PRACTICAL PATIENT
SAFETY SOLUTIONS

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This document has been made available by the team at Practical Patient Safety Solutions to support delegate learning from the WoCoVA 2022 meeting.

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How to help mitigate the chances of error in healthcare.

We suggest that an understanding of Human Factors can be the starting point in minimising avoidable error in healthcare.

Human factors (HF) is the study of how people work together and use technology. The study involves the interaction of human abilities, expectations, and limitations, with work environments and system design.

For over thirty years, airline pilots in the U.K. have been required to study Human Factors/ Non technical skills because their operating procedures are based on Human Factors principles.

 Many organisations in diverse industries such as high-speed rail, chemical and petrochemical processing and nuclear power generation can show similar safety improvements over the last thirty years.

The feature that all these organisations have in common is that they all have **Safety Management Systems (SMS).** Interestingly the SMSs in different industries were the product of convergent evolution. As they responded to their different accidents, they tried different solutions and, through iterative processes, the Safety Management Systems of these different industries evolved to become very similar to each other.

Organisational psychologists who have studied organisations which successfully use Safety Management Systems have created the term '**High Reliability Organisations (HRO)** to describe them. Unfortunately, the most unreliable part of a High Reliability Organisation is the human operator.

HROs have found that human reliability issues can be managed using Human Factors science. For example, this science can be employed to create reliable checking and communication processes and to design equipment warning systems to detect inappropriate control inputs and dangerous conditions.

The **Chartered Institute for Ergonomics and Human Factors (CIEHF)** describes the role of human factors as being about 'helping people to do the right thing and to make it impossible or hard to do the 'wrong thing' by designing out the potential for making mistakes'.

How did High Reliability Organisations become safe ?

The organisations which developed into High Reliability Organisations all suffered many major accidents in the 1970s and 80s. In most of these accidents, an operator had made a catastrophic error which was not 'caught' before disaster struck. Basic human instincts require us to blame and even punish the person responsible for the harm. The **'Person Approach'** to accident analysis is also driven by legal imperatives. However, this did not stop further accidents as the 'system' still set up further hapless persons to fail.

In the late 1980s several accidents occurred which showed very clearly that the 'person' was actually lured into a trap by a deceptive set of circumstances and by a set of problems which came to be known as **'system failures'.**

These insights led to the adoption of the **'Systems Approach'**. Accordingly, the importance of this approach is reflected in the fact that the first module in the U.K.'s **National Patient Safety Syllabus** is entitled the 'Systems Approach to Patient Safety.'

The second module in the Syllabus is entitled 'Learning from incidents'.

High Reliability Organisations learn from their accidents by using **Thematic Analysis**. This is an approach where HROs study many accidents together, noting the recurring themes or problems. Some of these problems may seem transient and insignificant in comparison to the huge and unforgivable error that had directly precipitated the disaster. However deeper analysis revealed that these trivial problems were much more pervasive and influential than one would suspect at first. HROs decided to take action to manage these problems.

The good news is that there are only a handful of these problems to deal with. The single most important 'theme' is **'communication failure'**. About three quarters of accidents in all high-hazard industries involve, at some stage in the 'event chain', a communication failure between members of the team. The communication failure may seem insignificant at the time but its effect grew, allowing further errors.

Other recurring themes include inconsistent or inadequate procedures, 'checking failures', changes of plan and inadequate training and lack of preparedness for foreseeable problems.

Having identified the common themes, HROs started to address each of these issues systematically.

Safety Critical Communications (SCC) Training

A safety critical communication is any communication which can cause harm if it is not sent, or it is sent but it is misunderstood. Detailed analysis of many accidents including those in healthcare show that at some stage in the chain of events that led to the accident, a safety critical message which was passed between two team members was misunderstood.

HROs provide Safety Critical Communications Training to their operators. The training course begins by showing numerous examples of messages between staff that were misunderstood. From these insights, some basic rules for passing safety critical messages have been developed:

Readback – It is appropriate that certain types of safety critical messages should be repeated back by the message receiver to the sender. The message sender should then confirm that the readback is correct. Readback should be given or requested if either party to the communication feels they would like the reassurance that it provides.

"Please give Mr Simon Hoffer 20 mg of iv Cytotoxelene"

"I will give Mr Simon Hoffer 20 mg of iv Cytotoxelene"

Summarizing - An extension to the readback concept is that complex operational discussions involving various options should be summarised by the operator who has been tasked with carrying out the action being discussed. The **use of pronouns** should be avoided (e.g. do not say "*Ok I'll give it to him*")

Use of standard words / terminology – There are many cases where what had seemed to the message sender to be a simple message with only one possible meaning was interpreted very differently by the message receiver. Some words can be unexpectedly ambiguous. To manage this, with those 'high-risk' communications where it may be difficult to correct a misunderstanding before harm is caused, only one form of words can be used to pass a message. An example, in aviation, requesting and granting permission for take-off can only be done using one form of words:

"Lufthansa 408 is ready for departure" (Note: the use of the words 'take-off' at this stage is prohibited. Only after permission is given by the control tower can these words be used)

"Lufthansa 408, on runway 23 you are cleared for take off"

"Lufthansa 408, runway 23 cleared for take off"

Opening phrases – Sometimes an **Urgent, Unusual or Unexpected** message can be assumed to be a routine message by the message receiver who then does not take the appropriate course of action. SCC protocols require such messages be prefaced with a phrase which effectively says 'this message may not be what you are expecting'. In air traffic control and railway signalling centres the rules even require that the pilot / driver must first acknowledge that they understand that the message which will follow is unusual or unexpected before the message is sent.

"Driver of train 2D57, hold your position, in a moment I will clear you to proceed through red signal G131 which has a control system fault."

"This is the driver of 2D57, I will continue to hold at signal G131 and I expect movement clearance shortly, standing by."

"Driver of train 2D57, I now clear you to proceed through red signal G131, you will obey all other signals."

"Thank you, train 2D57 is cleared through red signal G131, I will obey all other signals"

This exchange may seem excessively cautious, but this is how the U.K. Railway system has found by experience that this is the safest way of managing this unusual situation.

Standard Operating Procedures (SOP)

High Reliability Organisations establish what is current 'best practice' when carrying out each safety critical activity. This becomes the basis for the standard operating procedure for carrying out that activity. The steps in the sequence of actions are arranged so that the activity can be safely stopped while briefings and checks are carried out.

From time to time, new technologies or the lessons from accident investigations may require a change to the standard operating procedure. In that case the change is promulgated to all operators and a new version of the SOP will be issued and introduced systemwide on a given date.

In some cases, short training films can be produced showing exactly how to carry out the procedure. The film can explain the reasons behind the design of the procedure if this is not clear.

Human Factors / Safety Management Training

Unfortunately, human beings do not always behave in consistent and logical ways. Standard operating procedures and equipment design must allow for these problems. As a result, some elements in HROs' standard operating procedures may appear, at first sight, to be strange, unnecessarily prescriptive or socially awkward. Since it is important that all team members follow the SOPs, HROs provide Human Factors and Safety Management Training courses which explain why it is necessary to follow these sometimes seemingly overwrought procedures.

These training courses also encourage operators to develop positive attitudes to such contentious issues as the use of recording equipment to monitor the work performance of front-line operators. Airline pilots and train drivers have their driving performance and voice communications recorded to ensure that they follow standard operating procedures. Monitoring technology is now fully accepted by pilots and train drivers as being in everyone's best interest. Furthermore, the monitoring systems provide direct feedback on the health of the 'safety culture'. Both the airlines and the railways find that compliance with correct operation is high and is continuously improving.

 If the organisation's management use the monitoring system in an unfair way to deal with individual operators, it will harm the safety culture and will be highly counterproductive.

Non-Technical Skills

Defined as the cognitive and social skills that underpin knowledge and expertise in high-demand work environments, non-technical skills are critical for operators in high hazard systems. In surgery deficiencies in non-technical skills have been associated with a higher risk of surgical complications and death owing to diagnostic failure, poor teamwork or miscommunication. The Non-Technical Skills for Surgeons (NOTSS) behaviour rating system is considered the standard instrument for characterising surgeons' non-technical skills, including situation awareness, decision-making, communication and teamwork, and leadership.

Crisis Management

Many of worst disasters to befall the organisations which developed into HROs involved a crisis which was mismanaged. Accident investigators were often able to confirm that the initial problem would have been manageable if the operators had followed the correct protocols. Examples include the Chernobyl nuclear power station explosion, the Piper Alpha oil rig explosion and the Kegworth Air disaster. There have also been several high-profile surgical disasters which resulted from mis-managed crises.

High Reliability Organisations have devoted a great deal of effort to understanding poor crisis management and to understand how to ensure effective crisis management.

A major factor in poor crisis management is a problem which has been labelled *'Tachypsychia'* by some 'high-hazard' industries. This term is used to describe the adverse effects on cognition of the release of adrenaline caused by the crisis.

Observed effects of '*Tachypyschia*' include, but are not limited to ;

- Memory problems
- Altered perception of the passage of time
- Perceptual narrowing (vision or hearing)
- Freezing or denial (– 'this is not happening')
- 'Mind Lock' (– not changing the plan or diagnosis)

The most frequently occurring problem across all domains, including healthcare, is that operators simply forget to carry out an important step of the procedure. Another strategy to manage 'tachypsychia' is the encouragement of juniors to speak up and challenge seniors if the juniors feel that the senior is being adversely affected by 'tachypsychia'. *("Sir, it is now 3 minutes since the oxygen dropped below 90%)*

Aviation has noticed that pilot's performance in the first 10 to 30 seconds of **'Tachypsychia'** is so unreliable that pilots are advised that it usually better to take no physical actions at all during that short period. Aviation terms this problem the **'Startle Effect'**. With the exception of a handful emergency situations such as taking action to avoid a collision, pilots are instructed to delay taking action to allow the startle effect to subside. Rather than carrying out the vital actions from memory immediately, they are trained to pick up their **Quick Reference Handbook**, announce the title of the 'emergency' – *their diagnosis*, ("Loss of all AC Generators") turn to the correct page, read the title of the checklist ("Loss of all AC Generators checklist") and then **'read and do'** the emergency actions from the checklist. It can be helpful use a finger to read down the list as items are sometimes missed.

Preparedness

Not even HROs cannot stop bad things from happening completely. Thus, they need to be prepared for disaster to strike at any time. Thus, simulated emergency drills are arranged on a regular basis and often without warning. There are also regular classroom training sessions to discuss risks and how to deal with them.

There are two problems that HROs do have.

1. Complacency - Because they may enjoy many years of accident-free operations, their personnel may become complacent. To combat this, the classroom courses show video reconstructions of accident and near miss events. HRO's do still have close calls from time to time. They are often very lucky. But then if you do the right thing, you are often lucky.
2. Novel, Unexpected, Difficult to Manage threats. As HRO's have successfully managed to avoid almost all of the recurring types of disasters of earlier years, the few incident scenarios that they would face in the future were more likely to be of a novel, unexpected or difficult to manage type. Classroom discussions ask staff for their input and ideas on these emerging threats. Sadly, one issue that comes into this category is the threat of deliberate harm. In the last decade a growing proportion of airliner losses have resulted from deliberate actions.

Thus HROs have to proactive in being prepared.

Glossary

In the early 1990's there was an airline safety conference. The delegate of one airline commented that it was having occasional problems because its pilots were making a particular type of mistake when using a new piece of equipment. The representative of another airline commented that they were having the same problem, but they had given it a different name.

It was soon realised that the problem might have been somewhat more widespread than had been appreciated. Due to non-standardised terminology, the error was not appearing in the incident databases with its true extent.

The first step in successfully addressing human error issues in an organisation or even an entire industry is to ensure that everyone speaks a common language. If there is an understanding of basic risk management concepts, well-informed and precise discussions involving all ranks of personnel can take place.

You will probably want to improve the healthcare system by making critical incident reports about systemic failures. Using the correct human factors terminology may make it more likely that hospital authorities will take remedial action.

Here is glossary of useful Patient safety / Human Factors terminology.

Accident
A generic, well understood and expressive word to describe an adverse event following a combination of human errors, system failures and chance events. In recent years the NHS has used several circuitous terms such as 'Serious Incident Requiring Investigation' and 'Serious Untoward Incident to express the idea.

Accident Storytelling
See Storytelling

ACRM Anaesthetic Crisis Resource Management
See CRM

Active errors / active failures (the concept contrasts with latent or system failures)
Errors and violations committed at the "sharp end" of the system - by pilots, air traffic controllers, doctors, nurses, ships' crews, control room operators, maintenance personnel, and the like. Such unsafe acts are likely to have a direct impact on the safety of the system. Because of the immediacy of their adverse effects, these acts are termed active failures.

Adverse Event
– Any injury caused by medical care. Examples include:
- pneumothorax from central venous catheter placement
- anaphylaxis to intravenous penicillin
- postoperative wound infection
- hospital-acquired infection
- surgical procedure carried out on the wrong patient

Identifying an incident as an adverse event does not imply 'error,' 'negligence,' or poor-quality care. It simply indicates that an undesirable clinical outcome resulted from some aspect of diagnosis or therapy and not the underlying disease process.

Thus, pneumothorax from central venous catheter placement counts as an adverse event regardless of insertion technique. Similarly, postoperative wound infections count as adverse events even if the operation proceeded with optimal adherence to sterile procedures, the patient received appropriate antibiotic prophylaxis in the peri-operative setting, and so on. However, some adverse events are the result of avoidable human errors and teamwork failures.

Adverse Drug Event (ADE)
An adverse event involving medication use. Examples include
   - anaphylaxis to penicillin
   - heparin induced thrombocytopenia
   - aminoglycoside-induced renal failure, ototoxicity and vestibulopathy
   - agranulocytosis from chloramphenicol
   - error by clinician - wrong dose, wrong route etc.

As with the more general term, adverse event, there is no necessary relation to error or poor quality of care. In other words, ADEs include expected adverse drug reactions (or "side effects") as well as events due to error.

Thus, a serious allergic reaction to penicillin in a patient with no prior such history is an ADE, but so is the same reaction in a patient who does have a known allergy history but receives penicillin due to a prescribing oversight.

Ignoring the distinction between expected medication side effects and ADEs due to errors may seem misleading, but a similar distinction can be achieved with the concept of preventability. All ADEs due to error are preventable, but other ADEs not warranting the label 'error' may also be preventable.

Alert Phrase
A predetermined phrase that an operator can utter to draw the attention of other team members to uncertainty, departures from normal or safe procedures, or other situations which may represent evidence of an incipient adverse event.

Ambiguity
This is an unresolved / unexplained conflict or contradiction between two sets of information, instrument indications or a difference between what is happening and what was expected to happen. It may also be said to occur when someone does something which is not normal in the operational situation. Ambiguities are often the first signs (Red Flags) of an incipient adverse event.

Anchoring Error
A cognitive bias in which past (especially recent) cases are allowed to bias current diagnostic evaluation. An example might be a physician who saw two recent cases presenting with a certain set of symptoms and signs that proved to have polymyalgia rheumatica, now assuming that subsequent patients with similar presentations have the same disease, thereby discounting other diagnostic possibilities.

Assertiveness training
Assertiveness is the antidote to the passivity which is evident in junior team members in hierarchical organisations. Major adverse events in high-hazard industries could have been prevented if junior team members had been more assertive, assertiveness training is now provided in many organisations.

Attitude
The tendency to react favourably or unfavourably towards certain stimuli such as individuals, groups of people, practices, customs and institutions. An example with relevance to Patient Safety might be a clinician's attitude toward carrying out formal verbalised checking procedures. Attitudes cannot be directly observed and have to be inferred by observing the subject's behavior and verbal statements. High Reliability Organisations have used attitude surveys to measure the effectiveness of their safety training programmes in modifying potentially hazardous employee attitudes.

Authority Gradient
The balance of decision-making power or the steepness of command hierarchy in a team. Members of a team with a domineering, overbearing, or dictatorial team leader experience a steep authority gradient. Expressing concerns, questioning, or even simply clarifying instructions would require considerable determination on the part of team members who perceive their input as devalued or unwelcome. Most teams require some degree of authority gradient; otherwise roles are blurred and decisions cannot be made in a timely fashion.

Behaviour
A subject's observable actions in the workplace. High Reliability Organisations observe the behaviour of employees to check that they are working safely.

Beta Testing (of equipment or procedures)
A trial of equipment or procedures carried out by personnel who were not involved in the development process. Often the designers cannot envision how their equipment or procedures could possibly be used or interpreted in a way different to the way they had in mind. Beta testing can reveal inadequately drafted procedural instructions or usability problems when a piece of equipment or a procedure is used by an inexperienced operator.

Blame Culture
A culture which assumes that errors are moral failures. It is convenient for managers to blame front line staff for accidents in order to distract attention from their poorly designed procedures and inadequate training courses.

Call – back
American term for 'Readback' q.v.

Change Blindness
Change Blindness is a psychological lack of attention which is not associated with any vision defect resulting in an event where an individual fails to notice a significant change occurring in the visual field.

Checklist
The algorithmic listing of actions to be performed in a safety-critical situation. In health care Acute Cardiac Life Support [ACLS] protocols for treating cardiac arrest ensure that, no matter how often performed by a given practitioner, no step should be forgotten

Close Call
– (American term) An event or situation that did not produce patient injury, but only because of chance. This good fortune might reflect robustness of the patient (e.g., a patient with penicillin allergy receives penicillin, but has no reaction) or a fortuitous, timely intervention (eg, a nurse happens to realize that a physician wrote an order in the wrong chart). Such events are termed "near miss" incidents in the U.K.

Confirmation bias
A preference, either conscious or otherwise, for data which confirms one's mental model or prejudices. Sometimes 'discrepant data' is subconsciously rejected without the subject even being aware of its existence. Numerous psychological experiments show that confirmation bias can have unfortunate consequences and can be difficult to manage.

CRM - Crew Resource Management or Crisis Resource Management
A range of approaches to ensure that a team is able to function effectively in normal and crisis situations by accessing all of the mental and physical resources of all of the members of the team. The term Crew Resource Management arose in aviation following analysis of the cockpit voice recordings of crashed aircraft. This revealed that the crew could have had all the information they needed to sort out a problem but that the captain had failed to use all the resources (e.g. the co-pilot's situation awareness) available to him. In anaesthesia, some progressive training programmes are using simulators and use the term '(anaesthetic) crisis resource management' for this type of team training

Culpability of Errors
Some errors are clearly more 'culpable' than others. Consider two cases:
1. A doctor who makes a 'slip of the tongue' when stressed during an acute event.
2. A doctor who is known to routinely consult without reading the patients' records, carries out inadequate examinations and who then makes a wrong diagnosis.
The latter is clearly more culpable than the former.

Culture of low expectations
The term "a culture of low expectations" was devised by Mark Chassin and Elise Becher
When a system routinely produces error-inducing situations (missing paperwork, miscommunications between team members, changes of plan, clinicians become inured to malfunction. In such a system, events which should be regarded as Red Flags, as a warning of impending danger are ignored as a *normal* operating conditions.

Discrepant data
A term used describe data which is inconsistent with the assumed mental model. This situation occurs when an operator, who has made an incorrect mental model, comes across data which reflects the true situation. In such cases the operator may decide to reject this data saying that the 'gauge must be broken'.

Ergonomics
Human Factors is also known as ergonomics and the two terms are used interchangeably to mean the same thing in English speaking countries. Non-English-speaking countries use translations of Ergonomics (e.g. *Ergonomie* in French and German) to refer to Human Factors.

Error
An error is defined as the failure of a planned action to be completed as intended (i.e., error of execution) or the use of a wrong plan to achieve an aim (i.e., an error of planning).

Error Chain also known an Event Chain
A term created by human factors trainers to describe the sequence of situations, events and errors that leads to an accident. The result of the error chain is to induce the operator to lose situation awareness and make the final error (or to fail to take the right course of action.)

Eustress

The term coined by endocrinologist Hans Selyeto describe the 'good stress' which enables us to feel eager, excited, thrilled, resilient, determined when dealing with challenging tasks.

Event Chain see Error Chain

Facilitation (contrasts with didactic instruction)
High Reliability Organisations must modify the attitudes and behaviour of their personnel when these are shown to be hazardous. 'Facilitation' is a technique that helps personnel to develop attitudes and behaviours that are appropriate and effective when working in a team in safety critical environments. Accident case studies are presented and the facilitator asks delegates to review their own attitudes and behaviours in the light of these cases and their own experiences.
Note: Instructing people to change their attitudes and behaviour normally has limited success.

Forcing Function
An aspect of equipment design that prevents a target action from being performed inappropriately. An example would be the design of automatic teller machines where the bank card has to be removed from the machine first before the cash is dispensed. In the past when the sequence was the other way around many people collected their money but left their card in the machine. An important 'forcing function' introduced in health care is the placing of concentrated potassium chloride in locked cupboards.

Hierarchy
The relationship between seniors and subordinates within an organisation *as perceived by the subordinate*. It reflects the extent to which the less powerful members of the culture expect and accept that power is distributed unequally. In a 'steep hierarchy' there is considerable deference by subordinates to their superiors. Expressing concerns, questioning arrangements or even clarifying instructions require considerable determination on the part of team members. The latter may perceive their input as devalued and unwelcome.

In a shallower hierarchy there is a general preference for consultation over prescriptive methods. Subordinates are comfortable in approaching, and if necessary, contradicting their superiors. It is important to note that hierarchies that are too shallow can produce a lack of discipline which can be as dangerous as a too steep hierarchy.

HROs - High Reliability Organisations
Organisations which, although operating with safety-critical technologies in dynamic and hazardous environments, manage to achieve very low rates of accidents. Their core philosophy is to expect and avoid failure rather than to achieve excellence.

Human Factors
An applied science "concerned to optimise the relationship between people and their activities by the systematic application of the human sciences, integrated within the framework of systems engineering". Initially developed to maximise production and profitability in manufacturing industry, human factors science has been successfully developed and employed to manage human error in 'high risk' domains.

Human Machine Interface HMI
The Human Machine interface is those parts of a machine which the operator uses to interact with the machine. The HMI provides means of 'inputting', which allows the users to control the system, and 'output' by which the machine informs the users of the system status.

Inattentional Blindness

Inattentional Blindness is a psychological lack of attention which is not associated with any vision defect resulting in an event where an individual fails to perceive an unexpected stimulus that is in plain sight. It is also known as Perceptual Blindness. See also Change Blindness.

Incident Reporting
Investigations of major accidents in a number of domains often reveal that similar events had nearly occurred previously but had been stopped but fortuitous circumstances. Incident reporting systems are designed to gather data on the latent or system failures that lead to 'near misses' and accidents. This data is used to redesign training programmes and standard operating procedures.

Intentional unsafe act
A deliberate act of harm or damage by a psychopathic employee or customer. Incidents have been reported in several safety critical industries.

'Just Culture'
A **Just Culture** is a prerequisite to a Reporting **Culture** where people feel they will be treated fairly, are encouraged to and therefore readily report hazards, safety concerns, errors and near misses which provide the organisation with vital safety-related information.

Lapse
An error of memory (contrast with mistake, slip)

Latent failures / system failures (the concept contrasts with active failures)
Long term situations which induce human error or inhibit error detection or prevention. These are usually associated with poor management.

Learning Curve
The acquisition of any new skill is associated with the potential for lower-than-expected success rates or higher-than-expected complication rates. This phenomenon is often known as a "learning curve." In some cases, this learning curve can be quantified in terms of the number of procedures that must be performed before an operator can replicate the outcomes of more experienced operators or teams.

While learning curves are almost inevitable when new procedures emerge or new providers are in training, minimising their impact is a patient safety imperative. One option is to perform initial operations or procedures under the supervision of more experienced operators. Surgical and procedural simulators may play an increasingly important role in decreasing the impact of learning curves on patients, by allowing acquisition of relevant skills in laboratory settings without risking patient safety.

Mental Models
Mental models are psychological representations of real, hypothetical, or imaginary situations. Scottish psychologist Kenneth Craik (1943) first proposed mental models as the basis for anticipating events, explaining events and managing operational situations.

Mind Lock
A term created by human factors trainers to describe a situation where a subject fails to reassess and change his mental model even when there is evidence that his actions, based on the flawed mental model, are not being successful in managing the problem at hand. Under normal circumstances this situation should prompt a re-evaluation of the diagnosis.

Mistake
An error resulting from a faulty intention (contrast with lapse, slip)

Mode confusion (with respect to equipment operation)
Mode confusion results from shortcomings in the design of the user interface of a piece of equipment and is said to occur when
- the operator of a piece of equipment believes the equipment is operating in a different mode to that intended
- the operator does not know what mode the equipment is operating in.

National Patient Safety Syllabus
A syllabus created in 2021 by the Academy of Medical Royal Colleges produced to provide a detailed educational curricula for staff groups.

Near miss
An event or situation that could have resulted in an accident, injury or illness, but did not, either by chance or through timely intervention. Near misses are 'free lessons' and should be prized as valuable learning opportunities. Unfortunately in some organisations and cultures they are ignored or concealed.

Negligence
Care that fell below the standard expected of clinicians in their community.

Non-Technical Skills
The cognitive and interpersonal skills needed to be a team member or a team leader in a safety critical situation. The *cognitive skills* include are defined as those mental processes used for gaining and maintaining situation awareness, for solving problems and making decisions. *Interpersonal skills* include communication and a range of behavioural activities associated with teamwork.

Opening Phrase
An informal or officially mandated phrase used at the beginning of a Safety Critical Communication to alert the message receiver that the message content is **urgent, unusual, or unexpected**.

Operator
A Human Factors term for any individual working in a 'high risk industry' whose errors can lead to a fatal outcome. (E.g.; pilots, doctors, nurses, train drivers, chemical plant control room operatives etc.)

Organisational error / accident
An error that results from the way the work is organised rather than from lack of technical (medical) skills and knowledge.   Thus a case of wrong side surgery is an organisational error (although the operation itself may be carried out with great surgical skill)

Patient Safety
The avoidance, prevention, and amelioration of adverse outcomes or injuries stemming from the processes of health care. These events include "errors," "deviations," and "accidents."

Perceptual Blindness
Perceptual Blindness is a psychological lack of attention which is not associated with any vision defect resulting in an event where an individual fails to perceive an unexpected stimulus that is in plain sight. It is also known as Inattentional Blindness. See also Change Blindness.

Perceptual Narrowing
A phenomenon where a subject's breadth of perception narrows in extremely stressful situations. As a result, he may fail to notice those stimuli which suggest that he has made the wrong mental model.

Preparedness
This is a term describing the extent to which an organisation or its teams are prepared to deal with a sudden emergency.

Preventability (of errors)
Some types of error are easier to prevent than others. Organisations which initiate error management programmes invariably target the most preventable errors first before addressing the more difficult types of error.

Primacy Effect
A tendency to base our mental models (diagnoses) on data which is perceived first. Anecdotal evidence has shown that people can create an incorrect mental model on only two pieces of deceptive data which happen to be observed first. Confirmation bias can then prevent the subject from noticing data which reflects the correct situation.

Production Effect (in memory)
The production effect is the difference in memory favouring words that had been spoken out loud relative to words that have been read silently. The memory appears to remember the process of creating the sound in one's voice box, lips and tongue rather than remembering the thought of saying them or even 'hearing' oneself saying it.

Readback
The repeating back of the essence of a message by its receiver in order that the sender can confirm that it has been correctly understood.

Red Flag (in Error Management)
A situation which may constitute evidence of an incipient adverse situation.

Red Rules
Rules about equipment and personnel availability or procedural targets that must be followed to the letter. Any deviation from a red rule must bring work to a halt until compliance is achieved.

Revenge Effect
The unexpected adverse 'unintended consequences' of the application of new technologies or policies.

Risk consciousness
A culture in which errors and systems failures are expected to occur at any time.

Risk management
In the context of hospital operations, the term risk management usually refers to self-protective activities meant to prevent real or potential threats of financial loss due to accident, injury, or medical malpractice.

Root cause analysis
A process for identifying the most basic or casual factor or factors that underlie variation in performance, including the occurrence of an adverse event.

Safety assurance
Safety assurance activities are a key element in a Safety Management System. Safety assurance includes systematic and ongoing monitoring and recording of the organisation's operational activities and thus its actual safety performance, as well as evaluating the organisation's safety management processes and practices

Safety Critical Communication (SCC)
A message which, if not correctly communicated, can result in harm.

Safety Culture
Safety culture and culture of safety are frequently encountered terms referring to a commitment to safety that permeates all levels of an organisation, from frontline personnel to executive management. More specifically, "safety culture" describes a number of features identified in studies of high reliability organisations outside of health care with exemplary performance with respect to safety. These features include:
- acknowledgment of the high-risk, error-prone nature of an organisation's activities
- a blame-free environment where individuals are able to report errors or close calls without fear of reprimand or punishment
- an expectation of collaboration across ranks to seek solutions to vulnerabilities
- a willingness on the part of the organisation to direct resources for addressing safety concerns

Safety Management System
Safety management system is a comprehensive management system designed to manage safety elements in the workplace. It includes policy, objectives, plans, procedures, organisation, responsibilities and other measures. The SMS is used in industries that manage significant safety risks, including aviation, petroleum, chemical, electricity generation and others.

Safety Policy
The Safety Policy is considered the foundation of the Safety Management System (SMS) established by an organisation. It is the first important milestone of SMS implementation that defines the value of safety and the safety values in the overall business and performance framework of the organisation. An important element of the safety policy is the promotion of a 'Just Culture.'

Security and Emergency Procedures (SEP) Course
An annual training course in many HROs which has several aims including
- refresher training in the location, serviceability checking and use of emergency equipment
- reviewing accident case studies, particularly those which have occurred in the last year
- consideration of all-new threats, including 'intentional adverse events' (homicidal acts, hacking etc)

Sentinel Event (American term)
A major accident. The choice of the word "sentinel" reflects the egregiousness of the event and the likelihood that investigation of such an event will reveal serious systems failures.

Serendipitous Effect
An unintended and unexpected benefit or side-effect of a new technology, policy, procedure or system. The opposite of a 'Revenge effect'.

Situational Awareness
The relationship between an operator's mental model and the reality of the current operational situation. If that mental model is accurate in all essential elements, situational awareness is said to be high. If there is a significant difference between reality and the model, awareness is said to be lost.

Slip
An unintended error of execution of a correctly intended action. (contrast with lapse, mistake)

'Software'
'Software is a Human Factors to describe those parts of the 'system' that are not Human or Hardware. One speaks of poor user interface design with a piece of equipment as a Human-Machine Interface problem. In the same way, issues resulting from inadequate procedures, documentation problems, confusing medication labels and so on would be categorized as a Human-Software problem

Standard Operating Procedures
Precisely defined, systematic and safe methods of carrying out tasks. Periodically revised in order to incorporate the lessons learned from accidents, SOPs are designed to maximise operator's situation awareness and to facilitate team resource management.

Startle effect
The 'Startle effect' has been studied in aviation where flight data and cockpit voice recorders have been used to understand pilot behaviour during the first moments of a 'sudden on-set' in-flight crisis. The data recorded excessive and jerky hand control movements, incoherent verbal communications and evidence of poor situation awareness and decision making during the first moments of the crisis. This 'startle effect' seems to last up to 30 seconds and is the first stage of Tachypsychia (see below).

Stop Work Authority (SWA)
A process in High Reliability Organisations where any member of a team is required to, and empowered to, call a stop to any activity which could end in disaster. SWA was originally developed in the United States chemical and petrochemical processing industries, where it was noted that many major accidents (explosions) had occurred after supervisors had ignored correct warnings from junior team members.

Storytelling
High Reliability Organisations often use accident storytelling to explain the thinking behind the adoption of certain standard operating procedures and to dispel complacency.

System
A system is a collection of elements that function together to achieve some objective. The elements of the 'healthcare' system can be classified into one of four areas:

Hardware – tangible objects such as equipment, medication etc. but not including documentation
Liveware – humans; clinicians, patients, support personnel, management,
Software – procedures, work schedules, policies, cultural values, documentation
Environment – conditions that affect changes in the other elements, for example long working hours that induce fatigue and reduced performance in the clinicians.

Systems approach
The concept that although individuals make errors, the characteristics of the systems within which they work can make errors more likely and also more difficult to detect and correct.

Further, the system approach takes the position that while individuals must be responsible for the quality of their work, more errors will be eliminated by focusing on systems than on individuals.

System failures
Long term situations which induce human error or inhibit error detection or prevention. These are usually associated with poor management.

Tachypsychia
A term created by the fire-fighting, police and military services in the United States to describe the cognitive changes brought about by the stress response in individuals facing a severe, sudden on-set crisis, particularly if there are life-threatening dangers. The following adverse effects of Tachypsychia have been noted:
- Memory problems
- Altered perception of the passage of time
- 'Auditory exclusion'
- Freezing / Denial – "*this is not happening"*
- "Mind Lock" – not changing the plan / diagnosis when that would seem to be necessary
- 'Serious misinterpretations of the situation'
- Partial blindness (missing obvious visual cues, loss of colour vision and tunnel vision)

See also 'Startle effect'

Task Fixation
Task fixation is an attentional phenomenon observed where an individual directs all of his cognitive capacity to one task and thereby fails to monitor the overall operational situation. It can be described expressively as being focused on one detail and missing 'the big picture'.

Team Resource Management
A process of interaction between the members of a team whereby each member of the team is empowered and encouraged to contribute in the most effective way to the task of the team. This can only take place if every member of the team fully understands their role within the group and how this role may vary depending the operational circumstances. Thus good team resource management requires agreed standard operating procedures.

Thematic Analysis
Analysis of multiple accident case studies to reveal underlying problems. Some of these problems may seem trivial in any individual case, but when it is revealed that the problem occurs more commonly and induces other problems, the need to address these problems becomes more important.

Threat
A long-standing situation or condition which is, in itself, either inherently dangerous or can induce the errors or loss of awareness. Most threats can be revealed by studying previous accident reports. Teams can work together to look for novel threats not previously associated with accidents but which are rendered more likely by new technologies or situations.

Threat management
Systematic review of the risks that threaten to cause adverse incidents to patients or staff in a team, department, specialty or other group. Best carried out as a preventative measure with wide involvement of professions and staff grades, to identify practical changes to systems and highlight area's where staff need particular caution or vigilance.

"Time outs" (American term)
Planned periods of quiet and/or interdisciplinary discussion focused on ensuring that key procedural details have been addressed. For instance, protocols for ensuring correct site surgery often recommend a "time out" to confirm the identification of the patient, the surgical procedure, site, and other key aspects, often stating them aloud for double-checking by other team members. In addition to avoiding major misidentification errors involving the patient or surgical site, such a time out ensures that all team members share the same "game plan" so to speak. Taking the time to focus on listening and communicating the plans as a team can rectify miscommunications and misunderstandings before a procedure gets underway.

Usability Testing
Usability testing is a method by which representative users of a product are asked to perform certain tasks in an effort to measure the product's ease-of-use, task time, and the user's perception of the experience. Usability testing can be carried out using 'hi-tech' methods such as video cameras to observe operators or informally, with operators reporting their experiences with the equipment verbally or in writing usually in the form of a questionnaire.

User Interface also known as the Human Machine Interface HMI
The user interface is those parts of a machine which the operator uses to interact with the machine. The user interface provides means of 'inputting', which allows the users to control the system, and 'output' by which the machine informs the users of the system status.

'Work-around'
(American Term) Short term changes to operational procedures made in order to continue work when problems such as missing documents or equipment are encountered. Although 'work- arounds' are carried out for the best of motives they have been associated with serious adverse events.