look-alike, sound-alike drugs (similar drug names account for one-third of medication errors);
- be careful with zeros and abbreviations;
- organize the workplace;
- reduce distraction when possible;
- focus on reducing stress and balancing heavy workloads;
- take the time to store drugs properly;
- thoroughly check all prescriptions;
- always provide thorough patient counseling.

Administering

Classic administration errors are the wrong dose of a drug being given to the wrong patient, by the wrong route, at the wrong time, or the wrong drug being used. Not administering a prescribed drug is another form of administration error. These errors can result from inadequate communication, slips or lapses, lack of checking procedures, lack of vigilance and calculation errors, as well as suboptimal workplace and medication packaging design. In these cases, there is often a combination of contributory factors.

Inadequate documentation can also lead to administration errors. For example, if a medication is administered, but has not been recorded as being given, another staff member may also give the patient the medication thinking that it had not yet been administered.

Calculation mistakes for IV drugs (e.g. drops/h or drops/min, ml/h or ml/min) are another type of administration error.

Monitoring

Errors in this area include inadequate monitoring for side-effects, not ceasing medication once the prescribed course has been completed or is clearly not helping the patient and not completing a prescribed course of medication. Monitoring errors occur when drug levels not measured or measured but not checked or acted upon. These errors often involve communication failures.

There is a particular risk of a communication failure when the care provider changes, for example, when a patient moves from a hospital to a community setting or vice versa.

Contributory factors for medication errors

Adverse medication events are frequently multifactorial in nature. Often there is a combination of events that together result in patient harm. This is important to understand for a number of reasons. In trying to understand why an error occurred, it is important to look for all the contributing factors, rather than the most obvious reason or the final step in the process. Strategies to improve medication safety also need to target multiple points in the process.

Patient factors

Certain patients are particularly vulnerable to medication errors. These include patients with specific conditions (e.g. pregnancy, renal dysfunction, etc.); patients taking multiple medications, particularly if these medications have been prescribed by more than one health-care provider; patients with a number of health problems; and patients who do not take an active interest in being informed about their own health and medications. Patients with memory issues (e.g. Alzheimer patients) and patients who cannot communicate well, including unconscious patients, babies and young children, and patients who do not speak the same language as the staff, are also particularly vulnerable to medication errors. Children and babies, especially neonates have a heightened risk of exposure to medication errors due to the drug-dose calculations required when treating them.

Staff factors

Staff factors that increase the risk of medication errors include inexperienced personnel; rushing, as in emergency situations; multitasking; being interrupted mid-task; and fatigue, boredom

and lack of vigilance. A lack of checking and double-checking habits or checking by different individuals can also lead to medication errors, as do poor teamwork, poor communication between colleagues and reluctance to use memory aids.

Workplace design factors

Workplace design factors also contribute to medication errors, including the absence of a safety culture in the workplace. This may be evidenced by a lack of reporting systems and failure to learn from past near misses and adverse events. Other workplace design factors include the absence of readily available memory aids for staff and/or other information on specific medications, poor or no access to diagnostic data for the pharmacy team and inappropriate storage of medications, e.g. different drugs with confusingly similar names kept near one another or medicines not stored in easy-to-use forms or not stored in their usual place. Inadequate staffing is another workplace design issue that can lead to increased medication errors.

Medication design factors

Certain medication design factors can also increase the risk of medication errors. Some medications can be easily confused, such as pills that are similar in appearance (e.g. colour, shape). Medications with similar names can also be easily confused. Examples of this problem include celecoxib (an anti-inflammatory), fosphenytoin (an anticonvulsant) and citalopram hydrobromide (an antidepressant), which when their brand names are used might be confusing (Celebrex, Cerebryx and Celexa); as well as ephidrin and epinephrine. Ambiguous labelling is another source of confusion. Different preparations or dosages of similar medication may have similar names or packaging. For example, phytonadione 1 mg and 10 mg are very similar looking. Some slow-release medications may differentiate themselves from the usual release form with a suffix. Unfortunately, there are many different suffixes in use to imply similar properties, such as slow release, delayed release or long-acting (e.g. LA, XL, XR, CC, CD, ER, SA, CR, XT and SR).

Certain medication design problems lend themselves to administration errors, including labelling that is too small to read and difficult-to-read dose information on vials. A lack of measuring instruments (e.g. spoons for syrups) is another problem.

Other technical factors

Other technical factors can also contribute to medication errors. For example, identical connectors for IV lines and intrathecal lines allow for drugs to be given by the wrong route.

Some ways to make medication use safer

Use generic names

Medications have both trade names (brand names) and generic names (active ingredient). The same drug formulation can be produced by different companies and given several different trade names. Usually the trade name appears in large letters on the box/bottle and the generic name appears in small print. It is difficult enough familiarizing oneself with all the generic medications in use; it can be almost impossible to remember all the related trade names. To minimize confusion and simplify communication, it is helpful if staff use only generic names. However, it is important to be aware that patients will often use trade names as this is what appears in large print on the packaging. This can be confusing for both staff and patients. For example, consider a patient being discharged from hospital with a prescription for their usual medication, but with a different trade name. The patient may not realize that the medication they were prescribed upon discharge is the same as their preadmission medication and hence continue taking that medication as well, since no one has told them to cease it or that it is the same as the "new" medication. It is important for prescribers and pharmacists to explain to patients that some medications may have two names.

Medical doctors and other prescribers should prescribe drugs by their generic names. Patients should be encouraged to keep a list of their medications, including both the trade and generic name of each drug.

Tailor your prescribing for individual patients

Before prescribing a medication, always stop and think, "is there anything about this patient that should alter my usual choice of medication?". Factors to consider include allergies, pregnancy, breastfeeding, co-morbidities, other medications the patient may be taking, and the size and weight of the patient.

Learn and practise collecting complete medication histories

Medication histories should be taken by both prescribing health professionals and pharmacists. When collecting a medication history, the following guidelines should be followed.

- Include the name, dose, route, frequency and duration of every drug the patient is taking.
- Ask about recently ceased medications.
- Ask about over-the-counter medications, dietary supplements and complementary medicines.
- Ask patients if there are any medications they have been advised to take, but do not actually take.
- Make sure what the patient actually takes matches your list. Be particularly careful about this across transitions of care. Practise medication reconciliation on admission to and discharge from hospital, as these are high-risk times for errors [7] due to misunderstandings, inadequate history taking and poor communication.
- Look up any medications you are unfamiliar with. You can search reliable, evidence-based sources of information and/or contact other health-care professionals (e.g. pharmacists).
- Consider drug–drug and drug–food interactions, medications that can be ceased and medications that may be causing side-effects.
- Always include a thorough allergy history. When collecting an allergy history, remember that if a patient has a potentially serious allergy and a condition for which staff may want to prescribe that medication; this is a high-risk situation. Alert the patient and alert other staff.

Know which medications used in your area are associated with high risks of adverse events

Some medications have a reputation for causing adverse drug events. This may be due to a narrow therapeutic window, particular pharmacodynamics or pharmacokinetics, or the complexity of dosing and monitoring. Examples of these medications include insulin, oral anticoagulants, neuromuscular-blocking agents, digoxin, chemotherapeutic agents, IV potassium and aminoglycoside antibiotics. It may be useful to ask a pharmacist or other relevant staff in your area what medications tend to be most often implicated in adverse medication events. (Instructors may want to spend time teaching about these agents.)

Be very familiar with the medications you prescribe

Never prescribe a medication you do not know much about. Encourage students to do homework on medications they are likely to use frequently in their practice. They should be familiar with the pharmacology, indications, contraindications, side-effects, special precautions, dosages and recommended regimens for theses medications. If you need to prescribe a medication you are not familiar with, read up on the medication before prescribing it. This will require having reference material readily available in the clinical setting. It is better for prescribers to know a few drugs well than many superficially. For example, rather than learning about five different non-steroidal anti-inflammatory drugs, a prescriber might just know one in detail and prescribe that one. Pharmacists, however, should be familiar with many medications.

Use memory aids

Perhaps in the past it was possible to remember most of the required knowledge regarding the main medications in use. However, with the rapid growth in the number of available medications and the increasing complexity of prescribing, relying on memory alone is not sufficient.

Students should be encouraged to have a low threshold to look things up. They should become familiar with selecting independent, evidence-based memory aids and using them. Students should view relying on memory aids as a marker of safe practice rather than a sign that their knowledge is inadequate. Examples of memory aids include textbooks, pocket-sized pharmacopoeias and information technology, such as computer software (decision/dispensing support) packages and personal digital assistants. A simple example of a memory aid is a card with all the names and doses of medications that may be needed in a case of cardiac arrest. This card can be kept in the prescriber's pocket and referred to in the event of an emergency, when there may not be time to get to a textbook or computer to check the dosage of a medication. (Note that memory aids are also referred to as cognitive aids).

Remember the 5 Rs when prescribing and administering medication

In many parts of the world, training programmes have emphasized the importance of checking the *5 Rs* before dispensing or administering a medication. The 5 Rs are: right drug, right route, right time, right dose and right patient. This guideline is relevant for all health-care professionals who prescribe and administer medication. Two additions to these 5 Rs are right documentation and the right of a staff member, patient or carer to question a medication order.

Communicate clearly

It is important to remember that the safe use of medication is a team activity and that the patient is also a member of the team. Clear, unambiguous communication will help to minimize assumptions that can lead to error. A useful maxim to

remember when communicating about medications is to *state the obvious* as often what is obvious to the doctor or pharmacist may not be obvious to the patient or nurse and vice versa.

Bad handwriting can lead to dispensing errors. Health professionals should write clearly and legibly including their name and contact details. Pharmacists who cannot read the writing should contact the person who signed the prescription to check the details.

Remembering the 5 Rs (as described above) is a useful way of remembering the important points about a medication that need to be communicated. For example, in an emergency situation, a doctor may need to give a verbal drug order to a nurse, "can you please give this patient 0.3 ml of 1:1000 epinephrine as soon as possible?" is much better than saying, "quick, get some adrenaline".

Another useful communication strategy is to *close the loop*. This decreases the likelihood of misunderstanding. In our example, the nurse would close the loop by saying, "OK, I will give the patient 0.3 ml of 1:1000 epinephrine as soon as possible".

Develop checking habits

It is helpful to develop checking habits early in one's career. For this to happen, these habits need to be taught at the undergraduate level. An example of a checking habit is to always read the label on the ampoule before drawing up a medication. If checking becomes a habit, then it is more likely to occur even if the clinician is not actively thinking about being vigilant.

Checking should be an important part of prescribing, dispensing and administering drugs. You are responsible for every prescription you write and every drug you dispense or administer. Check the 5 Rs and for allergies. High-risk medications and situations require extra vigilance with checking and double-checking, for example, when very potent emergency drugs are being used to treat a critically ill patient. Double-checking colleagues' actions, as well as your own actions, contributes to effective teamwork and provides an additional safeguard. (However, it is very important that everyone first checks his/her own work, as delegating checking can lead to errors.)

Remember that computerized prescribing does not remove the need for checking. Computerized systems solve some problems (e.g. illegible handwriting, confusion around generic and trade names, recognizing drug interactions), but also present a new set of challenges [8].

Some useful maxims regarding checking:
- unlabelled medications belong in the bin;
- never administer a medication unless you are 100% sure you know what it is.

Encourage patients to be actively involved in their own care and the medication process. Educate your patients about their medication(s) and any associated hazards. Communicate plans clearly with patients. Remember that patients and their families are highly motivated to avoid problems. If they are made aware of the important role they play in the medication process, they can contribute significantly to improving the safety of medication use.
Information can be both verbal and written and should cover the following aspects:
- name of the generic drug;
- purpose and activity of the medication;
- dose, route and administration schedule;
- special instructions, directions and precautions;
- common side-effects and interactions;
- how the effects of the medication (e.g. efficacy, side-effects, etc.) will be monitored.

Encourage patients to keep a written record of the medications that they take and details of any allergies or problems they have had with medications in the past. This list should be presented whenever they interact with the health-care system.

Report and learn from medication errors

Discovering more about how and why medication errors occur is fundamental to improving medication safety. Whenever an adverse drug event or near miss occurs, there is an opportunity for learning and improving care. It will be helpful for students if they understand the importance of talking openly about errors and are aware of what processes are in place in their training programmes or in the facilities in which they are working to maximize learning from errors and progress in medication safety.

The reporting of errors is facilitated when trust and respect have been established between health-care professionals. For example, pharmacists are more likely to report and explain near-miss errors when prescribers are open to listening to their explanations.

Safe practice skills for students

Although students are generally not permitted to prescribe or administer medication until after graduation, there are many aspects of medication safety that students can start practising and preparing for. It is hoped that the following list of activities can be expanded upon at multiple stages throughout a student's training. Each task on its own could form the basis of an important educational session (lecture, workshop, tutorial). Thorough coverage of these topics is beyond the scope of an introductory session to medication safety.

An understanding of the inherent hazards of using medicines will affect how a clinician performs many daily tasks. Below are instructions for how a safety-conscious clinician will perform different tasks.

Prescribing

Consider the 5 Rs, know the drugs you prescribe well and tailor your treatment decisions to individual patients. Consider individual patient factors that may affect the choice or dose of medication, avoid unnecessary use of medications and consider risk–benefit relationships.

Documentation

Documentation should be clear, legible and unambiguous. Those who struggle to write neatly should print. Consider the use of electronic prescribing, if available. Include the patient's name, the name of the drug and the dose, route, time and schedule for its administration as part of the documentation. It is also important to include the contact details of the prescribing clinician, in order to facilitate communication between the pharmacist and the prescriber.

Use of memory aids

Have a low threshold to look things up, know how to select memory aids and look for and use effective technological solutions, if available.

Teamwork and communication surrounding the use of medications

Remember that the use of medication is a team activity. Communicate with the other people involved in the process and make sure that false assumptions are not being made. Be on the look out for errors and encourage the rest of the team to be vigilant of their own actions and those of others.

Administering medications

Be familiar with the hazards and safety precautions associated with administering medication by different routes–oral, sublingual, buccal, inhaled, nebulized, transdermal, subcutaneous, intramuscular, intravenous, intrathecal, per rectum and per vagina. Check the 5 Rs whenever you administer medication.

Involving and educating patients about their medications

Look for opportunities and ways to help patients and carers help minimize errors. Listen carefully to what they have to say.

Learning and practising drug calculations

Be familiar with how to manipulate units and adjust volumes, concentrations and doses. Practise calculating adjustments based on clinical parameters. In high-stress and/or high-risk situations, consider ways to decrease the chance of a calculation error, such as using a calculator, avoiding doing arithmetic in your head (use a pen and paper instead), asking a colleague to perform the same calculation to see if you concur and using any other available technology. When dispensing drugs, it is important to always check the calculated dose.

Collecting a medication history

Always take a thorough medication history before prescribing and regularly review patients' medication lists, especially those of patients taking multiple medications. Cease all unnecessary medications. Always consider medication as a possible cause of symptoms during the diagnostic process. When a patient cannot provide his/her medication history (e.g. an unconscious patient), these records may be available from his/her pharmacist or general practitioner. In some situations, a medication history might be collected by a pharmacist before the patient sees a doctor.

Detecting and reducing possible interactions and/or contraindications

Collecting an allergy history

Always ask about allergies before prescribing any medication. If a patient has a serious medication allergy, stop and think whether that patient is at risk of someone wanting to prescribe that medication. For example, if a community doctor sends a patient to hospital with suspected appendicitis and the patient has a serious penicillin allergy, it is possible that there will be some momentum within the hospital to give the patient penicillin. In this situation, it is important to emphasize the allergy in communication with the hospital staff, warn the patient that the usual treatment for appendicitis involves penicillin-based antibiotics and encourage the patient to be alert

to what medication he/she is being given and to speak up if someone tries to give him/her penicillin. The risk of cross-allergy should also be mentioned. It is also important for health-care professionals to ask about allergies before administering medications.

Monitoring patients for side-effects
Be familiar with the side-effects of the medications you prescribe/dispense/administer and be proactive in looking for them. Educate patients about potential side-effects: how to recognize them and appropriate actions should they occur. Always consider medication side-effects as part of the differential diagnosis when assessing patients with undifferentiated clinical problems.

Learning from medication errors and near misses
Learn from errors through investigation and problem-solving. If an error can occur once, it can occur again. Consider strategies to prevent the recurrence of errors at both an individual practitioner level and an organizational level. Be familiar with how to report errors, adverse reactions and adverse events involving medication. Pharmacists might consider running multidisciplinary meetings to discuss common mistakes and identify methods/procedures for avoiding these mistakes (e.g. excluding sound-alike drugs from the hospital formulary).

Summary 

Medications can greatly improve health when used wisely and correctly. Nevertheless, medication errors are common and cause preventable human suffering and financial cost. Remember that using medications to help patients is not a risk-free activity. Know your responsibilities and work hard to make medication use safe for your patients.

Teaching strategies and formats 

There are a variety of ways to teach students about medication safety and a combination of approaches is likely to be most effective.

Options include: interactive lectures, small group discussions, problem-based learning, practical workshops, tutorials, project work including tasks to be undertaken in the clinical environment and at the bedside, online learning packages, reading and case analyses.

Lecture presentation and/or group discussion 
The PowerPoint presentation included in this package is designed for use as an interactive introductory lecture on medication safety or a teacher-led small group discussion. It can be readily adjusted to be more or less interactive and you can adapt it for your clinical setting by including local examples, local issues and local systems. A series of questions are interspersed throughout the presentation to encourage students to actively engage with the topic and also short cases with questions and answers that could be embedded in the lecture or provided for the students as a separate exercise.

Below are listed some other educational methods and ideas to consider using for teaching about medication safety.

Problem-based learning
Use cases that raise issues relevant to medication safety. Students can be asked to respond to reflective questions after reading through a case. Alternatively, students could work through a set of drug-calculation problems.

Additional teaching and learning activities
– Practical workshops
Students can practice their skills under time pressure, mimicking emergency situations. Suggested workshop topics include drug administration, prescribing and drug calculations.

– Project work 
Possible projects include the students performing one or all of the following:
- interview pharmacists to find out what errors they commonly see;
- accompany a nurse on a drug round;
- interview nurses or doctors who administer a lot of medication (e.g. anaesthetists) and ask them about their experience and knowledge of medication error and what strategies they use to minimize the chance of a mistake;
- research a medication that has a reputation for being a common cause of adverse events and present your findings to fellow students;
- prepare a personal formulary of medications likely to be commonly prescribed in the early postgraduate years;
- perform a thorough medication history on a patient taking multiple medications. Do some homework to learn more about each of these medications, then consider potential side-effects, drug interactions and if there are any medications that could be ceased. Discuss your thoughts with a pharmacist or doctor

and share what you have learnt with fellow students;
- find out what is meant by the term *medication reconciliation* and talk to hospital staff to find out how this is achieved at your facility. Observe and, if possible, participate in the process during admission and discharge of a patient and consider how the process may prevent errors and also whether there are any gaps or problems with the process.

Role-playing exercises

Role-playing exercises are another valuable educational tool for teaching students about medication safety.

Scenario I: Erroneous administration of drugs

Description of event

During the early hours of the morning shift, the morning shift nurse administered 100 units subcutaneous regular insulin, instead of 10 units as was written in the physician's order. The error stemmed from the physician's illegible handwriting.

The patient, who was suffering from dementia, was uncooperative and seemed to be asleep. During the nurse's regular checking, she discovered the patient to be completely unresponsive. A blood test confirmed that the patient was in a state of hypoglycaemic shock. The on-call physician was called and the error was discovered.

The patient was treated with an infusion of glucose 50% IV. A crash cart was brought to the patient's room, to be readily available if necessary. The patient recovered within a few minutes, woke up and began behaving normally.

Role play

Later that morning, the patient's son, a lawyer, came to visit his father. Looking agitated, he turned to the nurse asking, "What happened to my father?" His father's roommate had told him that there had been a problem and that there had been many people at his father's bedside early in the morning. The nurse who administered the insulin was called to speak with the patient's son.

If the nurse explains the chain of events, takes responsibility for and admits her error, the patient's son will not placated and will reply: "Is that the level of care my father has been receiving?"; "What kind of nurses work in this ward?"; "I won't have it. I will take action!"; "I demand to speak to the head physician immediately!"; "I demand to see this event's report!" If the nurse does not explain the error in detail, the patient's son will be upset and unwilling to accept any subsequent explanation.

A physician passing by overhears the conversation. The physician will enter the room if the actor asks him to. If the actor does not request the physician, the physician will enter the room after approximately 8 minutes (12-minute scenario). The physician will enter the room and ask about the events being discussed. The nurse will update him as to the morning's events and her conversation with the patient's son (either in his presence or not, depending on the physician and nurse).

Character description

The son, 45-years-old, is a well-dressed lawyer. He visits his father whenever possible. He is interested in everything going on around him, but is having difficulty accepting his father's new medical state. He feels confused, neglected and a bit sad. He really wants to help but does not know how. A conversation with the social worker reveals that previously there was never a need for him to care for his father, but ever since his mother fell and broke her leg and his father's situation began to deteriorate, the burden of their care has rested on his shoulders alone.

Actor tips

The actor must complain to the head physician of a cover-up and omission of facts and threaten negative publicity (going to the press) (i.e. "You almost killed him! You're lucky it didn't end that way!")

Scenario II: Death due to erroneous medical care

Description of event

Sarah, a 42-year-old woman, was admitted for the resection of a localized, non-metastatic malignant duodenal tumour.

Sarah was otherwise healthy, without any family history of malignancy. She had consented to surgery and any other treatment deemed necessary afterward based on the pathology results.

On the morning of the surgery, the patient said goodbye to her husband and two young children (aged 13 and 8). A small localized mass was resected in its entirety. The mass was sent to pathology for diagnosis. Two hours into surgery, the patient showed signs of decreased saturation,

tachycardia and hypotension. The patient received IV fluids, while the surgeon rechecked the resection site for signs of haemorrhage, tearing or an embolism. After finding nothing, the surgeon sutured the site according to protocol.

Upon her return to the ward, the patient quickly developed a high fever, which remained unchanged for a week. A prescription for antibiotics was written:

IV. Gentamicin 80 MGR X 3 P/D

The nurse copied the following order:
IV. Gentamicin 80 MGR X 3 P/DOSE

The nurse who copied the order mistook the letter "D" to mean "dose", while the physician who wrote the order actually meant "day". Over the next 10 days, the patient received 240 mg of gentamicin, three times daily.

During that time, the patient began showing signs of renal failure and hearing impairment. On the tenth day of treatment, as the nurse manager was taking stock of the drugs administered, the error was discovered. The treatment was stopped, but the patient's general status deteriorated due to acute renal failure. Ten days later, the patient died of generalized organ failure.

The patient's family was critical of the nursing staff throughout her hospitalization, blaming them for malpractice. They expressed their anger to the nurse manager and the department chief.

After the patient died, her husband asked to speak to the head nurse. He blamed the nurses for the error and malpractice that culminated in his wife's death. He claimed to have already discovered which nurse copied the order and threatened to sue her.

Character description
The patient's husband is a hardworking man who works in a store. He has difficulty providing for his family and is struggling to make ends meet. He is an angry and restless man who has not yet come to terms with his wife's cancer diagnosis. He is angry with everyone and especially with the nursing staff, after his wife told him she received "too many antibiotics because the nurse couldn't do math". He wants to know what killed his wife, who is at fault and who is going to pay for it. He wants top hospital management involved and wants help for his children. He is very upset and shouts a lot.

Scenario III: Patient–health-care worker communication

Description of event
Kirk, 54-years-old, has been admitted due to transient chest pain complaints. He has been previously hospitalized in the ICU due to acute coronary events. This time, preliminary test results were inconclusive and his pain is not as severe. The physician has ordered complete rest and continuous 48-hour cardiac monitoring. Kirk is a heavy smoker and is overweight. He has not been taking the medications prescribed to help with his high blood pressure and high cholesterol.

The patient demands to be released immediately. He is afraid his hospitalization may cause him to lose his job at an automobile factory.

His anger is directed at the nurse-in-charge of the evening shift. He claims he was promised that he would be discharged and that there is no need for him to be monitored or for complete rest. He is uncooperative. He has already convinced another nurse to let him leave the ward for a short period. Now, he demands to leave the ward again and refuses to remain in his room. He demands to smoke and wants to be discharged. He is angry and shouting by the nurses' station.

Assuming the nurse-in-charge insists he stay in the ward, the patient will accuse her of being insensitive and will claim the other nurse was nicer and more empathetic and understanding.

The on-call physician is in the vicinity but does not intervene and continues caring for other patients (some of whom are near the nurses' station where the event is taking place).

Character description
Kirk is overweight and a heavy smoker. He enjoys getting attention by shouting. He is very concerned that he will not be able to work as much as he has been and may be fired. He is very afraid of surgery, as his best friend died on the operating table two years ago at the same hospital.

Source: These scenarios were supplied by Amitai Ziv, The Israel Center for Medical Simulation, Sheba Medical Center, Tel Hashomer, Israel.

Case studies

A prescribing error

This case study illustrates the importance of collecting complete and accurate medication histories.

A 74-year-old man saw a community doctor for treatment of new onset stable angina. The doctor had not met this patient before and took a full history and medication history. He discovered that the patient has been healthy and only takes medication for headaches. The patient could not recall the name of the headache medication. The doctor assumed it was an analgesic that the patient takes whenever he develops a headache. But the medication was actually a beta-blocker that the patient took every day for migraine. A different doctor had prescribed this medication. The doctor commenced the patient on aspirin and another beta-blocker for the angina. After commencing the new medication, the patient developed bradycardia and postural hypotension. Unfortunately, the patient fell three days later due to dizziness on standing and fractured his hip in the fall.

Questions

– How common are medication errors?

– How could one prevent these errors from occurring?

– Is there a role for patients in preventing errors?

Source: WHO Patient Safety Curriculum Guide for Medical Schools. Geneva, World Health Organization, 2009:242-243.

An administration error

This case history illustrates the importance of checking procedures when administering drugs, as well as the importance of good communication between team members. It also demonstrates the importance of keeping all materials in accurately labelled containers.

A 38-year-old woman came to the hospital with 20 minutes of itchy red rash and facial swelling. She had a history of serious allergic reactions. A nurse drew up 10 ml of 1:10 000 adrenaline (epinephrine) into a 10 ml syringe (1 mg in total) and left it at the bedside ready to use, just in case the doctor would request it. Meanwhile, the doctor inserted an IV cannula. The doctor saw the 10 ml syringe of clear fluid that the nurse had drawn up and assumed it was normal saline. There was no communication between the doctor and the nurse at this time.

The doctor administered all 10 ml of adrenaline (epinephrine) through the IV cannula, thinking he was using saline to flush the line. The patient suddenly began to feel terrible and anxious. She became tachycardic and then unconscious with no pulse. She was discovered to be in ventricular tachycardia, was resuscitated and, fortunately, made a good recovery. The recommended dose of adrenaline (epinephrine) in anaphylaxis is 0.3–0.5 mg IM. This woman received 1 mg IV.

Discussion

– What factors might be associated with this adverse event?

– Outline how the team could have functioned better?

Source: WHO Patient Safety Curriculum Guide for Medical Schools. Geneva, World Health Organization, 2009:242-243.

Monitoring error

This case study illustrates the importance of communicating with patients about their medications. Patients should always be advised as to how long to continue to take prescribed medications. This case study also illustrates the importance of collecting accurate and thorough medication histories, in order to avoid negative outcomes.

A patient was started on oral anticoagulants in hospital for treatment of a deep venous thrombosis following an ankle fracture. The intended treatment course was three to six months. However, neither the patient nor the community doctor were aware of the planned duration of treatment. The patient continued to take this medication for several years, being unnecessarily exposed to the increased risk of bleeding associated with this medication. At some point, the patient was prescribed a course of antibiotics for a dental infection. Nine days after he started taking the antibiotic, the patient became unwell with back pain and hypotension, as a result of a spontaneous retroperitoneal haemorrhage, and required hospitalization and a blood transfusion. A blood coagulation test revealed grossly elevated results; the antibiotic had potentiated the therapeutic anticoagulant effect.

Questions

– What are the main factors associated with this adverse event?

– How might the adverse event been prevented?

Source: WHO Patient Safety Curriculum Guide for Medical Schools. Geneva, World Health Organization, 2009:242-243.

Prescribing error leading to adverse effects

In this case, a dentist underestimated the systemic immunodeficient status of the patient and, in doing so, failed to take appropriate measures to prevent adverse effects of systemic antibiotics.

An HIV-positive, 42-year-old man saw a dentist for a dental treatment consisting of a root canal treatment, treatment of gum disease and extraction of a tooth due to severe decay.

After taking a medical and dental history, the dentist decided that the patient's medical status was stable and prescribed a course of prophylactic antibiotics before performing any dental treatment. In the second visit, during intraoral examination, the dentist noticed that the patient had developed oral lesions resembling fungal (*Candida*) infection.

When he considered the patient's systemic condition, he realized that he had failed to focus on the increased risk of fungal infections in people with HIV/AIDS when taking systemic antibiotics and had forgotten to prescribe the appropriate antifungal drugs together with antibiotics to prevent such lesions. He further realized that he had considered the patient's systemic condition to be stable without consulting the patient's physician.

Thus, he had underestimated the immunodeficient status of the patient. He referred the patient to his physician for treatment of the oral fungal lesions and the patient received the necessary treatment. The patient's dental treatment was postponed until the state of his systemic and oral health was appropriate.

Questions

– What factors may have been present that influenced the dentist's initial treatment plan in isolation from the treating doctors?

– What factors might have existed that led the dentist to underestimate the immunodeficient status of the patient?

– What factors may have prevented the dentist from prescribing antifungal drugs with systemic antibiotics for this HIV-positive patient?

Source: Case supplied by Nermin Yamalik, Professor, Department of Periodontology, Dental Faculty, Hacettepe University, Ankara, Turkey.

Communication is essential between health professionals and patients

In this case, a pharmacist, realizing that a patient does not understand how medications interact, spent some time explaining to the patient each of the medications the patient was taking and their appropriate use.

Mary is an 81-year-old woman in chronic pain, caused by serious back pain including osteoporosis; coronary heart disease and depression, caused by her constant pain and lack of confidence in the medications she has been prescribed. Her medications include prescriptions by her neurologist, endocrinologist, two general practitioners and a rheumatologist. She was prescribed a total of 18 different drugs. Many of the medications were for pain. Because of the frequency of her taking medications (NSAIDS) for her pain, she suffered from gastritis (inflammation of the lining of the stomach). This made her very wary of the analgesics, which she took from time to time. Mary visited different pharmacies to buy different pain killers (paracetamol, ibuprofen etc).

Mary is concerned about the pain killers she is taking because of their gastro-toxicity; sometimes she uses all of them, while also taking 'over the counter' (OTC) drugs bought in pharmacies. Despite this, Mary does not feel any better. Mary is afraid of the adverse drug reactions of tramadol and is not using it regularly. For strong pain relief she uses paracetamol, but the pain killer has little effect. Similarly, she sees no improvement with the antidepressant citalopram, even after a week of regular use; subsequently she uses the medication occasionally. Box B.11.1 lists all medications Mary was taking.

A pharmacist, realizing that Mary does not understand how her medications interact, spent some time explaining to her each of the medications and their appropriate use. He discussed with her the inappropriate use of combinations of NSAIDs, and in particular:

- the appropriate use of metamizol with higher doses of paracetamol if she has no liver problems;
- plans to evaluate the effects of citalopram one month after initiation of course;
- the importance of informing physicians about her medications and her medical history;
- the need to evaluate drug interactions in order to minimize the risks of adverse drug reactions;

Box B.11.1. List of drugs for patient

Neurologist:
Gabapentin
tramadol + paracetamol (for pain relief)
thiaprofenic acid (for pain relief)

OTC drugs with paracetamol (for pain relief)

Endocrinologist:
levothyroxine
omeprazole
colecalciferol+ Ca+Zn+Mn
colecalciferol
atorvastatin
strontium ranelate
diclofenac (for pain relief)

General practitioners:
citalopram
bromazepam (for phobia)
nimesulide (for pain relief)
tramadol (for pain relief)
metamizol (for pain relief)
metoprolol
indobufen

Rheumatologist:
Meloxicam (for pain relief)

- the need to review contraindications and use OTC drugs appropriately.

By the second visit to the pharmacist, Mary was satisfied with her pain management.

Questions

– What communication errors may have occurred to result in Mary misusing her medications?

– What are some of the problems associated with inadequate and incomplete information sharing between health professionals?

– Should all patients be educated about their medications?

– What mechanisms could be put in place to ensure that every attending health professional is aware of the medications being prescribed and taken by patients?

– What is the responsibility of a health professional who prescribes or provides medications to patients?

– What is the responsibility of pharmacists in providing advice regarding the use of OTC drugs? What would the algorithm have to be to maximize the beneficial effect of OTC drugs and minimize potential risks?

Source: Jiri Vlcek, Professor of Clinical Pharmacy and Pharmaceutical Care.
Clinical phartmacists on internal department in teaching hospital in Hradec Kralove
Charles University, Prague, Faculty of Pharmacy, Department of Social & Clinical Pharmacy.

Tools and resource material

WHO patient safety solutions
These are summary documents detailing solutions for patient safety problems. A number of them concern medication issues.

Solution 1 – Look-alike, sound-alike medication names.
Solution 5 – Control of concentrated electrolyte solution.
Solution 6 – Assuring medication accuracy at transitions in care.
Solution 7 – Avoiding catheter and tubing misconnections.
Solution 8 – Single use of injection devices.
These documents are available on the Internet (http://www.who.int/patientsafety/solutions/en/; accessed 21 February 2011).

Other internet references
The Agency for Healthcare Research and Quality (United States Department of Health and Human Services, Rockville, MD) maintains an online case archive that can be used as a source of case studies that may be helpful in your teaching (http://www.webmm.ahrq.gov). Other useful online references include the sites maintained by the Institute for Safe Medication Practices (Horsham, PA) (http://www.ismp.org) and the National Patient Safety Agency (http://www.npsa.nhs.uk).

Educational DVDs
Beyond Blame documentary. This DVD runs for 10 minutes and is a powerful way to engage students in the issue of medication safety. It consists of a doctor, a nurse and a pharmacist

talking about serious medication errors they have been involved in. This DVD is available for purchase through the Institute for Safe Medication Practices (http://www.ismp.org; accessed 21 February 2011).

The WHO *Learning from Error* Workshop includes a DVD depiction of a medication error–the administration of intrathecal vincristine. The DVD illustrates the multifactorial nature of error.

Books

Vicente K. *The human factor*. London, Routledge, 2004:195–229.

Cooper N, Forrest K, Cramp P. *Essential guide to generic skills*. Oxford, Blackwell Publishing Ltd, 2008.

Institute of Medicine. *Preventing medication errors: quality chasm series*. Washington, DC, National Academies Press, 2006 (http://www.iom.edu/?id=35961; accessed 21 February 2011).

Assessing knowledge of this topic

A variety of assessment methods can be used to assess knowledge of medication safety and performance in this area, including:

- MCQ;
- drug calculation quizzes;
- short-answer questions;
- written reflection on a case study involving a medication error, identifying the contributing factors, and considering strategies to prevent recurrence;
- project work with accompanying reflection on learning outcomes of the activity;
- OSCE stations.

OSCE stations might include prescribing/dispensing/administration exercises. These stations can be used to: evaluate students' ability to collect a medication and allergy history; administer a medication, checking the 5 Rs and for allergies; and educate a patient about a new medication.

Note that several of these potential assessment topics are not covered in detail in the accompanying PowerPoint presentation. They are included here as ideas for assessment in the area of medication safety on the assumption that students would have received additional instruction on these particular aspects of medication safety.

Evaluating the teaching of this topic

Evaluation is important in reviewing how a teaching session went and how improvements can be made. See the Teacher's Guide (Part A) for a summary of important evaluation principles.

References

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7. Vira T, Colquhoun M, Etchells E. Reconcilable differences: correcting medication errors at hospital admission and discharge. *Quality & Safety in Health Care*, 2006, 15:122–126.
8. Koppel R, Metlay JP, Cohen A. Role of computerized physician order entry systems in facilitating medication errors. *Journal of the American Medical Association*, 2005, 293:1197–1203.

Slides for Topic 11: Improving medication safety

Didactic lectures are not usually the best way to teach students about patient safety. If a lecture is being considered, it is a good idea to plan for student interaction and discussion during the lecture. Using a case study is one way to generate group discussion. Another way is to ask the students questions about different aspects of health care that will bring out the issues contained in this topic such as the blame culture, the nature of error and how errors are managed in other industries.

The slides for Topic 11 are designed to help the instructor deliver the content of this topic. The slides can be adapted for the local environment and culture. Instructors do not have to use all of the slides and it is best to tailor the slides to the areas being covered in the teaching session.

All drug names used are according to the *WHO International Nonproprietary Names for Pharmaceutical Substances* (http://www.who.int/medicines/services/inn/en/; accessed 24 March 2011).

Annexes

Patient Safety Curriculum Guide: Multi-professional Edition

Annex 1
Link to the Australian Patient Safety Education Framework

The Australian Patient Safety Education Framework has a separate volume containing the literature relied upon to build the Framework. The literature review used a Campbell Collaboration style for reporting the literature. The bibliography is freely available to everybody and will assist teachers developing curricula and in patient safety research.

The accompanying bibliography can also be accessed online at: http://www.safetyandquality.gov.au/internet/safety/publishing.nsf/Content/60134B7E120C2213CA257483000D8460/$File/framewkbibli0705.pdf; accessed 14 March 2011.

Annex 2
Assessment examples

Example 1: Modified essay question
An accident (Topics 6 and 8)

Instructions to the student
A 20-year-old man lost control of his bicycle and fell to the road having been hit by a car that did not stop. He is conscious, but is not able to speak coherently. He may be in shock. You (as a health care-sciences student) slow down as you approach the scene of the accident and a passer-by flags you down and asks you to help.

What three important ethical issues are associated with treating patients in emergencies?

Outline the legal/professional responsibilities in relation to providing assistance in an emergency.

Outline the components of consent for the unconscious patient and conscious patient.

Summarize the challenges of providing leadership in this clinical situation.

Example 2:
Multiple choice question (Topics 4 and 8)

As a student, you have been invited to observe a knee replacement in an elderly female. The day before the operation, you talked to the patient and remembered being told that trouble with her left knee had made it impossible for her to walk and that she was looking forward to having it fixed. In the operating theatre, you hear the surgeon say to his assistant that they are going to be operating on her right knee.

What should you, as a student, do next?

a) Do nothing because you may have confused this patient with another patient.
b) Locate and review the medical records to confirm the side for the knee replacement.
c) Say nothing because you have not asked permission to speak to others about her situation.
d) Say nothing because hospitals never make mistakes and the student probably misheard.
e) Tell the surgeon that you thought that the patient was having her left knee replaced.
f) Keep silent because the surgeon is likely to know what he is doing.

Comments: Everybody has a role in patient safety. Every individual has an obligation to speak up when they think a potential error may be made that might harm a patient. Junior members of health-care teams are important eyes and ears for the team and their contributions can minimize the number of errors in the system. Wrong-site surgery is an important type of adverse event. Most countries have access to clinically-endorsed guidelines to assist the correct identification of patients and site of surgery. These guidelines call for junior members of the team to be appropriately assertive.

Example 3:
OSCE station concerning patient safety (Topics 8 and 6)

Station No.
Patient communication: an adverse event
Instructions to the student

The patient has just come out of routine surgery for the repair of an inguinal hernia. During the operation, the trainee surgeon had some difficulty in undertaking the procedure. The supervising surgeon took over and the operation was reported as being successful. However, there was extensive bruising around the scar site. You have been asked to discuss the patient's concerns with him.

NB: Please remember to hand your identification label to the examiner.

Continuing example 3:
OSCE station concerning patient safety

Station No.
Patient communication: an adverse event

Instructions to the person acting as the patient
Please read your instructions carefully prior to the start of the examination.

You have come into hospital for the emergency removal of your appendix. You were previously fit and well and work as a plumber.

As you were recovering from the anaesthesia, the theatre nurse explained that the training doctor found that the operation through a small incision was more difficult than expected. The consultant surgeon then took over and things went smoothly during a laparotomy.

The scar site is bigger than you expected and is painful, but you have been given some painkillers, which are helping. You are keen to discuss what happened to you in more detail.

Early on, you indicated an interest in making an official complaint about the care you have received.

Continuing example 3:
OSCE station concerning patient safety

Station No.
Patient communication: an adverse event

Instructions to the examiner
Please carefully read the instructions to the student and the simulated patient.

Greet the student and give the written instructions to the student.

Observe the interaction between the student and the simulated patient and complete the mark sheet.

Please do not interact with the student or the simulated patient during or after completion of the task.

The purpose of this station is to assess the student's ability to discuss an adverse event with a patient

Continuing example 3:
OSCE station concerning patient safety

Station No.

ASSESSMENT FORM:
Patient communication: an adverse event

Student name:

.....

.....

Examiner's name:

.....

..... (block capitals)

Greet the student and give the written instructions to the student.

Remember to ask the student for his/her identification label and affix the label to the top of the mark sheet.

Please circle the appropriate mark for each criterion.

In this example the standard expected is that of a final year medical or nursing graduate.

Please circle the appropriate mark for each criteria

	Performed competently	Performed but not fully competent	Not performed or incompetent
Initial approach to the patient (introduces him/herself, explains what he/she will be doing)	2	1	0
Communicates with patients & carers in ways they understand	2	1	0
Demonstrates the principles of "open disclosure"	2	1	0
Ensures patients are supported & cared for after an adverse event	2	1	0
Shows understanding to patients following adverse events	2	1	0
Manages the factors likely to lead to complaints	2	1	0
Total			

Overall rating on station	Clear Pass	Borderline	Clear Fail

Example 4:
Short answer questions

The following questions are part of an assessment for nursing and midwifery, but can apply to medical and dental students.

A patient is undergoing surgery; the case history is part of the examination.

When preparing Mrs McDonald for surgery, you notice her consent form has not been signed.

Q1
Explain your role in ensuring Mrs McDonald's consent has been signed.

Q2
List the elements of a valid consent.

Q3
Identify the ways in which consent can be legally conveyed.

Q4
Mrs McDonald is unsure of when she last ate. Explain the risks associated with not fasting prior to surgery.

Mrs McDonald is transferred back to your ward postoperatively later that same afternoon. Her operation went well. She has a simple adhesive dressing over her wound.

Q5
List three (3) postoperative nursing assessments you would complete on Mrs McDonald and provide a rationale for each assessment.

Q6
What infection control measures would be appropriate for Mrs McDonald?

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Patient Safety Curriculum Guide: Multi-professional Edition

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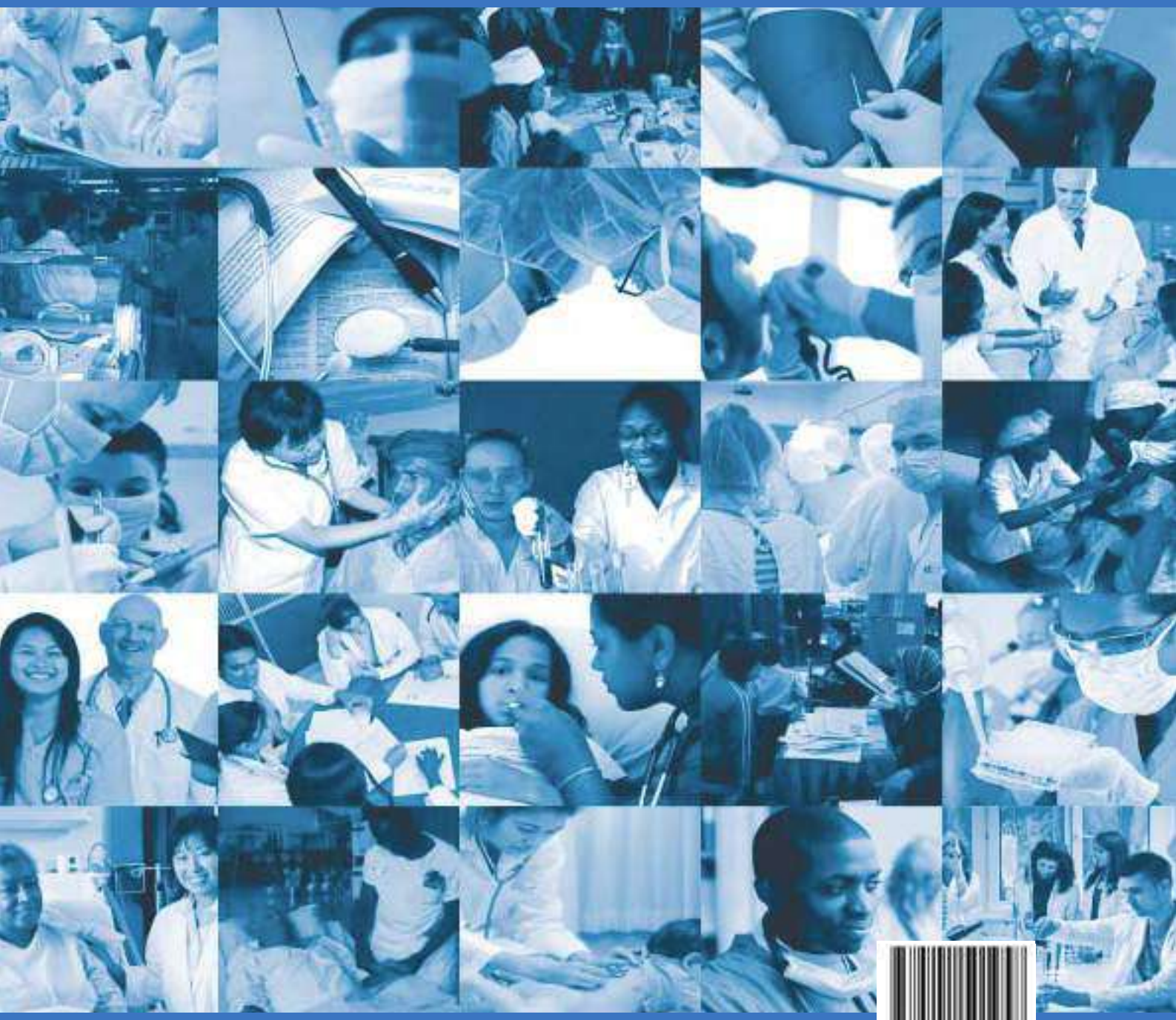

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1/4/22 April

1/4/22	2	Instrament	8:30a qa	Anilama.
		Instrament	3pm 3:30pm	Anilama
2/4/22	2	Instrament	8:30a qa	Anilama.
		Instrament	3pm 3:30pm	Anilama
4/4/22	2	Co Han (Tray)	8:30a qa	Lekha.
		Instrament	3pm 3:30pm	Lekha.
5/4/22	2	Instrament.	8:30a qa	saloaja.
		Instrament	3pm 3:30pm	saloaja.
6/4/22	2	Instrament	8:30a qa	Anilama
		Instrament	3pm 3:30pm	Anilamas
7/4/22	2	Instrament	8:30a qa	saloaja
		Instrament	3pm 3:30pm	saloaja
8/4/22	2	Instrament	8:30a qa	Lekha
		Instrament	3pm 3:30a	Lekha
9/4/22	2	Instrament	8:30a qa	selin
		Instrament	3pm 3:30pm	selin
11/4/22	2	Instrament.	8:30a qa	selin
		Instrament	3pm 3:30pm	selin
12/4/22	2	Instrament	8:30a qa.	Anilama
		Instrament	3pm 3:30pm.	Anilama
13/4/22	2	Co Han (Tray)	8:30a qa	Saloaja
		Instrament	3pm 3:30pm	saloaja
16/4/22	2	Instrament	8:30. qa	Lekha
		Instrament	3:30pm 3:30pm	saloaja
18/4/22	2.	Instrament	8:30 qa.	Anilama
		Instrament	3pm 3:30pm	selin
19/4/22	2	Instrament	8:30 qa.	selin
		Instrament	3pm 3:30pm	Anilama
20/4/22	2	Instrament	8:30a qa.	Anilama.
		Instrament	3pm 3:30pm	selin
21/4/22.	2	Instrament	8:30a qa	selin
		Instrament	3pm 3:30pm	selin
22/4/22	2	Instrament	8:30a qa	selin
		Instrament	3pm 3:30pm	selin.

23/4/22	2	Instrament	8:30a qa	selin
		Instrament	3pm 3:30pm	selin
25/4/22	2	Instrament	8:30a qa	selin
		Instrament	3pm 3:30pm	selin
26/4/22	2	Instrament	8:30a qa	Anilama.
		Instrament	3pm 3:30pm	Anilama
27/4/22	2	Instrament	8:30a qa	Anilama
		Instrament	3pm 3:30pm	Anilama
28/4/22	2	Instrament	8:30a qa	Anilama
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		Instrament	3pm 3:30pm	Anilama

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3/5/22	2	Instrament	8:30a qa	selin
		Instrament	3pm 3:30pm	selin
4/5/22	2	Instrament	8:30a qa	selin
		Instrament	3pm 3:30pm	selin
5/5/22	2	Instrament	8:30a qa	selin
		Instrament	3pm 3:30pm	saloaja
6/5/22	2	Instrament	8:30a qa	saloaja
		Instrament	3pm 3:30pm	saloaja
7/5/22	2	Instrament	8:30a qa	saloaja
		Instrament	3pm 3:30pm	saloaja
9/5/22	2	Instrament	8:30a qa	saloaja
		Instrament	3pm 3:30pm	saloaja.
10/5/22	2	Instrament	8:30a qa	saloaja
		Instrament	3pm 3:30pm	saloaja.

11/5/22	2	instrumentals	8:30 9am Saloon
		"	3pm 3:30pm Saloon
12/5/22	2	instruments	8:30 9am Lekha
		Cotton.	3pm 3:30pm. Lekha
13/5/22	2	instrument	8:30 9am. Lekha
		"	8:30 9am. Lekha
14/5/22	2	Instrumental	8:30 9am Lekha.
		"	3pm 3:30pm Lekha
16/5/22	2	instrument	8:30 9am. Lekha
			8:30 9:30m. Lekha
17/5/22	2	instrumental	8:30 9am Lekha.
		"	8:30 9:30 Anilama.
18/5/22	2	instrumental	8:30 9am Anilama.
		"	8:30 9:30 Anilama
19/5/22	2	instrumental	8:30 9am Anilama.
		"	3:30 9am Anilama.
20/5/22	2	instruments	8:30 9am Anilama.
		"	8:30 3pm Anilama.
21/5/22	2	instruments	8:30 9am Anilama
		cotton.	3:30 9am Anilama.
23/5/22	2	instruments	8:30 9am Anilama.
		"	8:30 3pm Anilama.
24/5/222		instruments	8:30 9am Saloon
		"	3pm 3pm Saloon
25/5/22	2	instruments	8:30 9:30 Saloon
		"	8:30 3pm Saloon
26/5/22	2	instruments	8:30 9am Saloon
		"	3pm 3:30 Saloon
27/5/2022	2	instruments	8:30 – 9am Saloon
			3p – 3:30 Sal.
28/5/2022	2	instruments	8:30 – 9am,
			3 – 3:30
30/5/2022	2	instruments	8:30 – 9am;

30/5/2022	2	instrument-	8:30 – 9am
		" cotton	3pm – 3:30
1/6/2022	2	instrumental	8:30 – 9am
		"	3pm – 3:30
2/6/2022	2	instrumental	8:30 – 9am
		" cotton	3pm – 3:30
3/6/2022	2	instruments	8:30 – 9am
		"	3pm – 3:30
04/6/2022	2	instrumental	8:30 – 9am
		"	3pm – 3:30
6/6/22	2	instrumental	8:30 – 9am
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7/6/2022	2	instrumental	8:30 – 9am
		" cotton	3pm – 3:30
8/6/2022	2	instrumental	8:30 – 9am
		"	3pm – 3:30
9/6/2022	2	instruments	8:30 – 9am
		" cotton	3:30pm – 3:30
10/6/2022	2	instruments	8:30 – 9am
		cotton (Tray)	3pm – 3:30
11/6/2022	2	instrumental	8:30 – 9am
		"	3pm – 3:30
13/6/2022	2	instrumental	8:30 – 9am
		"	3pm – 3:30
14/6/2022	2	instrumental	8:30 – 9am
		" cotton	3pm – 3:30
15/6/2022	2	instrumental	8:30 – 9am
		"	3pm – 3:30
16/6/2022	2	instruments	8:30 to – 9am
		"	3pm to – 3:30
17/6/2022	2	instruments	8:30 to 9am
		cotton	3pm to 3:30
18/6/2022	2	instruments	8:30 to 9am
		"	3:30 to 3:30

20/6/2022	②	Instruments	8.30 - 9.30	Salaja
		"	3pm - 3.30	
21/6/2022	②	instruments	8.30 - 9.30	Ushaa
		"	3.30 - 3.30	
22/6/2022	②	instruments	8.30 - 9.30	Amlama
		"	3.30 - 3.30	
23/6/2022	②	instruments	8.30 - 9.30	Usha
		"	3pm - 3.30	
24/6/2022	②	instruments	8.30 - 3.30	Amlama
		"	3pm - 3.30	
24/6/2022	②	instruments	8.30 - 9.30	Amlama
		"	3pm - 3.30	
25/6/2022	②	Instruments	8.30 - 9 am	Salaja
		Cotton	3pm & 3.30	
27/6/2022	②	Instruments	8.30 to 9 am	Salaja
		"	3pm - 3.30	
28/6/2022		Instruments	8.30 9 am	Amlama
		instrument, cotton	3pm - 3.30	
29/6/2022		instrument	8.30 30pm	Amlama
		" cotton	3.30pm	
30/6/2022		Instrument	8.30 - 9.30	Salaja

1/7/2022	2	instrument	8.30-9.30	Salaja
		"	3pm - 3.30	
2/7/	②	" cotton	8.30 - 9.30	Ushaa
		"	3p - 3.30	
④/7/2022	2	"	8.30 - 9.30	Lalaa
			3 pm - 3.30	
5/7/2022	②	" cotton	8.30 - 9.30	Usha
		"	3 - 3.30	
6/7/	②	Instrument	8.30 - 9.30	Lalaa
		"	3 - 3.30	
7/7/2022	2	instrument, cotton	8.30 - 9.30	Amla
			3 - 3.30	
8/7/2022	②	"	8.30 - 9.30	Lalaa
			3.7 - 3.30	
⑨/7/2022	②	Instrument	8.30 - 9.30	Lalaa
		"	3.6 - 3.30	
11/7/2022	②	instrument	8.30 - 9.30	Usha
		"	3 - 3.30	
12/7/2022	2	instrument	8.30 - 9.30	Salaja
		" cotton	3 - 3.30	
13/7/2022	2	instrument	8.30 - 9.30	Salaja
		" cotton	3p - 3.30	
14/7/2022	2	instrument	8.30 - 9.30	Amla
		" cotton	3 - 3.30 pm	
16/7/2022	2	instrument	8.30 - 9.30	Amlama
		" cotton	3 - 3.30	
18/7/2022	②	instrument	8.30 - 9.30	Salaja
		" cotton	3p - 3.30pm	
19/7/2022	2	instrument	8.30 - 9.30	Amlama
		" cotton	3 - 3.30	
20/7/2022	②	instrument	8.30 - 9.30	Lalaa
		"	3 - 3.30	

21/7/2022	②	Instrument Cotton "	8·30 – 9·30 3. 30 3·30pm	Lebba
22/7/2022	②	Instrument	8·30 – 9·30 3 – 3·30	Balaya
23/7/2022	②	Instrument Cotton	8·30 – 9·30 3 – 3·30	Anlam
25/7/2022	②	Instrument Cotton "	8·30 – 9·30 8 · 3·30	Balaya
26/7/2022	②	Instrument " Cotton	8·30 – 9·30 3 · 3·30	Anlam
27/7/2022	②	Instrument " Cotton	8·30 – 9·30 3. 3·30pm	Lelcha
28/7/2022	②	Instrument Cotton "	8·30 – 9·30 3·30 3·30 pm	Balaya
29/7/2022	②	Instrument "	8·30 – 9·30 3 – 3·30	Balaya
30/7/2022	②	Instrument " Cotton	8·30 – 9·30 3 – 3·30pm	Balaya

Date	Cycle No	Type of material	Start and time	Operator
1/8/2022	②	Instrument " cotton	8·30 – 9am 3 – 3·30 pm	Balaya
2/8/2022	②	Instrument "	8·30 – 9am 3 – 3·30 pm	Anlam
3/8/2022	②	Instrument " Cotton	8·30 – 9am 3. 3·30pm	Lelcha
4/8/2022	②	Instrument " cotton	8·30 – 9am 2pm – 2·30	Lelcha
5/8/2022	②	Instrument "	8·30 – 9am 2pm – 2·30	Balaya
6/8/2022	②	Instrument " cotton	8·30 – 9am 3. 3pm	Anlam
8/8/	②	Instrument " cotton	8·30 – 9am 3 – 30pm	Balaya
9/8.	②	Instrument "	8·30 – 9am 3. 30pm	Balya
10/8	②	Instrument "	8·30 – 9am 3·30 · Balaya	
11/8		Instrument "	8·30 – 9 · 3·30	Anlamo
12/8		Instrument "	8·30 – 9 · 3·30pm	Lelcha
13/8		Instrument "	8·30 – 9 3 · 30	Balaya
~~16/8~~ 16/8		Instrument " cotton	8·30 · 9 3·3pm	Anlam
17/8/2022		Instrument "	8·30 – 9 3·30 ·	Lelcha
18/8		Instrument "	8·30 – 9 · 3·30	Balaya

19/8/2022	②	Instruments	8.30-9	Salogi
		" cotton	3.30pm	
20/8/	②	Instruments	8.30-9	Ukke.
		"	3.30pm	
22/8/	②	Instrument	8.30-9.	
		"	3.30pm	Amlama.
23/8/	②	Instrument	8.30-9	
		"	3.30pm	Amlama
24/8.	②	Instrument	8.30 to 9.	
		" cotton	3.30.	Lekha
25/8/22	②	Instrument	8.30-9.	
		"	8.30	Salogi.
26/8/2022	2	Instruments	8.30-9	
		"	3.30	Ukka.
27/8/2022	2	Instrument	8.30-9.	
		"	3.30	Amlama.
29/8/	2.	Instruments	8.30-9.	
		" cotton	3.30pm	Salogi.
30/8/2022	2	Instruments	8.30-9	
		"	3.30pm	Lekha.
31/8/2022	2	Instruments	8.30-9.	
		"	3.30pm	Lekha.

1/9/2022	2.	Instruments	8.30-9	
		" cotton	3.30	Salogi
2/9/	2	Instruments	8.30-9	
		" cotton	3.30.	Amlama.
3/9/	2.	Instruments	8.30-9.	
		"	3.30.	Lekha.
5/9/	2	Instruments	8.30-9.	
		"	3.30-	Amlama.
6/9	2	Instruments	8.30-9	
		"	3.30	Lekha
7/9.	2.	Instruments	8.30-9-	
		"	3.30.	Amlama
9/9.	2.	Instruments	8.30-9	
		"	3.30.	Lekha
10/9.	2.	Instruments	8.30-9	
		" cotton	3.30.	Amlama
12/9	2.	Instruments	8.30-9	
		"	3.30	Lekha.
13/9	2.	Instruments	8.30-9	
		"	3.30.	Lekha.
14/9.	2	Instruments	8.30-9.	
		"	8.30. 9pm	Salogi.
15/9.	2.	Instruments	8.30-9	
		" cotton	3.330	Amlama
16/9	2	Instruments	8.30-9	
		"	3.30pm	Salogi
17/9.	2	Instrument	8.30am 9am.	Amlama.
		"	3.30pm	Amlama.
19/9.	2	Instrument	8.30am 9am	Amlama
		"	3.30pm	Amlama
21/9.	2	Instrument	8.30am 9am	Amlama.
		"	3.30pm	Amlama.
22/9.	2	Instrument	8.30-9am	Amlama
		"	3.30pm	Amlama.

23/9.	2	Instrument II	8·30a 9a 3·30pm.	Anilam Anilam.
24/9.	2	Instrument II	8·30a 9a 3·30 pm	Celkha. Celkha.
26/9.	2	Instrument Cotton	8·30a 9a 3·30 pm	Lekha Celkha
27/9.	2	Instrument II	8·30a 9a 3·30pm	Celkha Celkha.
28/9.	2	Instrament Cotton	8·30a 9a 3·30 pm	Celkha Celkha
29/9.	2	Instrument II	8·30a 9a 3·30 pm	Saloon. Saloon
30/9.	2	Instrument II	8·30a 9a 3·30 pm	Saloon Saloon.

October

1/10/22	2	Instrument II	8pm	8·330a 3·30pm	Anilama Anilama
3/10/22	2	Instrament II	8·30a	9a 3·30pm	Anilama Anilama.
4/10/22	2	Instrament II	9·a	9·30a 3·30pm	Celkha Celkha.
5/10/22	2	Instrament II	9a	9·30a 3·30pm	Saloon Saloon.
6/10/22	2	Instrament II	9a	9·30a 3·30pm	Anilama Anilama
7/10/22	2	Instrament II	9a	9·30a 3·30pm	Anilama. Anilama.
8/10/22	2	Instrament II	9a	9·30a 3 pm	Anilama Anilama
10/10/22	2	Instrament II	9a	9·3a 3 pm	Anilama Anilama.
11/10/22	2	Instrament II	9·a	9·30a 3 pm	Lekha. Lekha.
12/10/22	2	Instrament II	9a	9·30a 3pm	Lekha. Lekha.
13/10/22	2	Instrament II	9a	9·30a 3 pm	Lekha Lekha
14/10/22	2	Instrament II	9a	9·30a 3 pm	Lekha Lekha
15/10/22	2	Instrament II	9a	9·30a 3 pm	Saloon Saloon
17/10/22	2	Instrament II	9a	9·30a 3 pm	Saloon Saloon.
18/10/22	2	Instrament II	9a	9·30a 3 pm	Selim Selim
19/10/22	2	Instrament II	9a	9·30a 3 pm	Selim Selim
20/10/22	2	Instrumen	9a	9·30a	Selim

21/10/22	2	Instrument	9am	9.30m	Celche
		"		3pm	Celche
22/10/22	2	Instrument	9am	9.30m	Amlane
		"		3pm	Amlane
25/10/22	2	Instrument	9am	9.30m	Amlane
		"	~~8.30am~~	3pm	Amlane
26/10/22	2	Instrument	8.30m	9am	Celche
		"		3pm	Celche
27/10/22	2	Instrument	8.30m	9am	Celche
		Cotton.		3pm	celche.
28/10/22	2	Instrument	9am	9.30m	Swoop
		"		3pm	Swoop
29/10/22	2	Instrument	8.30m	9am	Swoop
		"		3pm	Swoop.
31/10/22	2	Instrument	9am	9.30m	selin
		Cotton		3.pm.	selin.

1/11/22	2	Instrument	8.30m	9am	Amlane
		"	3pm	3.30pm	Amlane
2/11/22	2	Instrument	8.30m	9am	Celche
		"	3pm	3.30pm	Celche
3/11/22	2	Instrument	8.30m	9am	Swoop
		"	8.pm	3.30pm	Swoop
4/11/22	2	Instrument	8.30m	9am	Swoop
		cotton	3pm	3.30pm	Amlane
5/11/22	2	Instrument	9am	9.30m	Amlane
		cotton	3pm	3.30pm	selin
7/11/22	2	Instrument	9am	9.30m	Selin
		"	3pm	3.30pm	Selin
8/11/22	2	Instrument	9am	9.30m	Amlane
		"	3pm	3.30pm	Amlane
9/11/22	2	Instrument	9am	9.30m	Amlane
		"	3pm	3.30pm	Amlane
10/11/22	2	Instrument	9am	9.30m	Amlane
		"	3pm	3.30pm	Amlane
11/11/22	2	Instrument	8.30m	9am	Amlane
		"	3pm	3.30pm	Amlane
12/4/22	2	Instrument	8.30m	9am	Amlane.
		Instrument	3pm	3.30pm	Amlane.
14/11/22	2	Instrument	8.30m	9am	Celche
		"	3pm	3.30pm	Celche
15/11/22	2	Instrument	8.30m	9am	Celche
		Cotton.	3pm	3.30pm	Celche.
16/4/22	2	Instrument	8.30m	9am	Celche
		Cotton	3pm	3.30pm	Celche
17/11/22	2	Instrument	9am	9.30m	Celche
		"	8pm	3.30pm	Celche.
18/11/22	2	Instrument	8.30m	9am	Celche.
		"	3pm	3.30pm	Celche
19/11/22	2	Instrument	8.30m	9am	Celche
		Instrument.	3pm	3.30pm	Celche

21/11/22	2	Instrament	9 am	9·30 am	Sulooja
		〃	3 Pm	3·30	Sulooja
22/11/22	2	Co Hon	9 am	9·30	Leela
		Instrament	3 pm	3·30	Leela
23/11/22	2	Co Hon	9 am	9·30	Leela
		Co Hon	3 pm	3·30 Pm	Anila
24/11/22	2	Instrament	9 am	9·30	Anila
		Instrament	3 pm	3·30 Pm	Anila
25/11/22	2	Instrament	9 am	9·30	Anila
		Instrament	3 pm	3·30 Pm	Sreeja
26/11/22	2	Instrament	9 am	9·30	Sreeja
		Instrament	3 pm	3·30 Pm	Sreeja
28/11/22	2	Instrament	9 am	9·30	Leela
		Instrament	3 pm	3·30 pm	Anila
29/11/22	2	Instrament	9 am	9·30 Pm	Sujatha
		Instrament	3 pm	3·30 Pm	Leela
30/11/22	2	Instrament	9 am	9·30 am	Seeja
		Instrament	3 pm	3·30 Pm	Anila

1/12/22	2	Instrament	9 am	9·30	Anila
		Co Hon	3 pm	3·30 Pm	Anila
2/12/22	2	Instrament	9 am	9·30	Sulooja
		Instrament	3 pm	3·30 Pm	Sulooja
3/12/22	2	Instrament	9 am	9·30	Sulooja
		Instrament	3 pm	3·30 pm	Sulooja
5/12/22	2	Instrament	9 am	9·30 am	Leela
		Instrament	3 pm	3·30 Pm	Leela
6/12/22	2	Instrament	9 am	9·30	Leela
		Instrament	3 pm	3·30 Pm	Leela
7/12/22	2	Instrament	8·30 am	9 a	Anila
		Instrament	3 pm	3·30 pm	Anila
8/12/22	2	Instrament	8·30 a	9 a	Anila
		Instrament	3 pm	3·30 pm	Anila
9/12/22	2	Co Hon	9 am	9·30	Anila
		Instrament	8 am	8·30	Anila
10/12/22	2	Co Hon	3 pm	3·30 Pm	Leela
		Instrament	3 pm	3·30	Leela
12/12/22	2	Instrament	9 am	9·30	Leela
		Instrament	3 pm	3·30 pm	Leela
13/12/22	2	Instrament	9 am	9·30 am	Leela
		Instrament	3 pm	3·30 Pm	Sulooja
14/12/22	2	Instrament	8·30 a	9 am	Sulooja
		Instrament	3 pm	3·30 Pm	Sulooja
15/12/22	2	Instrament	8·30 a	9 a	Leela
		Instrament	3 pm	3·30 Pm	Leela
16/12/22	2	Instrament	8·30 a	9 am	Anila
		Instrament	3 pm	3·30 pm	Anila
17/12/22	2	Instrament	8·30 a	9 am	Anila
		Instrament	3 pm	3·30 Pm	Anila
19/12/22	2	Instrament	8·30 am	9 am	Anila
20/12/22	2	Instrament	8·30 am	9 am	
		〃	3 pm	3·30 Pm	

21/12/22	2.	Instraments	8.30 am	9 am
	2	"	8 pm	3.30 pm
22/12/22	2	Instraments.	8.33 am	9.3 am
		"	3.5 pm	3.35 pm
23/12/22	2	Instraments	8.30 am	9.30 am
		"	3.5 pm	3.35 pm
24/12/22	2	Instraments.	8. am	8.30 am
		"	3.pm	3.30 pm
26/12/22	2	Instraments.	8.am	9 pm
		"	3 pm	3.30 pm
27/12/22	2	Instraments.	8.3 am	8.33 am
		"	3.pm	3.30 pm
28/12/22	2	Instraments.	8 am	8.30 am
		"	3 pm	3.30 pm
29/12/22.	2	Instraments.	8 am	8.30 am
		"	3 pm	3.30 pm
30/12/22	2.	Instraments.	8 am	8.30 am
		"	3 pm	3.30 pm
31/12/22.	2.	Instraments.	8 am	8.30 am
		"	3 pm	3.30 pm
2/1/23	2.	Instraments.	8 am	8.30 pm
		"	3 pm	3.30 pm
3/1/23	2.	Instraments.	8 am	8.30 pm
		"	3 pm	3.30 pm
4/1/23	2.	Instraments.	8 am	8.30 pm
		"	3 pm	3.30 pm
5/1/23	2.	Instraments.	8 am	8.30 pm
		"	3 pm	3.30 pm
6/1/23	2.	Instraments.	8 am	8.30 pm
		"	3 pm	3.30 pm
7/1/23	2.	Instraments.	8 am	8.30 pm
		"	3 pm	3.30 pm
8/1/23	2.	Instraments.	8 am	8.30 pm
		"	3 pm	3.30 pm

2	Instraments	8.30 am	9 am
		3.5 pm	3.35 pm
2	Instraments	8.30 am	9 am
		3.5 pm	3.35 pm
2	Instraments	8.30 am	9 am
		3 pm	3.30 pm
2	Instraments	8 am	8.30 am
		3 pm	3.30 pm
2	Instraments	8 am	8.30 am
		3 pm	3.30 pm
2	Instraments	8 am	8.30 am
		3 pm	3.30 pm
2	Instraments	8 am	8.30 am
		3 pm	3.30 pm
2	Instraments	8 am	8.30 am
		3 pm	33.0 pm
2	Instraments	8 am	8.30 am
		3 pm	3.30 pm
2	Instraments	8 am	8.30 am
		3 pm	3.30 pm
2	Instraments	8 am	8.30 am
		3 pm	3.30 pm
2	Instraments	8 am	8.30 am
		3 pm	3.30 pm
2	Instraments	8.10 am	8.40 am
		3.10 pm	3.40 pm
2	Instraments	8.5 am	8.35 am
		3.5 pm	3.35 pm
2	Instraments	8 am	8.30 am
		3 pm	3.30 pm
2	Instraments	8 am	8.30 am
		3 pm	3.30 pm
2	Instraments.	8 am	8.30 am
		3 pm	3.30 pm

10/1/23	2	Instraments	8am	8:30pm
			8Pm	8:30pm
11/1/28	2	Instraments	8am	8:30am
			3Pm.	3:30pm.
12/1/23	2	Instraments	8:10am	8:40pm
			3pm	3:30pm
10/1/23	2	Instraments	8:10am	8:40am
			3pm	3:30pm
14/1/23	2	Instraments	8:10am	8:40am
			3pm	3:30pm
16/1/23	2	Instraments.	8am	8:30am
			3pm	3:30pm
17/1/23	2	Instraments	8:5am	8:35am
			3:5pm	3:35pm
12/1/23	2	Instraments	8:5am	8:35am
			3:pm	3:30pm
19/1/23	2	Instraments	8:5am	8:35am
			3:pm	3:30pm
20/1/23	2	Instraments.	8:10am	8:40
			3:5pm	3:35pm
22/1/23	2	Instraments	8am	8:30am
			3pm	3:30pm
24/1/23	2	Instraments	8am	8:30am
			3pm	3:3pm
25/1/23	2	Instraments	8am	8:30am
			3pm	3:30pm
27/1/23.	2	Instraments	8am	8:30am
			3 pm	3:30pm
28/1/23	2	Instraments	8am	8:30am
			3pm	3:30pm
30/1/23	2	Instraments	8am	8:30am
			3pm	3:30pm

February 2023.

1/2/23	2	Instraments	8am	8:30am Saloojs
			3pm	3:30pm Saloojs
2/2/23	2	Instraments	8:5am	8:35am Rosamma
			3pm	3:30pm Rosamma
3/2/23	2	Instraments	8:10am	8:40am Anila
			3pm	3:30pm Anila
4/2/23	2	Instraments	8am	8:30am Saloojs
			3pm	3:30pm Rosamma
6/2/23	2	Instraments	8am	8:30am Rosamma
			3pm	3:30pm Anila
7/2/23	2	Instraments	8am	8:30am Anila
			3pm	3:30pm Anila.
8/2/23	2	Instraments	8:10am	8:40am Rosamma
			8:5pm	3:35pm Rosamma
9/2/23	2	Instraments	8:10am	8:40pm Rosamma
			3:pm	3:30pm Anila
10/2/23	2	Instraments	8am	8:30am Anila
			3pm	3:30pm Rosamma
11/2/23	2	Instraments	8am	8:30am Rosamma
			3pm	3:30pm Saloojs
13/2/23	2	Instraments	8am	8:30am Rosamma
			3pm	3:30pm Rosamma
14/2/23	2	Instraments	8am	8:30am Anila.
			3pm	3:30pm Rosamma
15/2/23	2	Instraments	8am	8:30am Anila
			3pm	3:30pm Anila
16/2/23	2	Instraments	8am	8:30am Rosamma
			3pm	3:30pm Saloojs
17/2/23	2	Instraments	8:30am	9:30am Rosamma
			3pm	3:30pm Rosamma
18/2/23	2	Instraments	8am	8:30am Rosamma
			3pm	3:30pm Anila
20/2/23	2.	Instraments.	8:10am	8:40am Anila

10/1/23	2	Instraments	8am	8.30pm
			8pm	8.30pm
11/1/23	2	Instraments	8am	8.30am
			3pm.	3.30pm.
12/1/23	2	Instraments	8.10am	8.40pm
			3pm	3.30pm
10/1/23	2	Instraments	8.10am	8.40am
			3pm	3.30pm
14/1/23	2	Instraments	8.10am	8.40am
			3pm	3.30pm
16/1/23	2	Instraments.	8am	8.30am
			3pm	3.30pm
17/1/23	2	Instraments	8.5am	8.35am
			3.5pm	3.35pm
18/1/23	2	Instraments	8.5am	8.35am
			3.pm	3.30pm
19/1/23	2	Instraments	8.5am	8.35am
			3.pm	3.30pm
20/1/23	2	Instraments.	8.10pm	8.40am
			3.5pm	3.35pm
23/1/23	2	Instraments	8am	8.30am
			3pm	8.30pm
24/1/23	2	Instraments	8am	8.30am
			3pm	3.3pm
25/1/23	2	Instraments	8am	8.30pm
			3pm	3.30pm
27/1/23.	2	Instraments	8am	8.30am
			3 pm	3.30pm
28/1/23	2	Instraments	8am	8.30am
			3pm	3.30pm
30/1/23	2	Instraments	8am	8.30
			8pm	3.30pm
31/1/23	2	Instraments	8am	8.30am
			3pm	3.30pm

1/2/23	2	Instraments	8am	8.30am Saloja
			3pm	3.30pm Saloja
2/2/23	2	Instraments	8.5am	8.35am Rosamma
			3pm	3.30pm Rosamma
3/2/23	2	Instraments	8.10am	8.40am Anila
			3pm	3.30pm Anila
4/2/23	2	Instraments	8am	8.30am Saloja
			3pm	3.30pm Rosamma
6/2/23	2	Instraments	8am	8.30am Rosamma
			3pm	3.30pm Anila
7/2/23	2	Instraments	8am	8.30am Anila
			3pm	3.30pm Anila.
8/2/23	2	Instraments	8.10am	8.40am Rosamma
			3.5pm	3.35pm Rosamma
9/2/23	2	Instraments	8.10am	8.40am Rosamma
			3.pm	3.30pm Anila
10/2/23	2	Instraments	8am	8.30am Anila
			3pm	3.30pm Rosamma
11/2/23	2	Instraments	8am	8.30am Rosamma
			3pm	3.30pm Saloja
13/2/23	2	Instraments	8am	8.35am Rosamma
			3pm	3.30pm Rosamma
14/2/23	2	Instraments	8am	8.30am Anila.
			3pm	3.30pm Rosamma
15/2/23	2	Instraments	8am	8.35am Anila
			3pm	3.30pm Anila
16/2/23	2	Instraments	8am	8.30am Rosamma
			3pm	3.30pm Saloja
17/2/23	2	Instraments	8.30am	9.30am Rosamma
			3pm	3.30pm Rosamma
18/2/23	2	Instraments	8am	8.30am Rosamma
			3pm	3.30pm Anila
20/2/23	2	Instraments.	8.10am	8.40am Anila
			3pm	3.30pm Rosamma

21/2/23	2.	Instraments	8am	8.30am Rosanna.
			3pm	8.30pm Rosanna
22/2/23	2.	Instraments	8.5am	8.35am Rosanna.
			3pm	3.30pm Anila
23/2/23	2.	Instraments	8.5am	8.35am Anila
			3pm	3.30pm Saloojas
24/2/23	2.	Instraments	8.5am	8.35am Anila
			3pm	3.30pm Rosanna
25/2/23	2	Instraments.	8.5am	8.35am Rosanna
			3pm	3.30pm Anila
27/2/23	2.	Instraments.	8.5am	8.35am Rosanna.
			3pm	3.30pm Rosanna
28/2/23	2.	Instraments.	8am	8.30am Anila.
			3pm	3.30pm Anila.

March - 2023

1/3/23	2	Instraments	8am	8.30pm Saloojas
			3pm	3.30pm Anila
2/3/23	2	Instraments	8.5am	8.35am Saloojas
			3pm	3.30pm Rosanna.
3/3/23	2	Instraments	8.5am	8.35am Rosanna
			3pm	3.30pm Anila
4/3/23	2	Instraments	8.5am	8.35am Anila.
			3pm	3.30pm Rosanna
5/3/23	2	Instraments	8.5am	8.35am Rosanna
			3pm	3.30pm Saloojas
6/3/23	2	Instraments	8.10am	8.40am Saloojas
			3pm	3.30pm Rosanna
7/3/23	2	Instraments	8.10am	8.40am Rosanna.
			3pm	3.30pm Saloojas
8/3/23.	2	Instraments	8.10am	8.40am Anila
			3pm	3.30pm Anila.

9/3/23	2	Instraments	8am	8.30pm Anila
			3pm	3.30pm Anila.
10/3/23	2	Instraments	8.am	8.30am Saloojas
			3pm	3.30pm Saloojas
11/3/23	2	Instraments. Cottan	8am	8.30am Rosanna
			3pm	3.30pm Rosanna.
13/3/23	2	Instraments Cottan	8am	8.30am Rosanna
			3pm	3.30pm Rosanna.
14/3/23	2	Instraments	8am	8.30am Anila.
			3pm	3.30pm Saloojas
15/3/23	2	Instraments	8am	8.30pm Anila.
			3pm	3.30pm Saloojas
16/3/23	2	Instraments	8am	8.30pm Rosanna
			3pm	3.30pm Rosanna.
17/3/23	2	Instraments	8am	8.30am Anila.
			3.pm	8.30pm Anila.
18/3/23	2	Instraments	8am	8.30am Saloojas
			8pm	3.30pm Saloojas.
20/3/23	2	Instraments	8am	8.30am Anila
			3pm	3.30pm Anila
21/3/23	2	Instraments	8am	8.30am Rosanna
			3pm	3.30pm Rosanna.
22/3/23	2	Instraments	8am	8.30am Rosanna
			3pm	3.30pm Rosanna
23/3/23	2	Instraments	8am	8.30am Anila.
			3pm	3.30pm Anila
24/3/23	2	Instraments	8am	8.30am Saloojas
			3pm	3.30pm Saloojas
25/3/23	2	Instraments	8am	8.30am Anila
			3pm	3.30pm Anila.
27/3/23	2	Instraments	8am	8.30am Rosanna
			3pm	3.30pm Rosanna
28/3/23.	2.	Instraments Cottan	8am	8.30am Anila
			3pm	3.30pm Anila.

29/3/23	2	Instraments	8am 8.30am	Rosanna
			3pm 3.30pm	Rosanna.
30/3/23	2	Instraments	8am 8pm	Anila
			3pm 3.30pm	Anila
31/3/23	2	Instraments	8.5am 8.35am	Saloojo
			8pm 3.30pm	Saloojo

April 2023

1/4/23	2	Instraments	8am 8.30am	Rosanna
			3pm 3.30pm	Rosanna
3/4/23	2	Instraments	8am 8.30am	Anila
			3pm 3.30pm	Anila
4/4/23	2	Instraments	8am 8.30am	Rosanna
			3pm 3.30pm	Rosanna
5/4/23	2	Instraments	8am 8.30am	Anila
			3pm 3.30pm	Anila
8/4/23	2	Instraments	8am 8.30am	Saloojo
			3pm 3.30pm	Saloojo
10/4/23	2	Instraments	8am 8.30am	Anila
			3pm 3.30pm	Anila
11/4/23	2	Instraments	8am 8.30am	Rosanna
			3pm 3.30pm	Rosanna
12/4/23	2	Instraments	8am 8.30am	Anila
			3pm 3.3pm	Anila
13/4/23	2	Instraments	8am 8.30am	Rosanna
			3pm 3.30pm	Rosanna
14/4/23	2	Instraments	8am 8.30am	Rosanna
			3pm 3.30pm	Saloojo
15/4/23	2	Instraments	8am 8.30am	Saloojo
			3pm 3.30pm	Anila
17/4/23	2	Instraments	8.10am 8.40am	Anila
			3pm 3.30pm	Rosanna
18/4/23	2	Instraments.	8am 8.30am	Rosanna
			3pm 3.30pm	Anila

19/4/23	2	Instraments	8.10am 8.40am	Anila
			3pm 3.30pm	Rosanna
20/4/23	2	Instraments	8.5am 8.35am	Saloojo
			8pm 8.30pm	Anila
22/4/23	2	Instraments	8am 8.35am	Rosanna
			8pm 8.30pm	Rosanna
24/4/23	2	Instrameats	8am 8.30am	Saloojo
			8pm 8.30pm	Rosanna
25/4/23	2	Instraments	8am 8.30am	Anila
			8pm 8.30pm	Rosanna.
26/4/23	2	Instraments	8am 8.30am	Rosanna
			3pm 3.30pm	Saloojo.
27/4/23	2	Instraments Cottan	8.10am 8.40am	Anila
			3.85pm 3.85pm	Saloojo.
28/4/23	2	Instraments. Cottan	8.5am 8.35am	Rosanna.
			3.5pm 3.35pm	Anila.
29/4/23	2	Instraments. Cottan	8am 8.30am	Saloojo
			3.pm 8.30pm	Rosanna.

May .2023.

2/5/23	2	Instraments & Cotten	8am 8.30am	Anila
			8pm 3.30pm	Saloojo.
3/5/23	2	Instraments & Tray	8am 8.30am	Rosanna.
			8pm 3.30pm	Saloojo
4/5/23	2	Instraments & Cotten	8am 8.30am	Rosanna
			8pm 3.30pm	Saloojo.
5/5/23	2	Instraments & Cottan	8am 8.30am	Anila.
			8pm 3.30pm	Rosanna.
6/5/23	2	Instraments	8am 8.30am	Anila
			8pm 3.30pm	Saloojo
8/5/23	2	Instraments	8.5am 8.35am	Rosanna
			8.10am 3.40pm	Anila.
9/5/23	2	Instraments & Cottan	8.5am 8.35am	Saloojo
			3.5pm 3.35pm	Rosanna.

10/5/23	2	Instraments & Cotton	8am	8.30am	Saloojs
			8pm	3.30pm	Anila
11/5/23	2	Instraments, Cotton	8am	8.30am	Rosamma
			3pm	3.30pm	Saloojs
12/5/23	2	Instraments & Cotton	8.5am	8.35	Anila
			3pm	3.30pm	Rosamma
13/5/23	2	Instraments & Tray	8.5am	8.35	Saloojs
			3pm	3.30	Anila
15/5/23	2	Instraments & Tray	8.10	8.40	Rosamma
			3pm	3.30	Saloojs
16/5/23	2	Instraments & Tray	8am	8.30am	Anila
			3.5pm	3.35pm	Rosamma
17/5/23	2	Instraments & Tray	8am	8.30am	Saloojs
			3.5pm	3.35pm	Anila
18/5/23	2	Instraments & Cottan	8am	8.30am	Rosamma
			3pm	3.30pm	Saloojs
19/5/23	2	Instraments & Cottan	8am	8.30am	Anila
			3pm	3.30pm	Rosamma
20/5/23	2	Instraments & Tray	8am	8.30am	Saloojs
			3.5pm	3.35pm	Anila

June 2023

1/6/23	2	Instraments & Cottan	8am	8.30pm	Anila
			3.5pm	3.35pm	Rosamma
2/6/23	2	Instraments & Tray	8.5am	8.35pm	Saloojs
			3.pm	3.30pm	Rosamma
8/6/23	2	Instraments & Cottan	8am	8.30pm	Anila
			3pm	3.30pm	Rosamma
5/6/23	2	Instraments & Cottan	8am	8.30am	Anila
			3pm	3.30pm	Rosamma
6/6/23	2	Instraments & Tray	8am	8.30pm	Saloojs
			3pm	3.30pm	Anila
7/6/25	2	Instraments & Cottan	8am	8.30am	Rosamma
			3pm	3.30pm	Saloojs

8/6/23	2	Instraments & Cottan	8am	8.30pm	Rosamma
		"	3pm	3.30pm	Anila
9/6/23	2	Instraments & Tray	8.5am	8.35am	Rosamma
		"	3.5pm	3.35pm	Saloojs
10/6/23	2	Instraments & Tray	8.10am	8.40am	Anila
		"	3pm	3.30pm	Saloojs
12/6/23	2	Instraments & Cotton	8am	8.30am	Rosamma
		"	3pm	3.30pm	Saloojs
13/6/23	2	Instraments & Tray	8am	8.10am	Anila
		"	8pm	3.30pm	Saloojs
14/6/23	2	Instraments & Cotton	8am	8.30pm	Rosamma
		"	3.5pm	3.35pm	Saloojs
15/6/23	2	Instraments	8am	8.30am	Anila
		"	3pm	3.30pm	Saloojs
16/6/23	2	Instraments	8am	8.30am	Rosamma
		"	3.5pm	3.35pm	Saloojs
17/6/23	2	Instraments	8am	8.30am	Anila
		"	3.5pm	3.35pm	Rosamma
19/6/23	2	Instraments	8.10am	8.40pm	Anila
		"	3pm	3.30pm	Saloojs
20/6/23	2	Instraments & Tray	8.10am	8.40pm	Rosamma
		"	3pm	3.30pm	Saloojs
21/6/23	2	Instraments & Tray	8.5am	8.35am	Anila
		"	3pm	3.30pm	Saloojs
22/6/23	2	Instraments & Cottan	8am	8.30am	Rosamma
		"	3.5pm	3.30pm	Anila
23/6/23	2	Instraments & Tray	8.10am	8.40am	Rosamma
		"	8pm	3.30pm	Saloojs
24/6/23	2	Instraments & Cottan	8am	8.30am	Anila
		"	3pm	3.30pm	Rosamma
26/6/23	2	Instraments & Tray	8am	8.30am	Anila
		"	3pm	3.30pm	Rosamma
27/6/23	2	Instraments & Tray	8am	8.30am	Saloojs
		"	3pm	3.30	Anila

28/6/23	2	Instraments & Cottan	8 am	8.30 am	Rosanna
		"	3 pm	3.30 pm	Saloojo
29/6/23	2	Instraments & Tray.	8.30 am	9 am	Anila.
			3 pm	3.30 pm	Saloojo.
30/6/23	2	Instraments & Cottan.	8 am	8.30 am	Anila
		"	3 pm	3.30 pm	Rosanna

July 2023.

1/7/23	2	Instraments & Cotten.	8. am	8.30 am	Saloojo
		"	3 pm	3.30 pm	Rosanna
4/7/23	2	Instraments & Tray.	8 am	8.30 am	Anila
		"	3.5 pm	3.35 pm	Saloojo
5/7/23	2	Instraments & Cottan.	8.5 am	8.35 am	Rosanna
		"	3 pm.	3.30 pm	Saloojo.
6/7/23	2	Instraments & Cottan.	8 am	8.30 am	Anila.
		"	8 pm	8.5 pm	Saloojo.
7/7/23	2	Instraments & Tray.	8 am	8.30 am	Rosanna
		"	8 pm.	3.30 pm	Anila.
8/7/23	2	Instraments & Cotten.	8.5 am	9.10 am	Saloojo
		"	3.5 pm	3.35 pm	Rosanna.
10/7/23	2	Instraments & cotten.	8. am	8.30 am	Anila.
		"	3 pm.	3.30 pm	Saloojo
11/7/23	2	Instraments & Tray..	8 am	8.5 am	Rosanna
		"	3.30 am	3.40 pm	Anila
12/7/23	2	Instraments & Cottan.	8 am	8.30 am	Rosanna
		"	3 pm	3.30 am	Anila
13/7/23	2	Instraments & Tray	8. am	8.30 am	Rosanna
		"	3 pm	3.30 pm	Saloojo
14/7/23	2	Instraments & Cotten	8 am	8.30 pm	Anila
		"	8 pm	8.30 pm	Saloojo
17/7/23	2	Instraments & Tray	8 am	8.30 am	Rosanna
		"	3 pm	3.30 pm	Anila

19/7/23	2	Instraments & Tray.	8 am	8.30 am	Anila.
		"	3 pm	3.30 am	Rosanna
20/7/23	2	Instraments & Cotten	8 am	8.30 am	Anila.
		"	3 pm	3.30 pm	Saloojo
21/7/23	2	Instraments & Tray.	8 am	8.30 am	Rosanna
		"	3 pm	3.30 pm	Anila.
22/7/23	2	Instraments & Tray.	8.5 am	8.35 am	Saloojo
		"	3 pm	3.30 pm	Rosanna
24/7/23	2	Instraments & Cotten	8 am	8.30 am	Anila
		"	3.5 pm	3.35 pm	Saloojo
25/7/23	2	Instraments & Tray	8 am	8.30 am	Rosanna
		"	3 pm	3.30 pm	Anila
26/7/23	2	Instraments & Cotten	8 am	8.30 am	Saloojo
		"	3 pm	3.30 pm	Rosanna
27/7/23	2	Instraments & Cotten	8.10 am	8.40 am	Anila.
		"	3 pm	3.30 am	Saloojo
28/7/23	2	Instraments & Cotten	8.5 am	8.35 am	Rosanna
		"	3 pm	3.35 pm	Anila
29/7/23	2	Instraments & Cotten	8 am	8.30 am	Saloojo
		"	3 pm	3.30 pm	Rosanna
31/7/23	2	Instraments & Cotten	8 am	8.30 am	Anila
		"	3.5 pm	3.35 pm	Saloojo

August 2023.

1/8/23	2	Instraments & Tray	8 am	8.30 am	Rosanna
		"	3 pm	3.30	Anila.
2/8/23	2	Instraments. & Cotten	8.10	8.40	Saloojo
		"	8 pm	8.3 pm	Rosanna
3/8/23	2	Instraments & Tray	8.20	8.50	Anila
		"	3 pm	3.30	Saloojo
4/8/23	2	Instraments & Cotten	8 am	8.30 am	Rosanna
		"	3 pm	3.30	Anila

28/6/23	2	Instraments & Cottan	8 am	8.30 am	Rosanna
		"	3 pm	3.30 pm	Saloojs
29/6/23	2	Instraments & Tray.	8.30 am	9 am	Anila.
			3 pm	3.30 pm	Saloojs.
30/6/23	2.	Instraments & Cottan.	8 am	8.30 am	Anila
		"	3 pm	3.30 pm	Rosanna

July. 2023.

1/7/23	2	Instraments & Cotten.	8. am	8.30 am	Saloojs
		"	3 pm	3.30 pm	Rosanna
4/7/23	2	Instraments & Tray.	8 am	8.30 am	Anila
		"	3.5 pm	3.35 pm	Saloojs
5/7/23	2	Instraments & Cottan.	8.5 am	8.35 am	Rosanna
		"	3 pm.	3.30 pm	Saloojs.
6/7/23	2.	Instraments & Cottan.	8 am	8.30 am	Anila.
		"	8 pm	9.5 pm	Saloojs.
7/7/23	2	Instraments & Tray.	8 am	8.30 am	Rosanna
		"	8 pm.	3.30 pm	Anila.
8/7/23	2.	Instraments & Cotten.	8.5 am	8.10 am	Saloojs
		"	3.5 pm	3.35 pm	Rosanna.
10/7/23	2.	Instraments & cotten.	8. am	8.30 am	Anila.
		"	8 pm.	330 pm	Saloojs
11/7/23	2	Instraments & Tray..	8 am	8.40 am	Rosanna
		"	3.30 am	3.40 pm	Anila
12/7/23	2.	Instraments & Cottan.	8 am	8.30 am	Rosanna
		"	3 pm	3.30 pm	Anila
13/7/23	2.	Instraments & Tray	8. am	8.30 am	Rosanna
		"	8 pm	3.30 pm	Saloojs
14/7/23	2	Instraments & Cotten	8 am	8.30 pm	Anila
		"	8 pm	8.30 pm	Saloojs
17/7/23	2	Instraments & Tray	8 am	8.30 am	Rosanna
		"	3 pm	3.30 pm	Anila
18/7/23	2	Instraments & Tray	8 am	8.30 am	Rosanna
		"	3 pm	3.30 pm	Saloojs

19/7/23	2	Instraments & Tray.	8 am	8.30 am	Anila.
		"	3 pm	3.30 am	Rosanna
20/7/23	2	Instraments & Cotten	8 am	8.30 am	Anila.
		"	3 pm	3.30 pm	Saloojs
21/7/23	2	Instraments & Tray.	8 am	8.30 am	Rosanna
		"	3 pm	3.30 pm	Anila.
22/7/23	2	Instraments & Tray.	8.5 am	8.35 am	Saloojs
		"	3 pm	3.30 pm	Rosanna
24/7/23	2	Instraments & Cotten	8 am	8.30 am	Anila
		"	3.5 pm	3.35 pm	Saloojs
25/7/23	2	Instraments & Tray	8 am	8.30 am	Rosanna
		"	3 pm	3.30 pm	Anila
26/7/23	2	Instraments & Cotten	8 am	8.30 am	Saloojs
		"	3 pm	3.30 pm	Rosanna
27/7/23	2.	Instraments & Cotten	8.10 am	8.40 am	Anila.
		"	3 pm	3.30 am	Saloojs
28/7/23	2	Instraments & Cotten	8.5 am	8.35 am	Rosanna
		"	3 pm	3.30 pm	Anila
29/7/23	2	Instraments & Cotten	8 am	8.30 am	Saloojs
		"	3 pm	3.30 pm	Rosanna
31/7/23	2.	Instraments & Cotten	8 am	8.30 am	Anila
		"	3.5 pm	3.35 pm	Saloojs

August 2023.

1/8/23	2	Instraments & Tray	8 am	8.30 am	Rosanna
		"	3 pm	3.30	Anila.
2/8/23	2.	Instraments. & Cotten	8.10	8.40	Saloojs
		"	3 pm	3.3 pm	Rosanna
3/8/23	2	Instraments & Tray	8.20	8.50	Anila
		"	3 pm	3.30	Saloojs
4/8/23	2	Instraments & Cotten	8 am	8.30 am	Rosanna
		"	3 pm	2.30	Anila
5/8/23	2	Instraments & Tray.	8 am	830	Saloojs
		"	3.5 pm	3.35	"

PUSHPAHIRI COLLEGE OF DENTAL SCIENCES

AUTOCLAVE REGISTER

Ortho Dept

PROSTHO DEPARTMENT

AUTOCLAVE REGISTER

20.3.21	2	Instruments	8.15 am	8.45 am	Usha. A.E
		Instruments	2pm	3.15 pm	Jessy
22.3.21	2	Instruments	8.10 am	8.40 am	Sabitha.
		Instruments	2.5 pm	3.20 pm	Savitha.
23.3.21	2	Instruments.	8.15 am	8.45 am	maxylitty
		Instruments	2pm	3.15 pm	usha.
24.3.21	2	Instruments	8.10 am	8.40 am	Savitha.
		Instruments	2pm	3.15 pm	usha.
25.3.21	2	Instruments Biocotbo	8.15 am	8.45 am	Sabitha.
		Instruments.	2pm	3.15 pm	Jessy
26.3.21	2	Instruments	8.15 am	8.45 am	Jessy
		Instruments	2pm	3.15 pm	Sabitha.
27.3.21	2	Instruments	8.15 am	8.45 am	Sabitha.
		Instruments	2pm	3.15 pm	Jessy
29.3.21	2	Instruments	8.20 am	8.56 am	Savitha.
		Instruments	2.5 pm	3.20 pm	usha.
30.3.21	2	Instruments	8.15 am	8.45 am	Sabitha.
		Instruments	2pm	3.15 pm	Savitha.
31.3.21	2	Instrument's	8.15 am	8.45 am	Jessy
		Instruments	2pm	3.15 pm	usha.

APRIL.

3.4.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	usha.
5.4.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Jessy.
6.4.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Jessy
7.4.21	2	Instruments	8.10 am	8.56 am	Rachel
		Instruments	2pm	3.15 pm	usha.
8.4.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	usha.
9.4.21	2	Instruments	8.15 am	8.45 pm	Rachel

10.4.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2 pm	3.15 pm	Jessy.
12.4.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2 pm	3.15 pm	Usha. A.S.
13.4.21	2	Instruments	8.10 am	8.50 am	Rachel
		Instruments	2 pm	3.15 pm	merit
14.4.21	2	Instruments	8.15 am	8.45 am	Sabitha.
		Instruments.	2 pm	3.15 pm	Jessy
15.4.21	2	Instruments	8.10 am	8.50 am	Rachel
		Instruments	2 pm	3.15 pm	Sabitha.
16.4.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2.10 pm	3.25 pm	Leelamma.
17.4.21	2	Instrument's	8.15 am	8.45 am	Rachel
		Instruments	2 pm	3.15 pm	merit
19.4.21	2	Instruments	8.15 am	8.50 am	Leelamma
		Instruments	2.10 pm	3.25 pm	Jessy
20.4.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2 pm	3.15 pm	Jessy
21.4.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2 pm	3.15 pm	Sabitha.
22.4.21	2	Instruments, Binding	8.15 am	8.45 am	Rachel
		Instruments	2 pm	3.15 pm	Jessy
23-4-21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2 pm	3.15 pm	Usha
24-4-21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2 pm	3.15 pm	exit
26-4-21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2 pm	3.15 pm	Usha.
27-4-21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2 pm	3.15 pm	Jessy
28-4-21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2 pm	3.15 pm	Jessy
29-4-21	2	Instrument	2 pm	3.15 pm	Usha

June

30-6-21	2	Instruments	8.15am	8.45am	Savitha
		Instruments	2pm	3.15pm	Sabitha
4-6-21	2	Instruments	8.15am	8.45am	Sabitha
		Instruments	2pm	3.15pm	Sabitha
10-6-21	1	Instruments	8.15am	8.45am	Sabitha
11-6-21	1	Instruments	8.15am	8.45am	Sabitha
14-6-21	1	Instruments	8.15am	8.45am	Sabitha
15-6-21	1	Instruments	2pm	3.15pm	Sabitha
16-6-21	1	Instruments	2pm	3.15pm	Merit
17-6-21	1	Instruments	8.15am	8.45am	Rachel
18-6-21	1	Instruments	2pm	3.15pm	Sabitha
21-6-21	1	Instruments	8.15am	8.45am	Rachel
22-6-21	1	Instruments	2pm	3.15pm	Sabitha
23-6-21	1	Instruments	8.15am	8.45am	Rachel
24-6-21	1	Instruments	2pm	3.15pm	Merit
25-6-21	1	Instruments	8.15am	8.45am	Merit
28-6-21	1	Instruments	2pm	3.45pm	Savitha
29-6-21	2	Instruments	2pm	3.45pm	Merit
		Instruments Bin			
30-6-21	1	Instruments	8.15am	8.45am	Rachel

July

1-7-21	1	Instruments	2pm	3.45pm	Sabitha
2-7-21	2	Instruments.	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Usha. A S
5-7-21	1	Instruments	8.15am	8.45pm	Jessy
6-7-21	1	Instruments	2pm	3.15pm	Usha. A S
7-7-21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Jessy
8-7-21	1	Instruments	8.15am	8.45pm	Usha.
9-7-21	1	Instruments	2pm	3.15pm	Sabitha
10-7-21	1	Instruments	8.15am	8.45am	Rachel
12-7-21	1	Instruments	8.15am	8.45am	Jessy
13-7-21	1	Instruments.	2pm.	3.15pm	Usha.

14.7.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments, Bin 2 cotton	2pm	3.15 pm	usha.
16.7.21	1	Instruments	2pm	3.15 pm	Jessy.
17.7.21	1	Instruments	8.15 am	8.45 am	Rachel
19.7.21	1	Instruments	2pm	3.15 pm	Jessy
20.7.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Jessy
21.7.21	1	Instruments	8.10 am	3.20 pm	usha
22.7.21	1	Instruments	8.15 am	8.45 am	usha.
23.7.21	1	Instruments	2pm	3.15 pm	Jessy
24.7.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm.	3.15 pm	Jessy
26.7.21	2	Instruments	8.15 am	8.45 am	Jessy
		Instruments	2pm	3.15 pm	usha
27.7.21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Jessy
28.7.21	2	Instruments	8.15am	8.45am	Rachel
		Instrument	2pm	3.15pm	usha.
29.7.21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	merit
30.7.21	2	Instrument	8.15am	8.45am	merit
		Instruments	2pm	3.15pm	usha.
31.7.21	1	Instrument	2pm	3.15pm	Jessy.

August

2.8.21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Jessy
3.8.21	2	Instruments	8.15am	8.45am	usha
		Instruments	2pm	3.15pm	merit
4.8.21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Jessy.
5.8.21	2	Instruments	8.15am	8.45am	Jessy
		Instruments	2pm	3.15pm	usha.
6.8.21	1	Instruments	2pm	3.15pm	Jessy

7.8.21	2	Instruments	8.15 8.45	Jessy
		Instruments	2pm 3.15pm	merit
9.8.21	2	Instruments	8.15 8.45	Rachel
		Instruments	2pm 3.15	merit
10.8.21	2	Instruments	8.15 8.45	Rachel
		Instruments	2pm 3.15	Jessy
11.8.21	2	Instrument	8.15 8.45	Rachel
		Instruments	2pm 3.15	Usha
12.8.21	2	Instruments	8.15 8.45	Rachel
		Instruments	2pm 3.15	Jessy
13.8.21	2	Instruments	8.15 8.45	Rachel
		Instruments	2pm 3.15	Jessy
14.8.21	2	Instruments	8.15 8.45	Rachel
		Instruments	2pm 3.15	Jessy
16.8.21	2	Instruments	8.15 8.45	Rachel
		Instruments	2 3.15	Jessy
17.8.21	2	Instruments	8.15 8.45	Rachel
		Instruments	2pm 3.15	Jessy
18.8.21	2	Instruments	8.15 8.45	Rachel
		Instruments	2pm 3.15	Jessy
19.8.21	2	Instruments	8.15 8.45	Rachel
		Instruments	2pm 3.15	Jessy
20.8.21	2	Instruments	8.15 8.45	merit
		Instruments	2 3.15	Usha
23.8.21	2	Instruments	8.15 8.45	Rachel
		Instruments	2 3.15	Usha
24.8.21	2	Instruments	8.15 8.45	Rachel
		Instruments	2 3.15	Subitha
25.8.21	2	Instruments	8.15 8.45	Rachel
		Instruments	2 3.15	Jessy
26.8.21	2	Instruments	8.15 8.45	Rachel
		Instruments	2pm 3.15pm	Jessy
27.8.21	1	Instruments	2pm 3.15	Jessy

28.8.21	1	Instruments	8.15	8.45	Rachel
		Instruments	8.15	8.45	Rachel
30.8.21	2	Instruments	2pm	3.15	usha
		Instruments	8.15	8.45	Rachel
31.8.21	2	Instruments	2pm	3.15	merit
		Instruments			

September 2021

1.9.21	2	Instruments	8.15	8.45	Rachel
		Instruments	2pm	3.15	Sabitha
2.9.21	2	Instruments	8.15	8.45	Rachel
		Instruments	2pm	3.15	Sabitha
3.9.21	2	Instruments	8.15	8.45	Rachel
		Instruments	2pm	3.15	Sessy.
4.9.21	2	Instruments	8.15	8.45	Rachel
		Instruments	2pm	3.15	Sabitha
6.9.21	2	Instruments	8.15	8.45	Rachel
		Instruments	2pm	3.15	Sessy.
7.9.21	2	Instruments	8.15	8.45	Rachel
		Instruments	2pm	3.15	Sessy
8.9.21	2	Instruments	8.15	8.45	Rachel
		Instruments	2pm	3.15	Sabitha
9.9.21	2	Instruments	8.15	8.45	Rachel
		Instruments	2pm	3.15	merit
10.9.21	2	Instruments	8.15	8.45	Rachel
		Instruments	2pm	3.15	Sabitha
11.9.21	2	Instruments	8.15	8.45	Rachel
		Instruments	2pm	3.15	Sessy
13.9.21	2	Instruments	8.15	8.45	Rachel
		Instruments	2pm	3.15	Sessy
14.9.21	2	Instruments	8.15	8.45	Rachel
		Instruments	2pm	3.15	Usha
15.9.21	2	Instruments	8.15	8.45	usha.
		Instruments, Rain & Cotton	2pm	3.15	Sabitha

16.9.21	2	Instruments, Bin & cotton	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	usha
17.9.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Jessy
18.9.21	2	Instruments	8 am	8.30 am	Rachel
		Instruments	2pm	3.15 pm	usha
21.9.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	jessy
22.9.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	usha
23.9.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Jessy
24.9.21	2	Instruments	8.15 am	8.45 am	Jessy
		Instruments	2pm	3.15 pm	usha
25.9.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	usha
27.9.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Jessy
28.9.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	usha
29.9.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	usha
30.9.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Jessy
		October			
1.10.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Jessy
4.10.21	2	Instruments	8.15 am	8.45 am	Rakhil
		Instruments	2pm	8.45 am	Jessy
5.10.21	2	Instruments	8.15 am	8.45 pm	Rachel
		Instruments	2pm	8.45 pm	Jessy
6.10.21	2	Instruments	8.15 am	8.45 am	Jessy
		Instruments	2pm	3.15 pm	usha

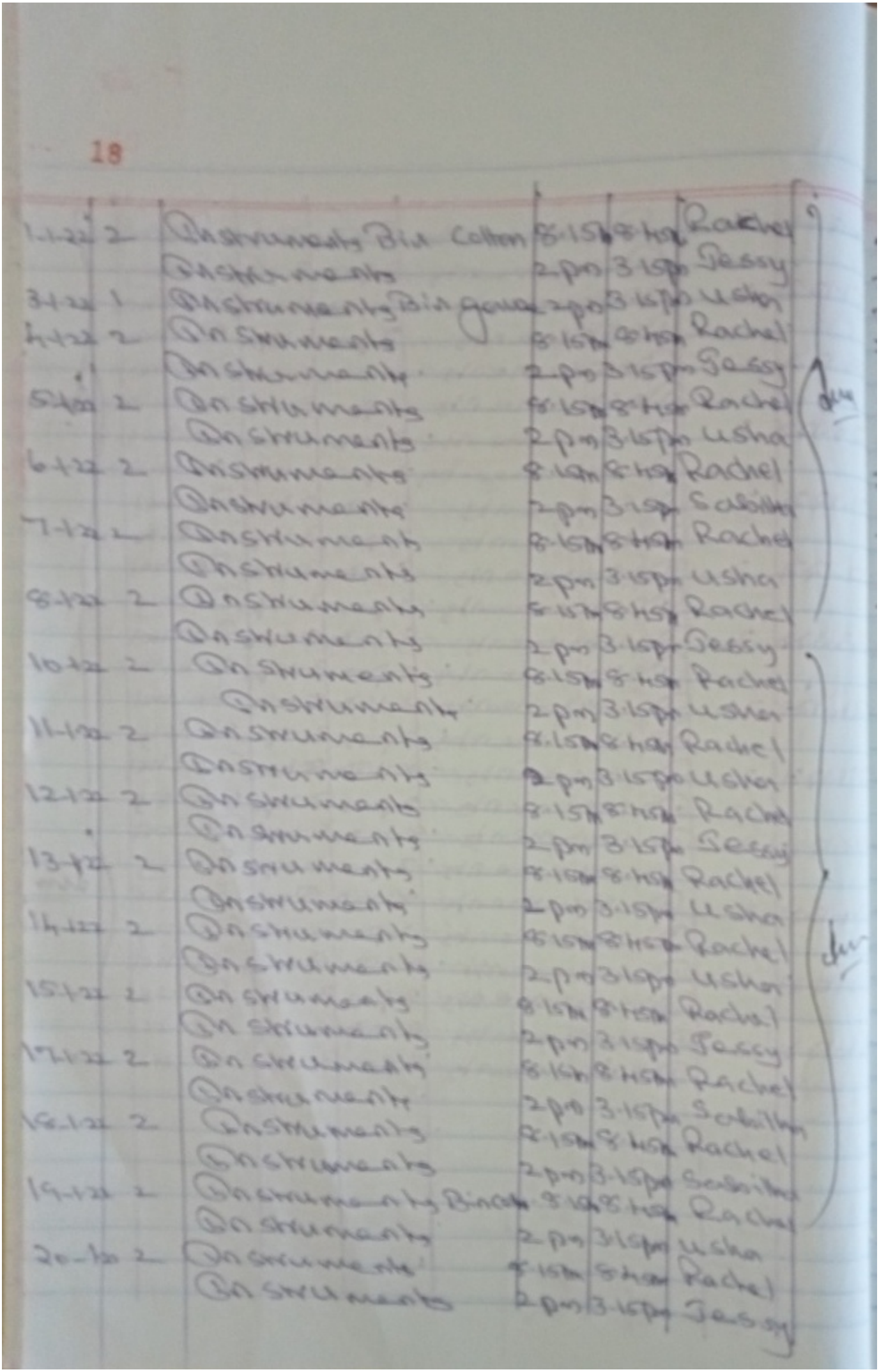
7.10.21	2	Instruments	8.15am 8.45am	Rachel
		Instruments	2pm 3.15pm	Usha
8.10.21	2	Instruments	8.15am 8.45am	Rachel
		Instruments	2pm 3.15pm	Usha
9.10.21	2	Instruments	8.am 8.30am	Jessy
		Instruments	2pm 2.15pm	Usha
11.10.21	2	Instruments	8am 8.45am	Rahul
		Instruments	2pm 3.15pm	Rahul
12.10.21	2	Instruments	8.15am 8.45am	Rahul
		Instruments	2pm 3.15pm	Jessy
13.10.21	2	Instruments	8.15am 8.45am	Rachel
		Instruments	2pm 3.15pm	Usha
14.10.21	2	Instruments	8.15am 8.45am	Rahul
		Instruments	2pm 3.45pm	Jessy
15.10.21	2	Instruments	8am 8.45am	Rahul
		Instruments	2pm 3.15pm	Jessy
16.10.21	2	Instruments	8.15am 8.45am	Rahul
		Instruments	2pm 3.15pm	Usha
25.10.21	2	Instruments	8.15am 8.45am	Rahul
		Instruments	2pm 3.15pm	Usha
26.10.21	2	Instruments	8.15am 8.45pm	Rachel
		Instruments	2pm 3.15pm	Usha
27.10.21	2	Instruments	8.15am 8.45pm	Rahul
		Instruments	2pm 3.15pm	Usha
28.10.21	2	Instruments	8.15am 8.45am	Rachel
		Instruments	2pm 3.15pm	Usha
29.10.21	2	Instruments	8.16am 8.45am	Rachel
		Instruments	2pm 3.15pm	Jessy
30.10.21	2	Instruments	8.15am 8.45	Rachel
		Instruments	2pm 3.15pm	Jessy

November.

1.11.21	2	Instruments.	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Usha.
2.11.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Usha.
3.11.21	2	Instruments	8.15 am	8.45 am	Usha.
		Instruments	2pm	3.15 pm	Jessy
5.11.21	2	Instruments	8.15 am	8.45 am	Usha.
		Instruments	2pm	3.15 pm	Jessy
6.11.21.	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Usha.
8.11.21	2	Instruments	8.15 am	3.15 pm	Rachel
		Instruments	2pm	3.15 pm	Jessy
9.11.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Jessy
10.11.21	2	Instruments, Bio Ecofon	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Jessy
11.11.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Jessy
12.11.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Jessy
13.11.21	2	Instruments	8 am	8.45 pm	Rachel
		Instruments	2pm	3.15 pm	Jessy
15.11.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Usha
22.11.21	1	Instruments	8.15 am	8.45 am	Usha
23.11.21	2	Instruments	8.15 am	8.45 am	Usha.
		Instruments	2pm	3.15 pm	Jessy
24.11.21	2	Instruments	8.15 am	8.45 am	Usha.
		Instruments	2pm	3.15 pm	Jessy
25.11.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Jessy
26.11.21	2	Instruments	8.15 am	8.45 am	Rachel
		Instruments	2pm	3.15 pm	Usha.

27-11-21	2	Instruments	8:15 8:45	Rachel
		Instruments	2pm 3:15	Jessy
29-11-21	2	Instruments	8:15 8:45	Rachel
		Instruments	2pm 3:15	Jessy
30-11-21	2	Instruments	8:15 8:45	Rachel
		Instruments	2pm 3:15	Usha
		December		
1-12-21	2	Instruments	8:15 8:45	Sabitha
		Instruments	2pm 3:15	Usha
2-12-21	2	Instruments	8:15 8:45	Rachel
		Instruments	2pm 3:15	Jessy
3-12-21	2	Instruments	8:15 8:45	Rachel
		Instruments	2pm 3:15	Usha
4-12-21	2	Instruments	8:15 8:45	Rachel
		Instruments	2pm 3:15	Usha
6-12-21	2	Instruments	8:15 8:45	Rachel
		Instruments	2pm 3:15	Jessy
7-12-21	2	Instruments	8:15 8:45	Rachel
		Instruments	2pm 3:15	Mesit
8-12-21	2	Instruments	8:15 8:45	Rachel
		Instruments	2pm 3:15	Sabitha
9-12-21	2	Instruments	8:15 8:45	Rachel
		Instruments	2pm 3:15	Mesit
10-12-21	2	Instruments	8:15 8:45	Rachel
		Instruments	2pm 3:15	Sabitha
11-12-21	2	Instruments	8:15 8:45	Rachel
		Instruments	2pm 3:15	Jessy
13-12-21	2	Instruments	8:15 8:45	Rachel
		Instruments	2pm 3:15	Usha
14-12-21	2	Instruments	8:15 8:45	Rachel
		Instruments	2pm 3:15	Jessy
15-12-21	2	Instruments	8:15 8:45	Rachel
		Instruments	2pm 3:15	Usha

16-12-21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Sessy
17-12-21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Usha
18-12-21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Sabitha
20-12-21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Sabitha
21-12-21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Sabitha
22-12-21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Sessy
23-12-21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Sabitha
24-12-21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Sessy
27-12-21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Sessy
28-12-21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Sessy
29-12-21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Sessy
30-12-21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Sessy
31-12-21	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2pm	3.15pm	Usha



21-1-22	1	Instruments	2 pm	3.15pm	Jessy
22-1-22	2	Instruments	8.15am	8.45am	Rachel
24		Instruments	2 pm	3.15pm	Usha
24-1-22	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2 pm	3.15pm	Subitha
25-1-22	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2 pm	3.15pm	Jessy
27-1-22	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2 pm	3.15pm	merit
28-1-22	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2 pm	3.15pm	merit
29-1-22	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2 pm	3.15pm	Usha
31-1-22	2	Instruments	8.15am	8.45am	Rachel
		Instruments	2 pm	3.15pm	Jessy

2-2-2022 FEBRUARY

1-2-22	2	Instruments	8.15am	to 8.45pm	Rachel
		Instruments	2.pm	to 3.15pm	Jessy.
2-2-22	2	Instruments	8.15am	to 8.45pm	Anila
		Instruments, Tray's	2.pm	to 3.15pm	Jessy
3.2.22	2	Instruments	8.15am	to 8.45pm	Anila.
		Instruments	2.pm	to 3.15pm	Jessy
4.2.22	2	Instruments	8.15am	to 8.45pm	Rachel
		Instruments Impressa tray.	2.pm	to 3.15pm	Jessy
5.2.22	2	Instruments	8.15am	to 8.45pm	Anila.
		Instruments	2.pm	to 3.15pm	Rachel
7.2.22	2	Instruments	8.15am	to 3.45pm	Anila.
		Instruments	2.pm	to 3.15pm	Rachel
8.2.22	2	Instruments	8.15am	to 8.45pm	Anila
		Instruments	2pm	to 3.15pm	Rachel.
9-2-22	2	Instruments	8.15am	8.45pm	Anila.
		Instruments in Cotton.	2pm	3.15pm	Rachel

11.2.22	2	Instruments + Cobra	8.15am	8.45am	Rachel	
		Instruments	2pm	3.15pm	Merit	
11.2.22	2	Instruments	8.15am	8.45am	Rachel	
		Instruments	2pm	3.15pm	Merit	
12.2.22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Bessy	
14.2.22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Bessy	
15.2.22	2	Instruments	8.15am	8.45am	Rachel	
		Instruments	2pm	3.15pm	Merit	
16.2.22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Savitha	
17.2.22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Savitha	
18.2.22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Bessy	
19.2.22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Rachel	
21.2.22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Bessy	
22.2.22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Bessy	
23.2.22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Merit	
24.2.22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Savitha	
25.2.22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Bessy	
26.2.22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Rachel	
28.2.22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Bessy	

DATE	CYCLE No.	MARCH-2022	start time	End time	operator	counter sign
1-3-22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Merit	
2-3-22	2	Instruments	8.15am	8.45am	Anila	
		Instruments Bin cleaning	2pm	3.15pm	Rachel	
3-3-22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Rachel	
4-3-22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Sessy	
5-3-22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Savilla	
7-3-22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Merit	
8-3-22	2	Instruments	8.15am	8.45am	Anila	
		Instruments Bin cleaning	2pm	3.15pm	Savilla	
9-3-22	2	Instruments	8.15am	8.45am	Rachel	
		Instruments	2pm	3.15pm	Sessy	
10-3-22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Sessy	
11-3-22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Sessy	
12-3-22	2	Instruments	8.15am	8.45am	Anila	
		Instruments	2pm	3.15pm	Anila	
14-3-22	2	Instruments	8.15am	8.45am	Merit	
14-3-22	2	Instruments	2pm	3.15pm	Sessy	
15-3-22	2	Instruments	8.15am	8.45am	Rachel	
		Instruments	2pm	3.15pm	Savilla	
16-3-22	2	Instruments	8.15am	8.45am	Rachel	
		Instruments Bin cleaning	2pm	3.15pm	Savilla	
17-3-22	2	Instruments	8.15am	8.45am	Rachel	
		Instruments	2pm	3.15pm	Sessy	
18-3-22	2	Instruments	8.15am	8.45am	Rachel	
		Instruments & cleaning	2pm	3.15pm	Sessy	
19-3-22	2	Instruments	8.15am	8.45am	Rachel	

DATE	cycle	Type of instruments	start time	End time	Operator	Counter sign
21/3/22	2	Instruments	8.00pm	06.30pm	Rachel	Jay
		Instruments	2pm	3.15pm	Jessy	
22/3/22	1	Instruments	8am	8:30am	Rachel	
	2	Instruments	2pm	3:15pm	Jessy	
23/3/22	1	Instruments	8am	8:30am	Rachel	
	2	Instruments	2pm	3:15pm	Jessy	
24/3/22	1	Instruments	8am	8:30am	Rachel	
	2	Instruments	2pm	3:15pm	Jessy	
25/3/22	1	Instruments	8am	8:30am	Rachel	Jay
		Instruments	2pm	3:15pm	Jessy	
26/3/22	1	Instruments	8am	8:30am	Savitha	
		Instruments	2pm	3:15pm	Savitha	
29/3/22	1	Instruments	8am	8:30am	Savitha	
		Instruments, kidney trays	2pm	3:15pm	Savitha	
30/3/22	1	Instruments, impressiontray	8am	8:45am	Savitha	
	2	Instruments	2pm	3:15pm	Anila	
31/3/22	1	Instruments	8am	8:45am	Anila	
~~APRIL 2022~~						
1/4/22	2	Impression trays, Instruments	2pm	3:15pm	Savitha	
	1	Instruments, kidney trays	8am	8:45am	Rachel	
	2	Instruments	2pm	3:15pm	Savitha	
2/4/22	1	Kidney tray's, Impression th	8am	8:45am	Rachel	
	2	Instruments	2pm	3:15pm	Anila	
4/4/22	1	Kidney trays Instruments	8am	8:45am	Savitha	
	2	Instruments	2pm	3:15pm	Rachel	
5/4/22	1	Instruments, kidney	8am	8:45am	Anila	Jay
	2	Instruments	2pm	3:15pm	Savitha	
6/4/22	1	Instruments impressiontrays	8am	8:45am	Savitha	
	2	Kidney tray Instruments	2pm	3:15pm	Anila	
7/4/22	1	Instruments	8am	8:45am	Rachel	
	2	Instruments, kidney trays	2pm	3:45pm	Savitha	
8/4/22	1	Instruments, tray's	8am	8:45am	Rachel	
	2	Kidney tray's	2pm	3:15pm	Savitha	
9/4/22	1	Instruments, kidney trays	8am	8:45am	Savitha	
	2	Impressiontray, kidney	2pm	3:15pm	Anila	

DATE	CYCLE NO	TYPE OF MATERIAL	Start time	End time	Operator	Countersign.
11/4/22	1	Instruments	8am	8.45am	Raichel	
	2	Instruments, tools	2pm	3.15pm	Savitha	
12/4/22	1	Instruments	8 AM	8.45am	Raichel	
	2	Instruments	2pm	3.15pm	Savitha	
13/4/22	1	Instruments	8AM	8.45am	Raichel	
	2	Instruments	2pm	3.15pm	Anila	
16/4/1	1	Instruments	8 Am	8.45am	Raichel	
	2	Instruments cotton	2pm	3.15pm	Savitha	
18/4	1	Instruments	8AM	8.45am	Raichel	
	2	Instruments	2pm	3.15pm	Anila	
19/4	1	Instruments	8m	8.45am	Raichel	
	2	Instruments	2pm	3.15pm	Savitha	
20/4	1	Instruments	8am	8.45am	Raichel	
	2	Instruments	2pm	3.15pm	Anila	
21/4	1	Instruments	8 Am	8.45am	Raichel	
	2	Instruments	2pm	3.15pm	Savitha	
22/4	1	Instruments	8am	8.45am	Raichel	
	2	Instrument	2pm	3.45pm	Anila	
23/4	1	Instruments	8am	8.45am	Raichel	
	2	Instrumentgauze	2pm	3.45pm	Savitha	
25/4	1	Instrument	8 AM	8.45am	Raichel	
	2	Instrument	2pm	3.45pm	Savitha	
26/4	1	Instruments	8AM	8.45m	Raichel	
	2	Instruments cotton	2pm	3.45pm	Savitha	
27/4	1	Instrument	8am	8.45am	Raichel	
	2	Instrument	2pm	3.45pm	Anila	
28/4	1	Instrument	8am	8.45am	Raichel	
	2	Instrument	2pm	3.45pm	Savitha	
29/4	1	Instrument	8am	8.45am	Raichel	
	2	Instrument	2pm	3.45pm	Savitha	
30/4	1	Instrument	8am	8.45am	Raichel	
	2	Instrument	2pm	3.45pm	Anila	

24

MAY

DATE	CYCLE No	Type of materials	start time	End time	operator	Counter sign
3/05/22	2	Instruments	8 AM	8.30 AM	Rachel	
		Instruments	2 PM	3.15 PM	Jessy	
4/5/22	2	Instruments	8 AM	8.30 AM	Rachel	
		Instruments	2 PM	3.15 PM	merit	
5/5/22	2	Instruments	8 AM	8.30 AM	Rachel	
		Instruments	2 PM	3.15 PM	Anila	
6/5/22	2	Instrument	8 AM	8.30 AM	Rachel	
		Instrument	2 PM	3.15 PM	Jessy	
7/5/22	2	Instrument	8 AM	8.30 AM	Rachel	
		Instruments	2 PM	3.15 PM	Anila	
9/5/22	2	Instrument	8 AM	8.30 AM	Rachel	
		Instrument	2 PM	3.15 PM	merit	
10/5/22	2	Instrument	8 AM	8.30 AM	Rachel	
		Instrument	2 PM	3.15 PM	Jessy	
11/5/22	2	Instrument	8 AM	8.30 AM	Rachel	
		Instrument	2 PM	3.15 PM	Jessy	
12/5/22	2	Instrument	8 AM	8.30 AM	Rachel	
		Instruments	2 PM	3.15 PM	Anila	
13/5/22	2	Instrument	8 AM	8.30 AM	Rachel	
		Instrument	2 PM	3.15 PM	merit	
14/5/22	2	Instrument	8 AM	8.30 AM	Rachel	
		Instrument	2 PM	3.15 PM	merit	
16/5/22	2	Instrument	8 AM	8.30 AM	Rachel	
		Instrument	2 PM	3.15 PM	Anila	
17/5/22	2	Instrument	8 AM	8.30 AM	Rachel	
		Instrument	2 PM	3.15 PM	Anila	
18/5/22	2	Instrument	8 AM	8.30 AM	Rachel	
		Instrument	2 PM	3.15 PM	Anila	
19/5/22	2	Instrument	8 AM	8.30 AM	Rachel	
		Instrument	2 PM	3.15 PM	Anila	
20/5/22	2	Instrument	8 AM	8.30 AM	Rachel	
		Instrument	2 PM	3.15 PM	merit	
21/5/22		Instrument	8 AM	8.30 AM	Rachel	

DATE	CYCLE NO	TYPE OF MATERIAL	START TIME	END TIME	OPERATOR	COUNTER SIGN
23/5/22	1	Instruments	8 AM	8.30 AM	Rachel	
	2	Instruments	2 pm	3.15 pm	Jessy	
24/5/22	1	Instruments & Gallbladder tray	8 AM	8.30 AM	Rachel	
	2	Instruments & gallbladder tray	2 pm	3.15 pm	Jessy	
25/5/22	1	Instruments	8 AM	8.30 AM	Rachel	
	2	Instruments	2 pm	3.15 pm	merit	
26/5/22	1	Instruments	8 AM	8.30 AM	Rachel	
	2	Instruments	2 pm	3.15 pm	Anila	
27/5/22	1	Instruments	8 AM	8.30 AM	Rachel	
	2	Instruments	2 pm	3.15 pm	Anila	
28/5/22	1	Instruments	8 AM	8.30 AM	Anila	
	2	Instruments	2 pm	3.15 pm	Jessy	
30/5/22	1	Instruments	8 AM	8.30 AM	merit	
	2	Instruments	2 pm	3.15 pm	Jessy	
31/5/22	1	Instruments	8 AM	8.30 AM	Rachel	
	2	Instruments	2 pm	3.15 pm	Anila	
		June 2022				
1/6/22		Instruments	8 am	8.30 am	Savitha	
		Instruments trays	2 pm	3.15 pm	Savitha	
2/6/22		Instruments	8 am	8.30 am	Raichel	
		Instruments. kidney trays	2 pm	3.15 pm	Savitha	
3/6/22		Instruments	8 am	8.30 am	Raichel	
		Instruments trays	2 pm	3.15 pm	Jessy	
4/6/22		Instruments	8 am	8.30 am	Raichel	
		kidney tray instrument	2 pm	3.15 pm	Jessy	
6/6/22		Instruments	8 am	8.30	Raichel	
		Instruments	2 pm	3.15 pm	Anila	
7/6/22		Instruments	8 am	8.45 am	Raichel	
		Instruments trays	2 pm	3.15 pm	Jessy	
8/6/22		Instruments	8 am	8.45 am	Raichel	
		Instruments, trays	2 pm	3.15 pm	Jessy	
9/6/22		Instruments	8 am	8.45 am	Raichel	

10/6/22	Instruments	8:30 am	8:45 pm	Raichel
23/5	Instruments, trays	2 pm	2:45 pm	Savitha
11/6/22	Instruments	8:30 am	8:45 pm	Raichel
24/5	Instruments, kidneytray	2 pm	2:45 pm	Jessy
13/6/22	Instruments,	8:30 am	8:45 pm	Raichel
25/5	Instruments, trays	2 pm	2:45 pm	Jessy.
14/6/22	Instruments	2 pm	2:45 pm	Jessy.
26/5	Instruments	8:30 am	9 am	Raichel
15/6/22	Instruments			
27/5				
16/6/22	Instruments	2 pm	2:45 pm	Anita
28/5	Instruments	8:30 am	9 am	Raicha
17/6/22	Instruments	2 pm	2:45 pm	Jessy
30/5	Instruments	8:30 am	9 am	Raichel
18/6/22	Instruments	2 pm	2:45 pm	Anita
31/5	Instruments	8:30 am	9 am	Raichal
20/6/22	Instruments	2 pm	2:45 pm	Jessy
	Instruments	8:30 am	9 am	Raichal
21/6/22	Instruments	2 pm	2:45 pm	Jessy
	Instruments	8:30 am	9 am	Raichel
22/6/22	Instruments	2 pm	2:45 pm	Jessy
	Instruments	8:30 am	9 am	Raichal
23/6/22	Instruments	8:30 am	9 am	Raichel
	Instruments	2 pm	2:45 pm	merit
24/6/22	Instruments	8:30 am	9 am	Raichal
	Instruments	2 pm	2:45 pm	Jessy
25/6/22	Instruments	8:30 am	9 am	Raichal
	Instruments Bin	2 pm	2:45 pm	Anita
27/6/22	Instruments	8:30 am	9 am	Raichel
	Instruments	2 pm	2:45 pm	merit
28/6/22	Instruments	8:30 am	9 am	Raichal
	Instruments	2 pm	2:45 pm	Jessy
29/6/22	Instruments	8:30 am	9 am	Raichal
	Instruments	2 pm	2:45 pm	merit

30/6/22	Instruments	8.30m.	9am	Rachel
	Instruments	2pm.	2.45pm.	Jessy.
	July 2022			
1/7/22	Instruments	8.30m.	9 Am.	Rachel.
	Instruments	2pm.	2.45pm	merit.
2/7/22	Instruments	8.30m	9am.	Rachel.
	Instruments	2pm.	2.45pm	Jessy.
4/7/22	Instruments	8.30 m	9Am.	Rachel.
	Instruments	2pm	2.45pm	merit.
6/7/22	Instruments	8.30m.	9Am.	Rachel.
	Instruments	2pm.	2.45pm	Jessy.
7/7/22	Instruments	8.30m	9Am.	Rachel
	Instruments	2pm.	2.45pm	Jessy
8/9/22	Instruments	8.30m.	9Am.	Rachel
	Instruments	2pm.	2.45pm.	Jessy.
9/9/22	Instruments	8.30m.	9am.	Rachel
	Instruments	2pm.	2.45pm.	Anila.
11/7/22	Instruments	8.30m.	9Am.	Merit
	Instruments	2pm.	2.45pm.	Anila.
12/7/22	Instruments	8.30m	9Am.	merit.
	Instruments	2pm.	2.45pm.	Jessy.
13/7/22	Instruments	8.30m.	9am.	merit
	Instruments	2pm.	2.45pm	Anila
14/7/22	Instruments	8.30m.	9Am.	Merit.
	Instruments	2pm.	2.45pm	Jessy.
15/7/22	Instruments	8.30m	9Am.	merit
	Instruments	2pm.	2.45pm.	Jessy.
18/7/22	Instruments	8.30m.	9am	merit.
	Instruments	2pm.	2.45pm.	Savitha
19/7/22	Instruments	8.30m.	9Am	Rachel.
	Instruments	2pm.	2.45pm.	Merit.
20/7/22	Instruments	8.30m.	9Am.	Rachel
	Instruments	2pm.	2.45pm.	Merit.

21/4/22	2	@nstruments	8.30AM	9 AM. Rachel.
		@n stru ments	2pm	2.45pm merit
22/4/22	2	@nstruments	8.30AM	9 AM Rachel
		@nstruments	2pm	2.45pm merit
23/4/22	2	@nstrument	8.30AM	9AM. Rachel
		@nstruments	2pm	2.45pm Anila
25/4/22	2	@n strument	8.30AM	9AM Rachel
		@n strumenta	2pm	2.45pm Jessy.
26/4/22	2	@nstruments	8.30AM	9AM Rachel
		@nstrument	2pm	2.45pm Jessy.
24/4/22	2	@nstrument	8.30AM	9AM Rachel
		@nstruments	2pm	2.45pm merit
28/4/22	2	@nstrument	8.30AM	9AM Rachel
		@nstruments	2pm	2.45pm Jessy
29/4/22	2	@nstruments	8.30AM	9AM. Rachel
		@nstrument	2pm	2.45pm Anila.
30/4/22	2	@nstruments	8.30AM	9AM. Rachel
		@nstruments	2pm	2.45pm Jessy.

1/8/2022

1/8/2022	Instraments, kidney tray	8.30am	9.00am	Raichel
1/8/2022	Instraments, trays	2.pm	2.45pm	Savitha
2/8/2022	Instraments trays	8.30am	9.00am	Raichel
	kidney tray, Instra	2.pm	2.45pm	Jessy
3/8/	Instraments	8.30am	9.00	Raichel
	Instraments, trays	2pm	2.45pm	Jessy
4/8	Instraments	8.30am	9pm.	Raichel
	Instraments, trays	2pm to	2.45pm	Anila.
5/8/22	cycle No-00152	2.40pm	3.30pm	Jessy
6/8/22	Instraments, trays	8.30am	9.00am	Jessy
	Instraments.	2.40pm	3.30	Anila.
8/8/22	Instraments, trays	8.30am	9.00am	Jessy.

9/8/22 · 2 Instruments 8.30am 9 Am Raichal
Instruments 2pm · 2 HS pm Jessy
10/8/22 2 Instruments 8.30am 9 Am Raichal.
Instruments 2 pm 2 HS pm Anila
11/8/22 2. Instruments 8.30 9 Am Raichal.
Instruments 2 pm 2 HS pm Jessy.
12/8/22 2 Instruments 8.30 9 Am Raichel
Instruments 2 pm 2 HS pm Anila.
13/8/22 2 Instruments 8.30 9 Am Raichal.
Instruments & Bill 2 pm 2 HS pm merit
14/8/22 2 Instrument 8.30am 9 AM Raichal,
Instrument 2 pm 2 HS pm Jessy
15/8/22 2 Instruments & gauze 8.30 9 Am Raichal.
Instruments & Cotton 2 pm 2 HS pm Anila
20/8/22 2 Instruments 8.30 9 Am Raichal.
Instruments 2 pm 2 HS pm Jessy
21/8/22 2 Instruments 8.30 Am 9 Am Raichal.
Instruments & gauze 2 pm 2 HS pm Jessy
23/8/22 2 Instruments 8.30am 9 Am Raichal.
24/8/22 2. Instruments 8.30 9 Am Raichal.
Instruments Cotton 2 pm 2 HS pm Anila.
25/8/22. Instruments Cotton 8.30am 9 Am. Raichal.
Instruments 2 pm 2 HS pm merit.
26/8/22 Instruments 8.30 9 Am. Raichal.
Instruments 2 pm 2 HS pm Jessy.
27/8/22 Instruments 8.30 9 Am Raichal.
Instruments 2 pm 2 HS pm Anila.
29/8/22 Instruments 8.30am 9 Am. Raichal.
Instruments 2 pm 2 HS pm merit
30/8/22 Instruments 8.30 9 Am Raichal.
Instruments 2 pm 2 HS pm Jessy.
31/8/22 Instruments 8.30 9 Am Raichal.

30

1/9/2022

1/9/22	Instruments, kidney tray	8:30 am	9:00 am	Rachel
	Instruments	2 pm	2:45 pm	Savitha
2/9/22	Instruments, kidney tray	8:30 am	9:00 am	Rachel
	Instruments, trays	2 pm	2:45 pm	Savitha
8/9/22	Instruments, kidney tray	8:30 am	9:00 am	Rachel
	Instruments	2 pm	2:45 pm	Jessy
5/9/22	Instruments, kidney tray	8:30 am	9:00 am	Rachel
	Instruments	2 pm	2:45 pm	Jessy
6/9/22	Instruments	8:30 am	9:00 am	Rachel
	Instruments, trays	2 pm	2:45 pm	Savitha
7/9/22	Instruments, kidney trays	8:30 am	9:00 am	Savitha
	Instruments	2 pm	2:45 pm	Jessy
6/9/22	Instruments trays	8:30 am	9 am	Rachel
	Instruments & cotton	2 pm	2 pm	Jessy
9/9/22	Instruments	8:30 am	9 am	Rachel
	Instruments	2 pm	2 pm	Merit
10/9/22	Instruments	8:30 am	9 am	Rachel
	Instruments	2 pm	2 pm	Anila
12/9/22	Instruments	8:30 am	9 am	Rachel
	Instruments & gauze	2 pm	2 pm	Jessy
13/9/22	Instruments	8:30 am	9 am	Rachel
	Instruments	2 pm	2 pm	Jessy
14/9/22	Instruments	8:30 am	9 am	Rachel
	Instruments	2 pm	2 pm	Anila
15/9/22	Instruments	8:30 am	9 am	Rachel
	Instruments	2 pm	2 pm	Merit
16/9/22	Instruments	8:30 am	9 am	Rachel
	Instruments	2 pm	2 pm	Anila
17/9/22	Instruments	8:30 am	9 am	Rachel
	Instruments	2 pm	2 pm	Jessy
19/9/22	Instruments	8:30 am	9 am	Rachel
	Instruments	2 pm	2 pm	Anila
20/9/22	Instruments	2 pm	2 pm	Jessy

	Instruments'	8.30am	9am.	Ravidas
21/9/22	Instruments	2 pm	2.45pm	Savitha
	Instruments, kidneytrays	8.30am	9am	Raichel
22/9/22	Instruments	2 pm	2.45pm	Jessy
	Instruments, trays	8.30am	9.am	Raichel
23/9/22	Instruments kidneytray	2pm	2.45pm	Savitha
	Instruments	8.30am	9.00am	Anila
24/9/22	Instruments	2. pm	2.45pm	Savitha
	Instruments, tray's	8.30am	9.00am	Raichel
26/9/22	Instruments	2.pm	2.45pm	Jessy
	Instruments, tray's	8.30am	9.00am	Raichel
27/9/22	Instruments	2.pm	2.45pm	Jessy
28/9/22	Instruments	8.00am	8.30am	Anila
	Instruments	2. pm	2.50pm	Jessy
29/9/22	Instruments, trays	8.00am	8.30am	Raichel
	Instruments	2. pm	2.45pm	Savitha
30/9/22	Instruments	8.00am	8.30	Raichel
	Instruments	2.pm	2.45pm	Jessy
1/10/22	Instruments	8.00	8.45am	Raichel
	Instruments	2.pm	2.45pm	Jessy
3/10/22	Instruments	8.00am	8.45am	Anila.
	Instruments	2. pm	2.45pm	Savitha
4/10/22	Instruments	8.00am	8.45am	Raichel
	Instruments	2. pm	2.45pm	Savitha
5/10/22	Instruments	8.00am	8.45am	Raichel
	Instruments	2.pm	2.45pm	Jessy
6/10/22	Instruments	8.00am	8.45am	Raichel
	Instruments	2 pm	2.45pm	Mercy
7/10/22	Instruments-	8AM	8.45AM	Raichal
	Instruments.	2 pm	2.45pm	Savitha-
8/10/22	Instruments	8AM	8.45AM	Jessy
	Instruments	2 pm	2.45pm	Savitha.
10/10/22	Instruments'	8AM	8.45AM	Ravidas

11.10.22 Instruments
Instruments
12.10.22 Instruments
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13.10.22 Instruments
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14.10.22 Instruments
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15.10.22 Instruments
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17.10.22 Instruments
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18.10.22 Instruments
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19.10.22 Instruments
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20.10.22 Instruments
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21.10.22 Instruments & collar
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22.10.22 Instruments
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24.10.22 Instruments
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26.10.22 Instruments
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27.10.22 Instruments
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28.10.22 Instruments
Instruments
29.10.22 Instruments
Instruments
31.10.22 Instruments

8am Shiv Ravi
2pm Shiv Jessy
8am Shiv Rachel
2pm Shiv Anita
8am Shiv Rachel
2pm Shiv Jessy
8am Shiv Rachel
2pm Shiv Anita
8am Shiv Rachel
2pm Shiv Merin
8am Shiv Rachel
2pm Shiv Jessy
8am Shiv Rachel
2pm Shiv Merin
2pm Shiv Jessy
8am Shiv Rachel
2pm Shiv Anita
8am Shiv Rachel
2pm Shiv Jessy
8am Shiv Rachel
2pm Shiv Anita
8am Shiv Rachel
2pm Shiv Jessy
8am Shiv Rachel
2pm Shiv Anita
8am Shiv Rachel
2pm Shiv Anita
8am Shiv Rachel

November

1-11-22	Ashwini Mg	8 AM 8:30 AM Ranchi
	Ashwini Mg	2 PM 2 HSP Jessy
2-11-22	Ashwini Mg	8 AM 8:30 AM Ranchi
	Ashwini Mg	2 PM 2 HSP Anila
3-11-22	Ashwini Mg	8 AM 8:30 AM Ranchi
	Ashwini Mg & Coke	2 PM 2 HSP Merit
4-11-22	Ashwini Mg	8 AM 8:30 AM Ranchi
	Ashwini Mg	2 PM 2 HSP Savitha
5-11-22	Ashwini Mg	8 AM 8:30 AM Ranchi
	Ashwini Mg	2 PM 2 HSP Anila
7-11-22	Ashwini Mg	8 AM 8:30 AM Ranchi
	Ashwini Mg	2 PM 2 HSP Anila
8-11-22	Ashwini Mg	8 AM 8:30 AM Ranchi
	Ashwini Mg	2 PM 2 HSP Jessy
9-11-22	Ashwini Mg	8 AM 8:30 AM Ranchi
	Ashwini Mg	2 PM 2 HSP Jessy
10-11-22	Ashwini Mg	8 AM 8:30 AM Ranchi
	Ashwini Mg	2 PM 2 HSP Anila
11-11-22	Ashwini Mg	8 AM 8:30 AM Ranchi
	Ashwini Mg	2 PM 2 HSP Merit
12-11-22	Ashwini Mg	8 AM 8:30 AM Ranchi
	Ashwini Mg	2 PM 2 HSP Savitha
14-11-22	Ashwini Mg	8 AM 8:30 AM Ranchi
	Ashwini Mg	2 PM 2 HSP Merit
15-11-22	Ashwini Mg	8 AM 8:30 AM Ranchi
	Ashwini Mg	2 PM 2 HSP Anila
16-11-22	Ashwini Mg	8 AM 8:30 AM Jessy
	Ashwini Mg	2 PM 2 HSP Anila
17-11-22	Ashwini Mg	8 AM 8:30 AM Ranchi
	Ashwini Mg	2 PM 2 HSP Anila
18-11-22	Ashwini Mg	8 AM 8:30 AM Ranchi
	Ashwini Mg	2 PM 2 HSP Jessy
19-11-22	Ashwini Mg	2 PM 2 HSP Savitha

21-11-22	Instruments	8am	8.30am	Rachal
	Instruments	2pm	2.45pm	Anila
22-11-22	Instruments & Kidney Tray	8am	8.30am	Rachal
	Instruments & Kidney Tray	2pm	2.45pm	Jessy
23-11-22	Instruments & Kidney Tray	8am	8.30am	Rachal
	Instruments & Kidney Tray	2.5pm	2.55pm	Anila.
24-11-22	Instruments	8am	8.30am	Rachal
	Instruments & Cotton & Kidney Tray	2.10pm	2.55pm	Savitha
25-11-22	Instruments & Kidney Tray	8am	8.30am	Rachal
	Instruments & Kidney Tray.	2pm	2.45pm	Anila.
26-11-22	Instruments & Gauze	8am	8.30am	merit
	Instruments	2pm	2.45pm	Jessy
28-11-22	Instruments,	8am	8.30am	Rachal
	Instruments & Cotton	2.5pm	2.50pm	merit
29-11-22	Instruments	8am	8.30am	Rachal.
	Instruments	2pm	2.45pm	Anila
30-11-22	Instruments & Kidney Tray	8am	8.30am	merit
	Instruments & Kidney Tray	2pm	2.45pm	Savitha

December. 2022.

1/12/22	Instruments & Kidney Tray	8am	8.35am	Rachal
	Instruments "	2pm	2.45pm	Anila
2/12/22	Instruments & Kidney Tray	8am	8.35am	merit
	Instruments & Gauze	2pm	2.45pm	Anila
3/12/22	Instruments.	8am	8.30am	Merit
	Instruments & Cotton	2pm	2.45pm	Rachal
5/12/22	Instruments & Gauze	8am	8.30am	merit
	Instruments & Kidney Tray	2pm	2.45	Rachal
6/12/22	Instruments	8am	8.30	merit
	Instruments	2pm	2.30	Jessy
7/12/22	Instruments & Cotton	8am	8.30	merit
	Instruments & Kidney Tray	2pm	2.30	Anila.

8/12/22	Instruments & Kidney Tray	8am	8.30	Rachel
	Instruments & Kidney Tray	2pm	2.30pm	Anila
9/12/22	Instrument & cottan	8am	8.30	merit
	Instrament & Kidney Tray	2pm	2.30pm	Jessy
10/12/22	Instraments & Kidney Tray	8am	8.30	merit
	Instruments & Kidney Tray	2pm	2.40	Rachal
12/12/22	Instraments & Kidney Tray	8am	8.30	merit
	Instraments & Kidney Tray	2pm	2.30pm	Anila
13/12/22	Instruments & Gloves	8am	8.30	merit
	Instruments & Cottan	2pm	2.50	Jessy
14/12/22	Instruments & Gloves	8am	8.30	merit
	Instraments & Cottan	2.10pm	3.50pm	Rachal
15/12/22	Instraments & Kidney Tray	8am	8.30	merit
	Instruments & Kidney Tray	2pm	2.45	Anila
16/12/22	Instruments & Tray	8am	8.30	merit
	Instruments & Tray.	2pm	2.45	Jessy
17/12/22	Instruments & Kidney Tray	8am	8.30	merit
	Instruments & Kidney Tray	2pm	2.45	Rachal
19/12/22	Instruments & Kidney Tray	8am	8.30	merit
	Instruments & Kidney Tray	2pm	2.45	Anila
20/12/22	Instruments & Kidney Tray	8am	8.30	merit
	Instruments & Kidney Tray	2pm	2.45	Jessy
21/12/22	Instruments & Kidney Tray	8am	8.30	merit
	Instruments & Kidney Tray	2pm	2.45	Rachal
22/12/22	Instruments & Kidney Tray	8am	8.30	merit
	Instruments & Kidney Tray	2pm	2.45	Anila
23/12/22	Instruments & Kidney Tray	8am	8.30	merit
	Instruments & Kidney Tray	2pm	2.45	Jessy
24/12/22	Instruments & Kidney Tray	8am	8.30	merit
	Instruments & Kidney Tray	2pm	2.45	Rachal
26/12/22	Instruments & Kidney Tray	8am	8.30	merit
	Instruments & Kidney Tray	2pm	2.45	Anila.
27/12/22	Instruments. & Kidney Tray	8am	8.30	merit
	Instruments & Kidney Tray	2pm	2.45	Jessy

28/12/22	Instruments & Kidney tray 8am	8:30	merit
	Instruments & Kidney tray 2pm	2:45	Rachal
29/12/22	Instruments & Kidney tray 8am	8:30	merit
	Instruments & Kidney tray 2pm	2:45	Drila.
30/12/22	Instruments & Kidney tray 8am	8:30	Rachal
	Instruments & Kidney tray 2pm	2:45	Drila.
31/12/22	Instruments & Kidney tray 8am	8:30	Rachal
	Instruments & Kidney tray 2:10pm	2:55pm	Drila.

January 2023

1/1/23	Instruments & Kidney tray 8am	8:30	merit
	Instruments & Kidney tray 2pm	2:45	Rachal
2/1/23	Instruments & Kidney tray 8am	8:30	merit
	Instruments & Kidney tray 2pm	2:45	Drila.
3/1/23	Instruments & Kidney tray 8am	8:30	merit
	Instruments & Kidney tray 2pm	2:45	Rachal
4/1/23	Instruments & Kidney tray 8am	8:30	merit
	Instruments & Kidney tray 2pm	2:45	Jessy
5/1/23	Instruments & Kidney tray 8am	8:30	merit
	Instruments & Kidney tray 2pm	2:45	Drila
6/1/23	Instruments & Kidney tray 8am	8:30	merit
	Instrument & Kidney tray 2pm	2:45	Rachal
7/1/23	Instruments & Kidney tray 8am	8:30	merit
	Instruments & Kidney tray 2pm	2:45	Jessy
9-1-23	Dr SM & nurses	8am	8:30am merit
	Dr Swaminath & Cotton	2pm	2:45pm Jessy
10-1-23	Dr Sridhar etc	8am	8:30am merit
	Dr Swaminathan	2pm	2:45pm Drila
11-1-23	Dr SM & nurses	8am	8:30am merit
	Dr Swaminathan	2pm	2:45pm Rachal
12-1-23	Dr Sridhar etc	8am	8:30am merit
	Dr Swaminathan	2pm	2:45pm Jessy

13-1-23	On instruments	8am	8.30am	Merit
	On instruments	2pm	2.45pm	Anila
14-1-23	On instruments	8am	8.30am	merit
	On instruments	2pm	2.45pm	Sessy
16-1-23	On instruments	8am	8.30am	merit
	On instruments	2pm	2.45pm	Anila
17-1-23	On instruments	8am	8.30am	merit
	On instruments	2pm	2.45pm	Sessy
19-1-23	On instruments	8am	8.30am	Rachel
	On instruments	2pm	2.45pm	Rachel
19-1-23	On instruments	8am	8.30am	merit
	On instruments	2pm	2.45pm	Sessy
20-1-23	On instruments	8am	8.30am	merit
	On instruments	2pm	2.45pm	Anila
21-1-23	On instruments & gauze	8am	8.30am	merit
	On instruments	2pm	2.45pm	Sessy
23-1-23	On instruments	8am	8.30am	merit
	On instruments	2pm	2.45pm	Anila
24-1-23	On instruments	8am	8.30am	merit
	On instruments	2pm	2.45pm	Sessy
25-1-23	On instruments	8am	8.30am	merit
	On instruments	2pm	2.45pm	Anila
26-1-23	On instruments	8am	8.30am	merit
	On instruments	2pm	2.45pm	Sessy
27-1-23	On instruments & cotton	8am	8.30am	merit
	On instruments	2pm	2.45pm	Rachel
28-1-23	On instruments	8am	8.30am	merit
	On instruments & cotton	2pm	2.45pm	Sessy
30-1-23	On instruments	8am	8.30am	merit
	On instruments	2pm	2.45pm	Anila
31-1-23	On instruments	8am	8.30am	merit
	On instruments	2pm	2.45pm	Rachel

		8am	8:30am	Leelavathi
1.2.23	Instruments	2pm	2.45pm	Jessy
	Instruments	8am	8.30	Jessy
2/2/23	Instruments	2pm	2.45pm	Jessy
	Instruments	8am	8.30am	Savitha
3/2/23	Instruments	2pm	2.45pm	Bindhu
	Instruments, kidney tray	8am	8.45am	Jessy
4/2/23	Instruments	2pm	2.45pm	Savitha
	Instruments kidneytrays	8am	8.45am	Leelavathi
6/2/23	Instruments	2pm	2.45pm	Jessy
	Instruments	8am	8.45am	Leelavathi.
7/2/23	Instruments, tray's	2pm	2.45pm	Jessy
	Instruments	8am	8.45am	Leelavathi.
8/2/23	Instruments, tray's	2pm	2.45pm	Savitha.
	Instruments	8am	8.45am	Leelavathi.
9/2/23	Instruments	2pm	2.45pm	Savitha.
	Instruments, kidney tray	8am	8.45am	Leelavathi.
10/2/23	Instruments	2pm	2.45pm	Savitha
	Instruments	8am	8.45am	Leelavathi
11/2/23	Instruments	2pm	2.45pm	Jessy
	Instruments	8am	8.45am	Leelavathi
13/2/23	Instruments, tray's	2pm	2.45pm	Soja.
	Instruments	8am	8.45am	Leelavathi
14/2/23	Instruments	2pm	2.45pm	Bindhu
	Instruments	8am	8.45am	Jessy
15/2/23	Instruments	2pm	2.45pm	Savitha.
	Instruments	8am	8.45am	Leelavathi
16/2/23	Instruments, kidneytray	2pm	2.45pm	Savitha.
	Instruments	8am	8.45am	Leelavathi.
17/2/23	Instruments, impression tray	2pm	2.45pm	Savitha.
	Instruments	8am	8.45am	Soja
18/2/23	Instruments	2pm	2.45pm	Jessy
	Instruments	8am	8.45am	Leelavathi
20/2/23	Instruments			

21/2/23	Instruments, trays	2pm	2.45pm	Soja.
	Instruments	8am	8.45am	Leelamma.
22/2/23	Instruments, kidneytray	2pm	2.45pm	Bindhu
	Instruments	8am	8.45am	Jessy
23/2/23	Instruments, kidneytray	2pm	2.45pm	Savitha.
	Instruments	8am	8.45am	Leelamma.
24/2/23	Instruments, trays	2pm	2.45pm	Jessy.
	Instruments	8am	8.45am	Leelamma.
25/2/23	Instruments, trays	2pm	2.45pm	Jessy
	Instruments	8am	8.45am	Leelamma
27/2/23	Instruments	2pm	2.45pm	Jessy
	Instruments	8am	8.45am	Savitha.
28/2/23	Instruments	2pm	2.45pm	Jessy.
	1/3/2023			
1/3/23	Instruments, trays	8am	8.45am	Leelamma.
	Instruments	2pm	2.45pm	Jessy
2/3/23	Instruments, trays	8am	8.45am	Leelamma.
	Instruments	2pm	2.45pm	Jessy
3/3/23	Instruments	8am	8.45am	Leelamma.
	Instruments, trays	2pm	2.45pm	Savitha
4/3/23	Instruments	8am	8.45am	Leelamma
	Instruments, trays	2pm	2.45pm	Jessy
6/3/23	Instruments	8am	8.45am	Leelamma.
	Instruments	2pm	2.45pm	Bindhu
7/3/23	Instruments, trays	8am	8.45am	Leelamma
	Instruments	2pm	2.45	Bindhu.
8/3/23	Instruments	8am	8.45am	Leelamma
9/3/23	Instruments	8.am	8.45am	Leelamma
	Instruments	2.pm.	2.45	Bindhu
10/3/23	Instruments	8.am	8.45am	Leelamma
	Instruments	2.00pm	2.45pm	soja

11/3/23	Intruments	8.am	8.45pm	Leelamme
	Intruments	2.pm	2.45pm	Savitha
13/3/23	Intruments	8.am	8.45m	Jessy
	Intruments	2.pm	2.45pm	Soja.
14/3/23	Intruments	8.am	8.45pm	Leelamme
	Intruments	2.00pm	2.45pm	Bindu
15/3/23	Instruments	8.am	8.45pm	Leelamme
	Instruments	2.00pm	2.45pm	Savitha
16/3/23	Instruments	8.am	8.45pm	Jessy.
	Instruments	2.00pm	2.45pm	Jessy.
17/3/23	Instruments	8.am	8.45pm	Leelamma
	Instruments	2.00pm	2.45pm	Soja.
18/3/23	Instruments	8 am	8.45pm	Leelamma
	Instruments	2.00pm	2.45pm	Bindu mir
20/3/23	Instruments	8.00pm	8.45am	Leelamma
	Instruments	2.00pm	2.45pm	Savitha
21/3/23	Instruments	8.00am	8.45am	Leelamma
	Instruments	2.00pm	2.45pm	Soja.
22/3/23	Instruments	8.00am	8.45am	Leelamma
	Instruments	2.00pm	2.45pm	Bindu mir
23/3/23	Instruments	8.00am	8.45am	Leelamma
	Instruments	2.00pm	2.45pm	Savitha
24/3/23	Instruments	8.00am	8.45pm	Leelamma
	Instruments	2.00pm	2.45pm	Jessy.
25/3/23	Instruments	8 Am	8.45pm	Leelam
	Instruments	2 pm	2.45pm	Jessy
27/3/23	Instruments	8 Am	8.45M	Leelam
	Instruments	2 pm	2.45pm	Savitha
28/3/23	Instruments	8 am	8.45m	Leelam
	Instruments	2 pm	2.45pm	Soja
29/3/23	Instruments	8 Am	8.45m	Leelamma
	Instruments	2 pm	2.45pm	Savitha
30/3/23	Instruments	8 Am	8.45m	Leelam

1-4-2023 April

1-4-23	Instruments	8 am	8.45 am	Leelam
	Instruments	2 pm	2.45 pm	Jessy
3-4-23	Instruments	8 am	8.45 am	Leelam
	Instruments	2 pm	2.45 pm	Savitha
4-4-23	Instruments	8 am	8.45 am	Leelam
	Instruments	2 pm	3.15 pm	Jessy
5-4-23	Instruments	8 am	8.45 am	Leelam
	Instruments	2 pm	3 pm	Suya
8-4-23	Instruments	8 am	8.45 am	Leelam
	Instruments	2 pm	3 pm	Suya
10-4-23	Instruments	8 am	8.45 am	Jessy
	Instruments	2 pm	3 pm	Savitha
11-4-23	Instruments	8 am	8.45 am	Leelam
	Instruments	2 pm	3 pm	Bindhu
12-4-23	Instruments	8 am	8.45 am	Leelam
	Instruments	2 pm	3 pm	Bindhu
13-4-23	Instruments	8 am	8.45 am	Leelam
	Instruments	2 pm	3 pm	Suya
14/4/23	Instruments	8 am	8.45 am	Leelam
	Instruments	2 pm	3 pm	Savitha
15/4/23	Instruments	8 am	8.45 am	Leelam
	Instruments	2 pm	3 pm	Jessy
17/4/23	Instruments	8 am	8.45 am	Leelam
	Instruments	2 pm	3 pm	Suya
18/4/23	Instruments	8 am	8.45 am	Leelam
	Instruments	8 pm	8.45 pm	Satyam
19/4/23	Instruments	8 am	8.45 am	Leelam
	Instruments	2 pm	2.45 pm	Jessy
20/4/23	Instruments	8 am	8.45 am	Leelam
	Instruments	2 pm	2.45 pm	Savitha
21/4/23	Instruments	8 am	8.45 am	Leelam
	Instruments	2 pm	2.45 pm	Suya
24/4/23	Instruments	2 pm	2.45 pm	Jessy

25/4/23	① Instruments	8 Am	8.45 Am	Leelavathi
	② Instruments	2 Pm	2.45 Pm	Savitha
26/4/23	① Instruments	8 Am	8.45 Am	Leelavathi
	② Instruments	2 Pm	2.45 Pm	Jessy
27/4/23	① Instruments	8 Am	8.45 Am	Leelavathi
	② Instruments	2 Pm	2.45 Pm	Savitha
28/4/23	① Instruments	8 Am	8.45 Am	Leelavathi
	② Instruments	2 Pm	2.45 Pm	Suya
29/4/23	① Instruments	8 Am	8.45 Am	Leelavathi
	② Instruments	2 Pm	2.45 Pm	Jessy

May

2/5/23	① Instruments	8 Am	8.45 Am	Leelavathi
	② Instruments & gauze	2 Pm	2.45 Pm	Jessy
3/5/23	① Instruments	8 Am	8.45 Am	Leelavathi
	② Instruments	2 Pm	2.45 Pm	Savitha
4/5/23	① Instruments	8 Am	8.45 Am	Leelavathi
	② Instruments	2 Pm	2.45 Pm	Savitha
5/5/23	① Instruments & Cotton	8 Am	8.45 Am	Leelavathi
	② Instruments	2 Pm	2.45 Pm	Savitha
6/5/23	① Instruments	8 Am	8.45 Am	Leelavathi
	② Instruments	2 Pm	2.45 Pm	Jessy
8/5/23	① Instruments	8 Am	8.45 Am	Leelavathi
	② Instruments	2 Pm	2.45 Pm	Savitha
9/5/23	① Instruments	8 Am	8.45 Am	Leelavathi
	② Instruments	2 Pm	2.45 Pm	Suya
10/5/23	① Instruments	8 Am	8.45 Am	Leelavathi
	② Instruments	2 Pm	2.45 Pm	Suya
11/5/23	① Instruments	8 Am	8.30 Am	Leelavathi
	② Instruments	2 Pm	2.45 Pm	Jessy
12/5/23	① Instruments	8 Am	8.30 Am	Leelavathi
	② Instruments	2 Pm	2.45 Pm	Savitha
13/5/23	① Instruments	8 Am	8.30 Am	Leelavathi
	② Instruments	2 Pm	2.45 Pm	Savitha

15/5/23	① Instruments	8 AM	8.45 AM	Leelavathi
	② Instruments	2 PM	2.45 PM	Sessy
16/5/23	① Instruments	8 AM	8.45 AM	Leelavathi
	② Instruments	2 PM	2.45 PM	Sessy
17/5/23	① Instruments	8 AM	8.45 AM	Leelavathi
	② Instruments	2 PM	2.45 PM	Savithri
18/5/23	① Instruments	8 AM	8.45 AM	Leelavathi
	② Instruments	2 PM	2.45 PM	Savithri
19/5/23	① Instruments	8 AM	8.45 AM	Leelavathi
	② Instruments	2 PM	2.45 PM	Sugan
20/5/23	① Instruments	8 AM	8.45 AM	Leelavathi
	② Instruments	2 PM	2.45 PM	Sugan
22/5/23	① Instruments	8 AM	8.45 AM	Leelavathi
	② Instruments	2 PM	2.45 PM	Bindhu
23/5/23	① Instruments	8 AM	8.45 AM	Leelavathi
	② Instruments	2 PM	2.45 PM	Bindhu
24/5/23	① Instruments	8 AM	8.45 AM	Leelavathi
	② Instruments	2 PM	2.45 PM	Sessy
25/5/23	① Instruments	8 AM	8.45 AM	Leelavathi
	② Instruments	2 PM	2.45 PM	Savithri
26/5/23	① Instruments	8 AM	8.45 AM	Leelavathi
	② Instruments	2 PM	2.45 PM	Sugan
27/5/23	① Instruments	8 AM	8.45 AM	Leelavathi
	② Instruments	2 PM	2.45 PM	Bindhu
29/5/23	① Instruments	8 AM	8.45 AM	Leelavathi
	② Instruments	2 PM	2.45 PM	Sessy
30/5/23	① Instruments	8 AM	8.45 AM	Leelavathi
	② Instruments	2 PM	2.45 PM	Savithri
31/5/23	① Instruments	8 AM	8.45 AM	Leelavathi
	② Instruments	2 PM	2.45 PM	Sugan

June

1-6-23	Instruments	8 AM	8.30 AM	Leelavathi
	Instruments	2 PM	2 HSPM	Jessy
2/6/23	Instruments	8 AM	8.30 AM	Leelavathi
	Instruments	2 PM	2 HSPM	Savitha
3/6/23	Instruments	8 AM	8.30 AM	Leelavathi
	Instruments	2 PM	2 HSPM	Suya
5/6/23	Instruments	8 AM	8.30 AM	Leelavathi
	Instruments	2 PM	2 HSPM	Suya
6-6-23	Instruments	8 AM	8.30 AM	Leelavathi
	Instruments	2 PM	2 HSPM	Jessy
7-6-23	Instruments	8 AM	8.30 AM	Leelavathi
	Instruments	2 PM	2 HSPM	Jessy
8-6-23	Instruments	8 AM	8.30 AM	Leelavathi
	Instruments	2 PM	2 HSPM	Jessy
9-6-23	Instruments	8 AM	8.30 AM	Leelavathi
	Instruments	2 PM	2 HSPM	Savitha
10-6-23	Instruments	8 AM	8.30 AM	Leelavathi
	Instruments	2 PM	2 HSPM	Suya
12-6-23	Instruments	8 AM	8.30 AM	Leelavathi
	Instruments	2 PM	2 HSPM	Jessy
13-6-23	Instruments	8 AM	8.30 AM	Leelavathi
	Instruments	2 PM	2 HSPM	Suya
14-6-23	Instruments	8 AM	8.30 AM	Leelavathi
	Instruments	2 PM	2 HSPM	Suya
15-6-23	Instruments	8 AM	8.30 AM	Leelavathi
	Instruments	2 PM	2 HSPM	Jessy
16-6-23	Instruments	8 AM	8.30 AM	Leelavathi
	Instruments Cotton	2 PM	2 HSPM	Suya
17-6-23	Instruments	8 AM	8.30 AM	Leelavathi
	Instruments	2 PM	2 HSPM	Jessy
19-6-23	Instruments	8.15 AM	8 HSM	Leelavathi
	Instruments	2 PM	2 HSPM	Jessy
20-6-23	Instruments	8 AM	8 HSM	Leelavathi

21-6-23	On strument	8.15am	8.45am	Leelam
	On strument	2 pm	2.45pm	Suga
22/6/23	On strument	8.15am	8.45am	Leelam
	On strument	2.30pm	3.15pm	Suga
23/6/23	On strument	8.30am	9 Am	Leelam
	On strument	2.15pm	3pm	Suga
24/6/23	On strument	8.15am	8.45am	Bindhu
	On strument	2.30pm	3.15pm	Jessy
26/6/23	On strument	8.15am	8.45am	Bindhu
	On strument	2.30pm	3.15pm	Suga
27/6/23	On strument	8.15am	8.45am	Bindhu
	On strument	2.30pm	3.15pm	Jessy
28/6/23	On strument	8.15am	8.45am	Suga
	On strument	2.30pm	3.15pm	Jessy
29/6/23	On strument	8.15am	8.45am	Leelame
	On strument	2.30pm	3.15pm	Jessy
30/6/23	On strument	8.15am	8.45am	Leelamm
	On strument	2.30pm	3.15pm	Suga

July

1-7-23	On strument	8.15am	8.45am	Leelam
	On strument	2.30pm	3.15pm	Jessy
4-7-23	On strument	8.15am	8.45am	Leelamm
	On strument	2.30pm	3.15pm	Savitha
5-7-23	On strument	8.15am	8.45am	Leelam
	On strument	2.30pm	3.15pm	Savitha
6-7-23	On strument	8.15am	8.45am	Leelam
	On strument	2.30pm	3.30pm	Savitha
7-7-23	On strument	8.15am	8.45am	Leelam
	On strument	2.30pm	3.15pm	Savitha
8-7-23	On strument	8.15am	8.45am	Leelamm
	On strument	2.30pm	3.15pm	Jessy
10-7-23	On strument	8.15am	8.45am	Leelam
	On strument	2.30pm	3.15pm	Savitha