Topic 5: Understanding and learning from errors

Coming to terms with health-care errors
It is important that medical students have a basic understanding of the nature of error. All health-care workers need to understand the different types of errors and how they come about. This is essential for devising strategies to prevent them from happening 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. See topic 3 “Understanding systems and the impact of complexity on patient care” for further information.

Keywords
Error, violation, near miss, hindsight bias, root cause analysis.

Learning objective
Understand the nature of error and how health care can learn from error to improve patient safety.

Learning outcomes: knowledge and performance

What a student needs to know (knowledge requirement):
explain the terms error, violation, near miss, hindsight bias.

What a student needs to do (performance requirements):
know the ways to learn from errors; participate in an analysis of an adverse event; practise strategies to reduce errors.

WHAT STUDENTS NEED TO KNOW (KNOWLEDGE REQUIREMENTS)

Errors
In simple terms, an error occurs “when someone is trying to do the right thing, but actually does the wrong thing (p.112).” [1] In other words, there is a non-deliberate deviation from what was intended. 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 by doing the wrong thing (commission) or by failing to do the right thing (omission).

A violation is different from errors caused by the system. Violations are errors caused by a deliberate deviation from an accepted protocol or standard of care.

Errors and outcomes are not inextricably linked. Students will often observe patients who have a bad outcome where no human error was made. Some treatments have well-recognized complications that can occur even in the best of hands and health care. Other numerous errors that are made do not lead to a bad outcome because the error was recognized in time and the appropriate steps or treatment taken to counteract the wrong treatment caused by the error. Sometimes, as mentioned in topic 3 in the section on HRO, patients themselves are resilient and even though an error was made the patient does not suffer because their own body or immune system has withstood the incorrect treatment.

It is important to point out that there is no reference to outcome in the definition of error, though the fact of the (usually untoward) outcome often is 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 retrieved. There is no doubt that the nature of the outcome usually influences our perception of the error, often due to 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 facet of the “human condition” (see topic 2 “What is human factors and why is it important to patient safety?”). The challenging reality for health-care workers is that the same mental processes that lead us to make “silly mistakes” away from the workplace are also in play when we are at work. However, the work context makes the consequences vastly different.

The term “medical error” is slightly misleading as it 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 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.

The unique feature in health care-associated errors is that when failure occurs (omission or commission) it is the patient or patients 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 some form of memory failure such as failing to administer a medication (see Figure 6).

Figure 6. Summary of the principal error types


A mistake is a failure of planning, i.e. the plan is wrong. This can be either rule based, because a “wrong” rule is applied, or knowledge based, because the 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 clinicians are confronted with what is for them a “new” clinical situation.

Slips, lapses and mistakes are all serious and can potentially harm patients, though again it all 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 “What is human factors and why is it important to patient safety?” Some other
general error reduction principles are outlined below. Reason has also promoted the concept of “error wisdom” [4] for frontline workers as a means to assess the risk 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.

**Situations associated with an increased risk of error**

We now know from various studies that students and junior doctors in particular are vulnerable to errors in particular circumstances.

**When they are unfamiliar with a task**

It is very important that students do not perform a procedure for their very first time on a patient. They need to first understand what they are doing and to practise on a mannequin or other prop in a simulated environment. If it is the first time, the student should be properly supervised and watched while they perform the procedure.

**Inexperience**

Students are in a privileged position because patients do not expect students to know much they appreciate 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 make people cut corners and take shortcuts when they should not. Not washing hands properly is an example.

**Inadequate checking**

The simple act of checking has saved thousands of patients receiving the wrong medications. Pharmacists routinely check drugs and assist the health team in making sure the patient receives the correct drug, dose and by the correct route. Students should establish good relationships with pharmacists and nurses who have habitual checking routines built into their discipline. Medicine has not had such a long tradition of using techniques to help minimize errors. Checking is a simple thing that students can start practising immediately when they are placed into the clinical environment.

**Poor procedures**

This can relate to a number of factors— inadequate preparation, inadequate staffing and inadequate attention to the particular patient. Students may be required to use a piece of equipment without fully understand what it is for or how to use it. Before using any equipment students should familiarize themselves with it. Watching someone use it and then discussing with them the procedure for which it is used is very instructive.

**Individual factors that predispose students (and other health-care workers) to errors**

In addition to recognized situations prone to errors, there are also individual factors that predispose errors:

**Limited memory capacity**

How medical students perceive themselves in the medical and hospital hierarchy may relate to how confident and willing they are to ask for help. Asking for help is expected of students yet it still remains a challenge for many students. This in turn may affect their ability to recognize their limitations. Lack of confidence could be a significant factor in whether a student asks for help in mastering a new skill. If they are unwilling or lack 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 medical students and junior doctors. The
preparedness of medical students for clinical practice has been studied. Most reveal that many graduating medical students in their early intern year have deficiencies in basic clinical skills. This may be because of a reluctance to ask for help as students. Inadequate understanding of the crucial signs of acute illness, airway obstruction and basic life support were examples of specific areas where new doctors had inadequate knowledge and skills.

Many students think that if they can regurgitate the medical information stored in textbooks they will be good doctors. However, this is not the case. The amount of information that a doctor is required to know today is far beyond that which is capable of being memorized. Today, educational outcomes are more about performance than retention of information. This is because educationalists recognize that the human brain is a limited organ that 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 were developed to assist clinicians to provide care following the best available evidence. Students should get into the habit of using checklists and not relying on their memory. Topic 7 has a section on guidelines.

Fatigue
Memory is affected by fatigue. Fatigue is a known factor in errors involving junior doctors. In recognition of the problems caused by fatigue many countries have or are reforming the excessive hours worked by doctors. The connection between sleep deprivation of interns due to long hours and circadian interruption and well-being was made three decades ago, yet it is only recently that governments and regulators have been serious about limiting hours. A 2004, study by Landrigan et al. [5] was one of the first to measure the effects of sleep deprivation on medical errors. They found that interns working in the medical intensive unit and coronary care unit of Brigham and Women’s Hospital (Boston, 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 show that sleep deprivation can have similar symptoms to alcohol intoxication [6].

Stress, hunger, 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 begin to monitor their own status and well being, being mindful that if they are feeling unwell or stressed that they are more likely to make errors.

Language or cultural factors
The potential for communication errors caused by language and cultural factors is obvious but there are many patient–doctor interactions that occur without an interpreter or understanding of the language. Students should appreciate the problems caused by language barriers and misunderstanding of cultural norms.

Hazardous attitudes
Medical students who perform procedures on patients without supervision might be said to display a hazardous attitude. The student may be more interested in practising or getting experience rather than any concern for the well-being of the patient. Students should always appreciate that accessing patients in a privilege and one that should not be taken for granted.
There are many easy to remember mnemonics to assist students monitor themselves. HALT is one such aid. Do not forget if you are Hungry Angry Late or Tired

Another tool is IM SAFE Illness Medication (prescription alcohol and others) Stress Alcohol Fatigue Emotion

WHAT STUDENTS NEED TO DO (PERFORMANCE REQUIREMENTS)

Know the ways to learn from errors

Incident reporting

Incident reporting and monitoring involves collecting and analysing information about any event that could have harmed or did harm a patient in the hospital, clinic or health-care organization. An incident-reporting system is a fundamental component of an organization’s ability to learn from error. The lessons allow the organization to identify and eliminate the “error traps”. Topic 6 “Understanding and managing clinical risk” provides more information on organizational responsibility for incident monitoring.

Incidents are traditionally under-reported, often because the person approach to incident analysis is still pervasive in health care, whereby the frontline workers—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 at several levels (see topic 3 “Understanding systems and the impact of complexity on patient care”).

The frequency of reporting and the manner in which incidents are analysed—using a systems approach rather than a person approach—are heavily dependent on the leadership and “culture” within an organization. More attention is being paid to the importance of organizational culture in health care in recent years [7], reflecting lessons learnt in other industries in relation to system safety. It is likely that there is a correlation in health care between organizational culture in a health service and patient safety.

An organization’s culture reflects the shared values and beliefs that interact with an organization’s structure and control systems to produce behavioural norms [8]. Organizations with a strong reporting culture are well placed to learn from errors because the staff feel free to report actual or potential problems without fear of ridicule or reprimand. Medical students and junior doctors are part of the work culture. They may feel that it is too hard and they have no power to change anything in the hospital or clinic. However, they can look out for ways to improve the system. It can be as simple as being respectful to the health-care team, including patients in discussions about their care or asking if the nurses would like a coffee if the student is making coffee.
Other successful strategies in terms of incident reporting and monitoring include: [6]

- anonymous reporting;
- timely feedback;
- open acknowledgement of successes resulting from incident reporting;
- reporting of near misses is useful in that “free lessons” can be learnt, i.e. system improvements can be instituted as a result of the investigation but at no cost to a patient.

### Root cause analysis

See also topic 7 “Introduction to quality improvement methods”.

The Veterans Affairs National Center for Patient Safety of the US Department of Veterans Affairs has developed a structured approach called root cause analysis to evaluate, analyse and develop system improvements for the most serious adverse events [9].

Reporting an incident requires the following basic information: [1]

- What happened?
- Who was involved?
- When did it happen?
- Where did it happen?
- The severity of the actual or potential harm.
- The likelihood of recurrence.
- The consequences.

Root cause analysis focuses on the system and not the individual worker and assumes that the adverse event causing harm to a patient is a system failure. The VA system uses a severity assessment code to help triage the reported incidents to ensure those indicating the most serious risk to the organization are dealt with first.

The root cause analysis model is a tested model that focuses on prevention not blame or punishment. Other processes are used when people are required to be accountable for their actions. The focus is on systems level vulnerabilities and not individual performance. The model examines multiple factors such as communication, training, fatigue, scheduling, rostering, environment, equipment, rules, policies and barriers.

The defining characteristics of root cause analysis include: [10]

- 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 improvements that could be made in systems or processes to improve performance and reduce the likelihood of such adverse events or close calls in the future.

### Practise strategies to reduce errors

Medical students can immediately start practising error reduction behaviours by looking after their own health. Being aware when they are tired, becoming familiar with the environment they work in, and being 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 medical students get used to asking questions if they do not know something relevant and important to the patients.

Some personal error reduction strategies for students are to

- know yourself (eat well, sleep well and look after yourself);
- know your environment;
Medical 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 doctors make mistakes. Students should
- assume that errors will be made and that they should prepare for them;
- identify those circumstances most likely to lead to errors;
- have contingencies in place to cope with problems, interruptions and distractions;
- always mentally rehearse complex procedures or if it is the first time you are doing an activity involving a patient.

**Summary**

Medical error is a complex issue, but error itself is an inevitable part of the human condition.

These tips are known to limit the potential errors caused by humans (see also topic 2 on human factors engineering). [11]
- avoid reliance on memory;
- simplify processes;
- standardize common processes and procedures;
- routinely use checklists;
- decrease the reliance on vigilance.

Learning from error can occur at both an individual and organizational level through incident reporting and analysis. Barriers to learning from error include a blame culture that institutes a person approach to investigation and the phenomenon of hindsight bias. A broadly based system approach is required for organizational learning and the possibility of system change to occur.

Root cause analysis is a highly structured system approach to incident analysis that is generally reserved for the most serious patient harm episodes.

**CASE STUDIES**

**Vincristine administration alert**

*The following alert No. 115 was published by WHO on 18 July 2007. It relates to the administration of the drug vincristine.*

**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 in a variety of international settings 55 times. 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, and in small print, being 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.

Reference

A nurse speaks up to avoid further error preventing 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 surgical procedure) was coming to an end, a nurse spoke up and reported that “the patient has a left contact lens in his eye”. The anaesthetist asked whether it was permanent and the nurse verified that it was disposable. The anaesthetist asked the patient why the contact 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. 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 was located and the contact lens was stored in a small container of saline.

Case from the WHO Patient Safety Curriculum Guide for Medical Schools working group. Supplied by Lorelei Lingard, University of Toronto, Toronto, Canada.

HOW TO TEACH THIS TOPIC

Teaching strategies/formats

Simulation exercises:

- different scenarios could be developed about adverse events and the need to report and analyse errors;
- practical exercises that show how errors are avoided;
- rehearse strategies for managing errors.
An interactive/didactic lecture

Use the accompanying slides as a guide, covering the whole topic. The slides can be PowerPoint or converted to overhead slides for a projector. Start the session with a case study from the Case Study Bank or get the students to identify some errors they have recently made.

A small group discussion session

- Small group discussion about common errors made in the workplace.
- One or more students could be presented with the topic and be 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.

Teaching activities

Different methods for generating discussion about the areas in this topic include:

- asking the students to keep a journal 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 happening again);
- selecting a case study from above that sets the scene for a discussion about the most common errors in health care;
- using examples from the media (newspapers and television) that have been published/broadcasted;
- using de-identified case examples from your own hospitals and clinics;
- using a case study get the students to brainstorm the possible errors and the associated factors;
- getting examples of lessons about error and system failure from other industries;
- inviting a staff member from another discipline such as engineering or psychology to talk error causation theory, cultures of safety and role of error reporting in safety;
- inviting a senior respected clinician to talk about their errors;
- inviting a quality and safety officer to talk about system in place to minimize errors and manage adverse events;
- discussing the difference between system failures, violations and errors;
- using a case study to analyse the different avenues for managing an adverse event;
- participating or be an observer in a root cause analysis.

Activities for students in their clinical placements:

- attend a root cause analysis investigation;
- ask students to find out if the hospital conducts mortality and morbidity meetings or other peer review forums where adverse events are reviewed;
- require the students to talk among themselves errors they have observed in the hospital using a non-blame approach;
- ask the students to select a ward or clinic where they are placed and inquire about the main types of errors in their area and the steps they take to minimize them and learn from them.

TOOLS AND RESOURCES

Medical error and patient safety
A vast array of resources on medical error and related topics from the Agency for Healthcare Research and Quality
New York Medical College. Medical errors and

**HOW TO ASSESS THIS TOPIC**

**Assessment strategies/formats**
A range of assessment strategies are suitable for this topic including MCQs, essays, SBA, case-based discussion and self-assessment. 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.

**HOW TO EVALUATE THIS TOPIC**

Evaluation is important to review how a teaching session went and how improvements can be made.

**References**

11. 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 Academy Press, 1999.

**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 assist the teacher 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.