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AUSTRALIAN COUNCIL FOR SAFETY AND QUALITY IN HEALTH CARE



Setting the Human Factor Standards for Health Care: Do Lessons from Aviation Apply?

A Report on the human factors in health care workshop held as part of the Sixth International Australian Aviation Psychology Symposium, Sydney 6 December 2003

July 2004

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The Australian Council for Safety and Quality in Health Care was established in January 2000 by the Australian Government Health Minister with the support of all Australian Health Ministers to lead national efforts to improve the safety and quality of health care, with a particular focus on minimising the likelihood and effects of error. The Council reports annually to Health Ministers.

This document provides a summary of outcomes from the ‘Human Factors in Healthcare Workshop: Do the Lessons from Aviation Apply?’ which was held in Sydney on 6 December 2003 as part of the Sixth International Australian Aviation Psychology Symposium. It is an attachment to the Council’s fifth annual report to Health Ministers, *Maximising National Effectiveness to Reduce Harm and Improve Care, Fifth Report to the Australian Health Ministers’ Conference, 29 July 2004*.

Copies of this document and further information on the work of the Council can be found at www.safetyandquality.org or from the Office of the Safety and Quality Council on telephone: +61 2 6289 4244 or email to: safetyandquality@health.gov.au.

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Executive Summary

National and international experts at the Human Factors in Healthcare Workshop all agree: human factors issues are major contributors to adverse events in healthcare.

Humans are, by nature, fallible. They have limited mental and information processing capabilities, their performance suffers when they are exposed to excessive levels of stress or fatigue, and good intentions are not enough to prevent mistakes from happening. In healthcare and other high-risk industries, this human fallibility can have serious, sometimes fatal, consequences for patients.

Aviation is an industry which has faced similar problems successfully, using a combination of human factors strategies such as training staff to recognise their own potential for error and developing systems for the industry to learn from mistakes. As a result, with over 10 million take-offs and landings annually, there are less than ten crashes a year in commercial aviation, on average.

In contrast, healthcare has traditionally regarded error as a moral failing, placing an unsustainable burden of perfection onto its practitioners. This attitude has impeded efforts to identify where errors occur, how common they are, what effects they have, and how best to protect patients. As a consequence, around 10% of patients entering Australian hospitals will be harmed by their care.

The Workshop speakers, including both national and international safety experts, researchers, and members of the focus groups, were unanimous in concluding that many of the valuable safety lessons learned by aviation are applicable in healthcare settings.

One reason for this transferability is the similarities between the two professions, such as the nature of the work, including its dependence on technological innovations, requirement for long periods of technical training, and need for staff to work in teams and within national, organisational, and professional cultures.

The aviation approaches thought to be most relevant and applicable to healthcare included:

1. Human factors training for staff

This has several components that complement technical training.

- Staff are taught about their own potential for error, why errors occur, and which situations increase the risk of error.
- Staff are given practical strategies for dealing with human fallibility, ie. how to avoid error, trap errors before they cause harm, or mitigate the effect of harm once it commences. They are also encouraged to learn from those errors that do slip through the net. “Flight” simulators of varying degrees of sophistication are used to safely rehearse strategies for dealing with unexpected emergencies.

- Staff learn teamwork and communication skills, such as graded assertiveness, a formalised pattern of communication which junior staff can use to convey critical messages about safety to senior colleagues.

2. Using human factors to make the system safer

These techniques are proactive. They help airline workers to be safer (and happier) at work. However, human factors also works reactively. Aviation encourages organisations to learn from errors. It has created a work culture which both encourages the reporting of mistakes, even those which do not lead to harm, and allows the system as a whole to make itself safer following an incident.

Several strategies have been employed to bring this about.

- A reporting system for error which does not protect staff against prosecution for negligence but does assure them of anonymity following routine near-miss reports and reports of errors with insignificant levels of resulting harm.
- Separate bodies for investigating aviation incidents and for disciplining employees.
- A primary focus of investigators on what, rather than who, caused the accident, including searching for factors which may be distant in time or place. The aim is to modify causal factors to ensure the accident will not recur, so investigators are also charged with making appropriate recommendations for change.

There are important differences between aviation and medicine which mean that not all its lessons can be imported to healthcare without adaptation. Every patient is unique in a way that produces far more variables than a scheduled flight. High levels of uncertainty in healthcare produce problems with multiple possible solutions. Aviation lessons which are likely to produce effective improvements in healthcare are those which relate to the fallibility of being human. In this regard, the techniques taught to pilots for recognising and managing external threats and self-generated errors are of real value to clinicians.

Workshop Recommendations

In Australia, there have already been attempts to introduce a human factors approach to medical error, but to date these efforts have been sporadic and often uncoordinated. It is, however, clear that healthcare workers are beginning to come to terms with medical mishap and do something about it.

The consensus of the Workshop was that healthcare should:

- Define a clear policy regarding human error, one that accepts error but not intentional noncompliance;
- Educate staff, including clinicians, managers, and policy makers, about the role of human factors in safety;
- Provide practical training in human factors concepts and non-technical skills, such as assertiveness, teamwork, communication, and expert decision-making;

- Use confidential incident reporting systems for near misses to uncover threats to safety;
- Use structured incident investigation processes, which include a review of human factors and gender issues, with appropriate debriefing and support processes;
- Use information from incident and near miss reporting and investigation to change the system for the better, and commit the necessary resources to achieve this;
- Devise and implement standardised operating procedures and suitable checklists, where appropriate;
- Routinely check performance against accepted standards, audit systems, and benchmark;
- Address the issue of fatigue and task saturation in healthcare workers, especially senior staff.

Section One

The Human Element in Healthcare

What Is Human Factors?

It is not clear who first coined the term ‘human factors’. The growth of assembly-line mechanisation after the First World War and the increase in work-related deaths and injuries prompted studies of the safety of work practices and the design of safeguards for heavy machinery. A number of these studies were published during the 1930s in a journal called *The Human Factor*.¹

Human factors is a discipline that seeks to *optimise the relationship between technology and the human*², applying information about human behaviour, abilities, limitations, and other characteristics to the design of tools, machines, systems, tasks, jobs, and environments for productive, safe, comfortable, and effective human use³. It concerns not only the psychology of human-machine interactions but human-human interactions as well: communication, teamwork, and organisational culture.

The Lessons Aviation Has Learned About Human Factors and Safety

To better understand aviation’s perspective on human factors and incident or accident investigation, a few critical events in aviation history are described.

The Nemesis of Technology

Paradoxically, the potential for pilots to commit errors has not been eradicated with advancing technology; rather, by aiding the execution of increasingly complex tasks it has introduced new opportunities for error.

The term ‘pilot error’ started appearing with increasing frequency in training and combat accident reports during the Second World War. In 1943 Lt. Alphonse Chapanis, a psychologist for the US Air Force, was called on to examine why pilots and copilots of B-17 and B-25 bombers frequently retracted the wheels instead of the flaps after landing, whereas pilots of C-47 transports did not. He noticed that the wheel and flap controls on the bombers were side-by-side and looked virtually identical, so they were easily confused. He also noted that the corresponding controls on the C-47 were not adjacent, and their methods of actuation were quite different.

Chapanis realised that *the so-called pilot errors were really cockpit design errors*. He demonstrated that poorly designed equipment and workplaces can contain ‘error traps’ which make it difficult, sometimes impossible, for an operator to perform a task without error. His solution, in this instance, was to put a small rubber wheel on the

¹ Vernon HM Accidents and their prevention. Cambridge: Cambridge University Press; 1936.

² Kantowitz B, Sorkin R (1983). Human factors: understanding people-system relationships. New York: John Wiley & Sons; 1983. p. 226-7.

³ Chapanis, A. Some reflections on progress. Proceedings of the Human Factors Society 20th Meeting; 1985; Santa Monica, CA. p. 1-8.

end of the landing gear lever. Pilots could now tell just by feel which control they were manipulated.⁴

Aviation has learned the hard way, through painful repetition, that technology, which promises to make things safer, can be accompanied by new hazards.

On 26 June, 1988 a newly delivered Air France, state-of-the-art A320 aircraft was to perform a series of flights on behalf of the Mulhouse Flying Club as part of an air show. A low-level fly-past was meant to showcase the automated flight control systems which were designed to be fail-safe. However, the plane touched trees at the end of the runway and crashed, and three of the 130 passengers were killed. The accident investigation report suggested the Captain had either been overcome by the complexity of the new 'fly-by-wire' technology or had failed to respond to the normal pilot cues which would warn of an imminent hazard to safety.⁵

Aviation accidents are often dramatic in their impact, particularly when captured on film, as was the case for the Air France crash, or when large numbers of casualties are involved. They always result in extensive investigation, sometimes taking several years to complete and occasionally leaving some questions unanswered. For the most part, however, lessons are learned and then written into protocols, practices, and procedures, extending the body of knowledge to be mastered by aviation crews. Pilots, like clinicians, have always used experience as a source of learning. The problem with this learning style is that it tends to set the examination before teaching the knowledge and techniques required to pass.

Does Managing Human Factors Matter?

A highly significant dimension of human factors is understanding how humans interact with each other, particularly in demanding situations.

The world's worst air disaster happened in 1977 when two Boeing 747 jumbo jets collided on a runway at Tenerife, killing 583 people. 'After reviewing the cockpit voice recordings investigators realised that the steep authority and experience gradient in the cockpit between the captain, the first officer and the flight engineer "*probably made his crew reluctant to question his decisions*".⁶ In other words, the junior staff were so intimidated by their senior that they felt they could not stop him from causing an accident they knew was about to happen, even though they had the ability to.⁷

The implications of this discovery, unfortunately, had little impact on commercial aviation until, in December 1979, a United Airlines DC-8 crashed on approach to Portland International Airport.

⁴ Roscoe SN. (1997) The adolescence of aviation engineering psychology. Available at: http://www.aero.ca/e_adolescence.html. Accessed 1 May 2004.

⁵ Aviation Safety Network. <http://aviation-safety.net/database/1988/880626-0.htm>.

⁶ Macarthur J. Air disaster. Volume 1. ACT, Australia: Aerospace Publications Pty Ltd; 1994. p 177.

⁷ Aircraft Accident Digest (International Civil Aviation Organisation Circular 153-AN/56)

On this occasion the captain had become preoccupied with a landing gear malfunction and delayed landing for over an hour. He failed to register that the aircraft was running out of fuel, and the plane crashed about six miles south-east of the airport, killing ten and seriously injuring 30. In the words of the official report, “*The other two flightcrew members, although they made several comments regarding the aircraft’s fuel state, did not express direct concern regarding the amount of time remaining to total fuel exhaustion*”.⁸ As with Tenerife, there was a steep authority gradient between the captain and his two supporting flightcrew members which threatened the safety of the crew and passengers.

This accident was the last straw and prompted U.S. commercial airlines to study how their flight crews interacted in critical situations. This in turn led to the first courses in CRM – Cockpit (later Crew) Resource Management, which covers a number of non-technical skills listed later in this paper. One of the most important is safety-critical communication skills with a particular focus on assertiveness training. Junior staff are empowered to warn their seniors of impending problems; senior staff are trained to listen.

Aviation regulators throughout the western world now require that crews pass an examination in human factors as part of the qualification process when obtaining an Airline Transport Pilot License. On joining their first airline company, they must undergo a minimum of two days further training in Crew Resource Management.

All of these skills are taught within the context of the organisation the pilot is joining. Should he or she move to another airline, a complete two-day course is required again to ensure that the safety culture of the new organisation is understood. Aviation regulators also require airline crews to undergo refresher training on a regular basis. This is usually a progressive syllabus, rolling through a two- or three-year cycle.

Full Disclosure of Accident Investigations

In 1931 a Fokker trimotor airplane flown by Transcontinental and Western Air lost a wing and crashed on a Kansas farm. The intense public scrutiny generated by the crash forced the Aeronautics Branch to *abandon its policy of secrecy* concerning the results of accident investigations, albeit not for entirely altruistic reasons.⁹ This and other accidents, including the spectacular crash of the Hindenburg in 1937, established early on a culture of *open disclosure* following investigations.

The human factors emphasis on open disclosure, frank discussion, and full analysis of adverse events is a key factor in helping accident victims and family members satisfy their need to know how and why a harmful event happened and feel assured that changes that will protect future passengers. Demonstrating accountability – owning up to errors, accepting responsibility for actions, and learning from mistakes - are an integral part of the human factors approach, and these behaviours are nurtured and encouraged. In some circumstances they are even rewarded.

⁸ National Transportation Safety Board Report NTSB-AAR-79-7.

⁹ Mola R. Accident investigation. Available at: http://www.centennialofflight.gov/essay/Government_Role/accident_invest/POL17.htm. Accessed 1 May 2004.

The Independence of Investigators

In 1935, a DC-2 also flown by Transcontinental and Western Air crashed and killed U.S. Senator Bronson Cutting of New Mexico. Congress decided to conduct its own investigation in parallel with the 'official' Bureau of Air Commerce inquiry. Congress concluded that the Department of Commerce and the Bureau worked too closely with the commercial airlines and aircraft manufacturers to be objective and, consequently, were reluctant to admit that the accidents may have been related to their own rules and procedures. While the Bureau was supposed to promote commerce through aviation, it was also supposed to find the cause of accidents, even if that meant embarrassing itself or American companies.

In 1938, the Civil Aeronautics Act established the new Civil Aeronautics Authority (CAA) and its three-member Air Safety Board to conduct accident investigations and recommend ways of preventing accidents entirely free from pressure by the aviation industry or government. This established a tradition of independent accident investigation embodied by the modern U.S. National Transportation Safety Board and the Australian Transport Safety Bureau.¹⁰ Thus in aviation, the process of accident investigation is deliberately separated from regulatory, administrative, and disciplinary bodies.

The Responsibility of Management in Air Safety

Pilots are usually the first to arrive at the scene of an accident. Historically, airlines would move as quickly as decorum allowed to the conclusion that it was caused by the ubiquitous pilot error. Pilots who survived accidents were sometimes justifiably aggrieved at these conclusions.

In November 1979, an Air New Zealand Boeing 747 on a special tourist flight crashed into Mt Erebus in Antarctica, killing everyone on board. Unknown to the aircrew, an error in the flight plan had been preprogrammed into the flight computer and set the plane on a collision course with the mountain. The formal accident report blamed the captain for deciding to continue to fly "toward an area of poor surface and horizon definition when the crew were not certain of their position, and was therefore unable to detect the rising terrain that intercepted the aircraft's flight path".¹¹ The Royal Commission found that "the single dominant and effective cause of the disaster was the mistake by those airline officials (navigation section planners) who programmed the aircraft to fly directly at Mt Erebus... the mistake is directly attributable, not so much to the persons that made it, but to the incompetent administrative airline procedures which made the mistake possible".¹² *This inquiry put the responsibility of ensuring an organisational culture and framework which prioritises safety squarely in the hands of administrators.*

¹⁰ Mola R. Accident investigation. Available at: http://www.centennialofflight.gov/essay/Government_Role/accident_invest/POL17.htm. Accessed 1 May 2004.

¹¹ Macarthur J. Air disaster. Volume 2. ACT Australia: Aerospace Publications Pty Ltd; 1996. p 76.

¹² Maurino DF, Reason J, Johnston N, Lee RB. Beyond aviation human factors: safety in high technology systems. Ashgate; Aldershot; 1998. p36-8.

Voluntary Reporting Systems

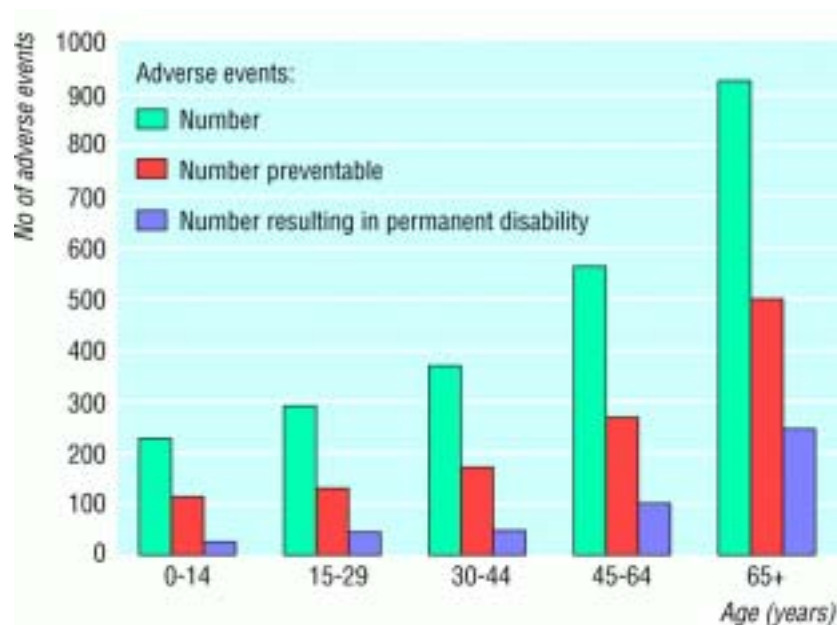
Aviation has learned the hard way that there is a need for a safe, robust, reporting systems which allow staff to report errors which had no adverse outcomes without fear of punishment; this information can then be used to make the system safer. Aircrews are not protected against prosecution for negligence, but their anonymity is assured when reporting near misses or errors with lead to insignificant levels of harm. The objective is to continuously monitor the system, looking for things that need to be improved. Confidential reporting systems exist in most western aviation systems, and allow all to benefit from the near-miss experiences of some.

An example of this highly effective defence against repeated error is the Aviation Self Reporting System introduced by the Australian Transport Safety Bureau in February 2004.¹³ It refuses to gloss over acts that result in incidents or accidents and places strict time limits on the interval between commission and admission. Nonetheless, it encourages reporting and offers protection from “administrative action by the Civil Aviation Safety Authority” when its reasonable preconditions to reporting are satisfied.

¹³ Civil Aviation Amendment Act 2003 (ASRS sections); Explanatory Memorandum (ASRS sections); Civil Aviation Amendment Regulations 2004 and its Explanatory Statement.

Do Human Factors Apply To Healthcare?

Human factors apply *wherever* humans work. In healthcare, work environments are rich with hazards: every instrument is a potential weapon, every drug a potential poison, and every worker a potential killer.



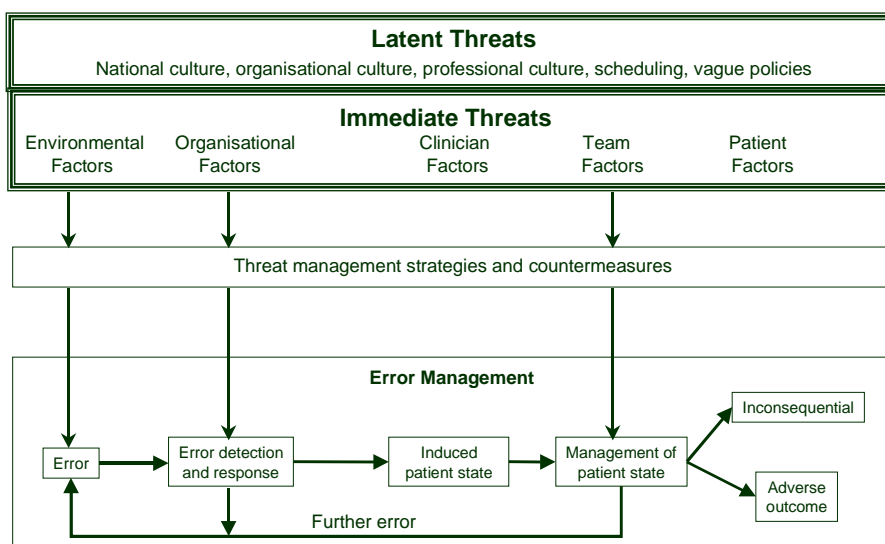
Australian research reveals just how large the problem of preventable adverse events in healthcare is.

This figure shows the number of adverse events, preventable adverse events, and number resulting in permanent disability by age. Adapted from the Quality in Australian Healthcare Study.

Source: Weingart SN, Wilson RM, Gibberd RW, Harrison B. Epidemiology of medical error. BMJ 2000;320:774-7.

Healthcare Workers Are Only Human

Not all design flaws in healthcare delivery are obviously hazardous. One of the most subtle mistakes made is a failure to realise that the best-motivated and most highly-trained professionals are also potentially lethal agents. Humans are fallible - they cannot deliver flawless performance at all times, no matter how willing to try. Some errors may be caused by less than adequate preparation; *some* - but not all. It is an unavoidable fact that humans have inbuilt limitations to their physical and mental abilities. Australian research, for example, shows that fatigue impairs performance in much the same way alcohol does, and yet clinicians are routinely exposed to fatigue through poor rostering procedures.



The sources of error and the potential solutions are many, and include both system and individual factors.

Source: Helmreich RL. On error management: lessons from aviation. BMJ 2000;320:781-5.

Healthcare and Human Fallibility: The Current Status

The traditional healthcare approach to human error might be called the “perfectibility” model. Here, it is assumed that if healthcare workers care enough, work hard enough, and are sufficiently well-trained, errors will be avoided.

This approach, however, may have unintended consequences which reduce patient safety rather than improve it. A system which demands constant perfection and publicly punishes error encourages staff to cover things up; blame inhibits learning both at a personal and at an institutional level, so no one learns from the mistakes of others and opportunities to improve patient safety are wasted. Where these errors are fundamentally caused by inadequate protocols or poor system design – such as a reliance on unsupervised, junior staff to make important clinical decisions after hours - patient safety will be continually at risk.

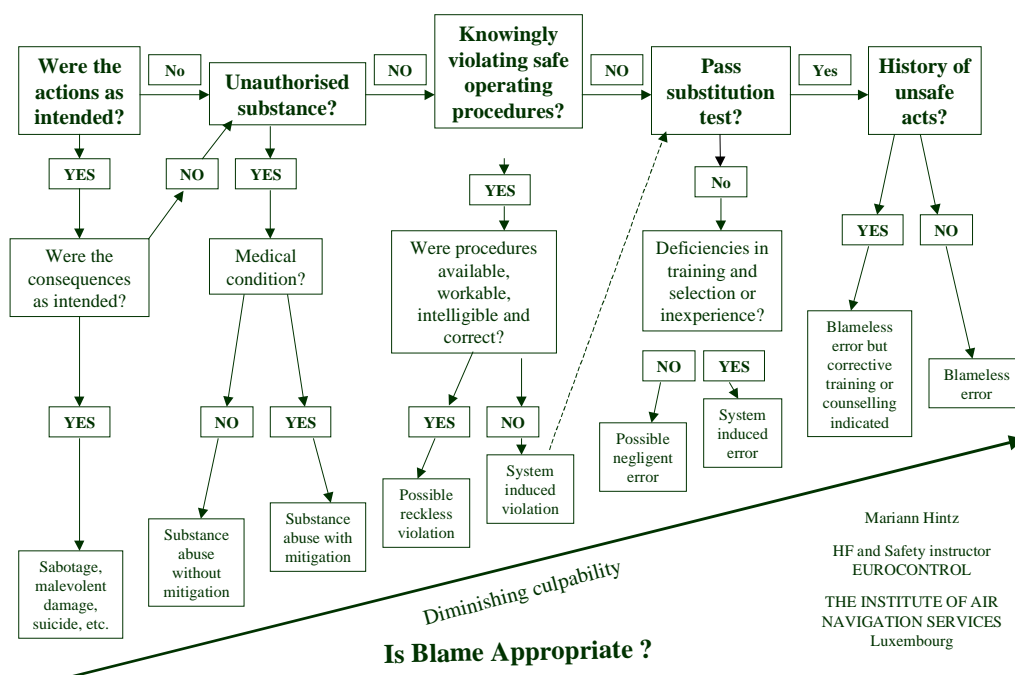
Where a punitive approach to every mishap is the normal response, regardless of whether the mistake was made unintentionally or with malicious intent, healthcare becomes an unattractive career option. The recent indemnity crisis in Australia has highlighted the intention of significant numbers of professionals working in high-risk areas, such as obstetrics, to withdraw from practice rather than continue working in an environment which stresses retribution rather than justice, and in which procedural fairness seems a forgotten concept. If the threat of punishment were a successful defence against repeated error, the problem of human fallibility should have long-since been eradicated.

Consider a system, even now in place in some overseas hospitals, which enforces a ‘three strikes and you’re out’ policy with clinical error. It generally results in no more than two errors being reported voluntarily. Human nature is such that staff will make reports only in an atmosphere of trust and where there are reasonable guarantees of protection.

A Human Factors Approach to Human Error in Healthcare

Punishing individuals who make mistakes can satisfy immediate social needs for justice - it may even satisfy less noble desires for punishment and retribution - but it does not prevent other individuals from making the same mistake in similar circumstances. *Human factors acknowledges the universal nature of human fallibility.* Rather than relying on healthcare professionals never to make mistakes, or focusing exclusively on punishing individuals who make harmful errors, human factors looks for more achievable ways to build layered defences into the system to protect patients. This is sometimes referred to as a ‘systems approach’.

For example, drug errors have long been high on the list of potentially-preventable adverse events in healthcare. Vincristine is a drug used to treat cancer. It is given intravenously, often in conjunction with other drugs that are injected into the fluid around the spinal cord. The medical literature is full of cases where inexperienced doctors have been asked to administer a cocktail of anti-cancer drugs and, due to a combination of ignorance and a lack of adequate supervision by trained staff, have injected vincristine around the spine rather than into a vein. The result, sadly, is an inevitable, slow, and excruciatingly painful death for the patient. At least thirteen cases have occurred in the UK alone.



Diminishing culpability – a system for distinguishing between responsibility, accountability and culpability, based on Professor Reason’s model.

The Institute of Air Navigation Services, Luxembourg. Used with permission.

On numerous occasions, doctors have been found accountable for these deaths in civil and/or criminal courts, but these public denunciations have failed to eradicate the

problem. Naming, blaming, and shaming may prevent a particular health care professional from making the same mistake twice; it does not stop others from falling into the same trap.

Following an adverse event such as the vincristine error, one element of a human factors approach would be to apply the ‘substitution test’ – could other clinicians with similar levels of training, faced with identical circumstances, have committed the same error? If, as in this case, the answer is yes, then what measures might prevent a recurrence of the event? A human factors approach adds layered protection for patients by looking further than the point of care delivery. Rather than relying exclusively on perfect clinician performance, it builds in systemic checks and forcing functions that neutralise human error. For example, could vincristine be dispensed in a syringe that could not physically be attached to a spinal needle? A simple design change could have the potential to protect all future patients.

The strength of this human factors engineering approach lies in its ability to anticipate problems rather than relying on hindsight to provide solutions, and its aim to find a permanent, effective, reliable solution for every problem. The substitution test highlights areas where system-wide changes may be required, and it is transparently just.

Rather than relying on a single layer of defence - namely, hoping that the threat of retribution will motivate healthcare workers never to make mistakes – human factors examines all causal factors leading up to an adverse event, then designs solutions involving four layers of defence:

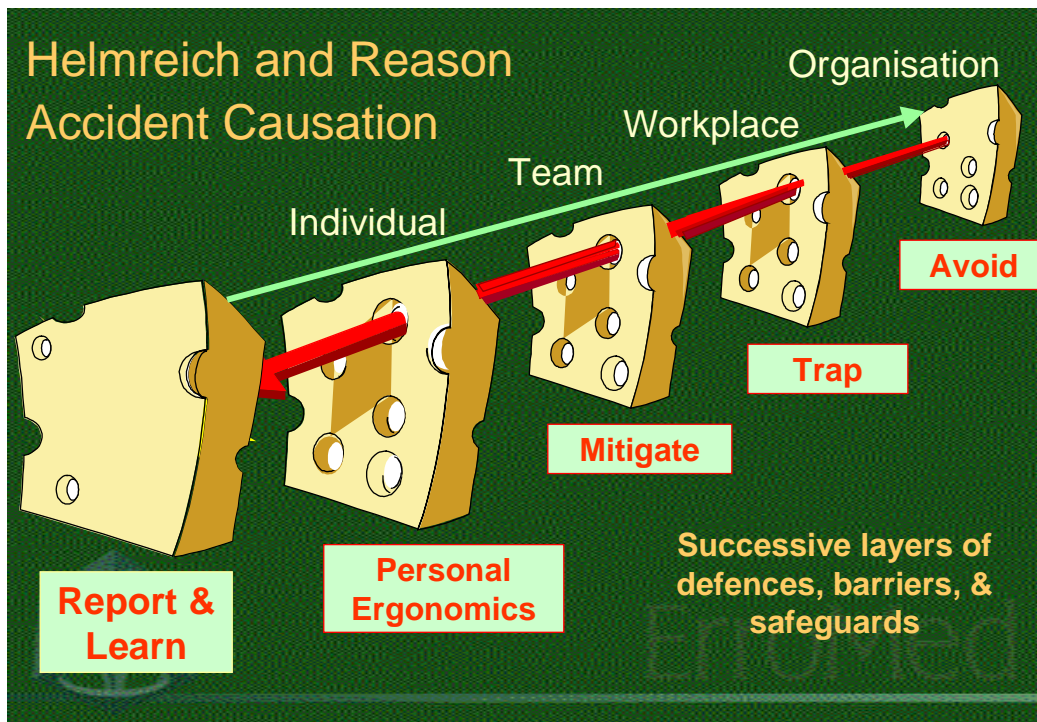
- Avoiding errors: making it harder for mistakes to recur;
- Trapping errors: making it easier for the system to pick up errors before they cause harm;
- Mitigating errors: making it easier for the system to detect harm early enough to minimise its impact;
- Learning from errors: making it easy for the system to learn from occasions where the safety nets listed above have failed.

Such safeguards need not be expensive or complicated. It can be as straightforward as using checklists rather than relying on human memory alone.

For example, a simple example of a checklist to be used when a patient is being discharged home could cover such important steps as:

- Going over the plans with the patient and/or carer, including running through which medications they will need to take and how to use them safely;
- Giving the patient written information, such as a list of red flag symptoms which mean they should seek medical advice urgently plus the contact details of the hospital staff member they should contact if they have concerns;
- Discussing the discharge with the patient’s GP, and sending the GP a typed copy of all the information needed to take over care of the patient;

- Making follow-up appointments for the patient to see specialists or have further radiological or pathology testing;
- Checking that all the services the patient might need at home, such as Meals on Wheels or home nursing, have been arranged.



Psychologist Professor James Reason's Swiss cheese model of error merged with Professor Helmreich's Avoid-Trap-Mitigate model: every layer of defence against error has its holes; the more the layers, the smaller the risk of causing harm. A safe reporting system is added to ensure system integrity is monitored.

Source: ErroMed Human Factors Group, Sydney. Used with permission.

Anaesthesia is an area of medicine that has already successfully adapted many of the aviation lessons on reducing the risk of error. By understanding the human factors behind 'error traps', anaesthesia has developed more error-proof or error-tolerant (ie. more 'ergonomic') equipment and workplace design. For example, medical gases are now delivered in colour-coded hoses, pipes, and cylinders. The hose-to-wall connectors are shape-coded so that it is impossible to connect a hose to the wrong gas. The oxygen and nitrous oxide flowmeters on the anaesthetic machine are linked such that it is impossible to deliver a combination of gases that contains less than 25% oxygen.

These equipment standards were developing following the realisation that intelligent, experienced, and highly trained professionals were continuing to make lethal hypoxic gas errors no matter how often staff were punished or warnings were given. In the USA, it is now a requirement that medical device manufacturers demonstrate how human factors considerations were met during a product's development.

Human factors is both proactive and reactive. Unlike the perfectibility model, it does not wait until patients get hurt before taking action. Instead, it looks for areas of healthcare where the risk of human error is high or the consequences particularly serious, with a view to designing appropriate defences. An analogy is the difference between preventive medicine and treatment: it is obviously better to identify individuals at risk of heart disease, and help them reduce that risk, than to do nothing until there is a life-threatening heart attack. Improvements in patient safety can be achieved by analysing near misses or narrow escapes, where mistakes were made but no harm inflicted. This is particularly true when investigation reveals undesirable trends.

Systems or Individuals: Do We Have To Choose?

A recent healthcare inquiry in Australia prompted a question that must be answered: can a human factors or systems approach coexist with a requirement for individuals to be accountable for their actions? If we accept the experience of aviation, the answer must be yes, but this prompts a further question: how can institutionalised healthcare hope to give patients the best protection achievable if it fails to train its practitioners to defend themselves against their most common failing – their own, innate, all-too-human fallibility?

Human factors accepts the relationship between responsibility, accountability, and culpability. Accountability is an essential characteristic of professionalism, and a systems approach is not intended to protect staff who deliberately engage in carelessness or recklessness or who are malicious. These people should indeed be identified and dealt with as culpable.

However, even here investigators need to look at the system factors which allowed such a person to enter the healthcare system and to harm patients. Again, aviation offers a potential solution. An applicant for a pilot position with QANTAS must pass a psychometric testing phase before the company will accept the accounting expense of a medical examination by its own doctors. It would appear the potential savings from one cost more than justify the imposition of another.

To protect patients not only from the criminally negligent but also staff making honest mistakes, it is necessary to find all of the system factors that account for a particular problem and then deal with them justly and appropriately. Investigators need to move beyond allocating blame as a primary objective: a more rational response to adverse events would be to design interventions to minimise the potential impact of harm due to inevitable errors. This may involve critically examining the way a system is designed, seeking out potential weaknesses, and harnessing the collective experience of near misses or close calls.

Applying Using Human Factors to Improve Safety in Healthcare: How Can Aviation Help?

Fortunately, healthcare does not need to reinvent the wheel when it comes to applying human factors principles to patient safety. It can look to decades of basic and applied human-factors-based safety research developed in other high-risk industries, particularly aviation.

The Appeal of Aviation

The aviation experience is appealing for many reasons, including that:

- Its active training history in applying human factors concepts to safety spans over a quarter of a century;
- The history of its efforts is well-documented;
- The published literature includes applied research which show human factors interventions do improve safety;
- There are many similarities between the aviation and healthcare industries.

The similarities between healthcare and aviation include include:

- Their long periods of training before initial qualification;
- their high-technology, high-risk environments requiring consistently safe standards of practice;
- That safety is a primary goal;
- Their need to keep costs under control;
- Their requirement to work in teams;
- Their need for good interpersonal skills;
- Similar professional cultures, including high levels of motivation to do well, a commitment to excellence, and pride in their training and ability.

Healthcare and Aviation: Not Mirror Images

However, there are also important differences between the two industries. For example:

- Unlike the average passenger exposed to business or holiday travel, the sick, injured, very old, and very young are inherently vulnerable when exposed to healthcare;
- There is little standardisation of equipment and protocols in healthcare;
- Healthcare is “face-to-face” and very personal while pilots and aircraft maintenance crews are largely hidden from their passengers;
- Every patient is unique, so healthcare is plagued with variables and uncertainties.

Consequently, some of the tools and techniques developed for aviation may not be appropriate for healthcare while others may require modification and adaptation. Furthermore, their effectiveness in healthcare settings will require verification. Nevertheless, there are real lessons to be learned.

So What Are the Most Useful Lessons from Aviation?

1. Teaching staff to deal with human fallibility

As described earlier, the aviation solution to the problem of human error has been to train pilots and flight attendants in human factors, through a program known as Crew Resource Management. In many western countries, this training is mandated by an aviation regulator, such as Australia's Civil Aviation Safety Authority, and is expected to be a routine part of crew operations on every flight. It focuses on the nontechnical skills needed to deal with threats and manage the human potential for error. The skills incorporate subsets of appropriate operational behaviours known as markers which include: leadership, decision-making, team coordination, safety-critical communication techniques, situational awareness (being able to see the wood and the trees) and self-assessment.

Similar programs are running in industries such as mining, shipping, and nuclear power. Although Crew Resource Management programs cannot be imported directly into healthcare, many of their components are highly relevant.

2. Voluntary reporting – the second pillar of wisdom

The beneficial effects on airline safety flowing from training in human factors are well-described in the research literature. However, training alone would be ineffective if not supported by other safety initiatives, such as the confidential reporting systems described earlier. The combination increases the likelihood that staff will deal effectively with errors that may otherwise lead to serious adverse events. It also assures that the system will learn from those events, both adverse and inconsequential, and take steps to prevent their recurrence.

Applying Human Factors to Healthcare: The Challenges

There are hurdles to be overcome when considering whether or not to adopt human factors training in healthcare, including the importation of the techniques developed in aviation.

First, it is not easy to change a whole culture. Aviation has been adapting for decades, and still has individuals and isolated groups who prefer the traditional approach. The shift away from relying on punitive measures to prevent error toward finding constructive ways to improve patient safety is a huge mental leap for some but, to be effective, it needs to be introduced across the system. This implies a need for top-down support and may even require changes in legislation if open disclosure of error is to become a universal ethos.

Second, there is no one unified healthcare system in Australia, but rather a loose network of interacting systems. Change management must allow for the cultural needs and often very different structures of these systems. At present a wide variety of independent human factors initiatives have been introduced in an ad-hoc fashion around the country. There is no central coordination and no way to ensure that initiatives are appropriate, effective, or consistently implemented.

On the other hand, these initiatives are well-intentioned. Some appear to be self-sustaining and have emerged from a single locale to improve safety and quality in many areas of healthcare. Clinicians are not only keen to help improve the system, they have the expertise to identify what is needed to achieve it.

Making the Transition

Applying human factors principles to healthcare will require a phased approach. Early research suggests human factors principles can be taught effectively in the Australian healthcare setting. The next step is to educate policy setters and administrators, then clinical teams working in high-risk environments, followed by inform patients, the media, and legal community.

Measuring Change

Effectiveness is an important issue for any intervention in healthcare. It will be essential to monitor which human factors initiatives and interventions actually improve patient safety or reduce adverse outcomes. To find this out, the industry needs workable reporting systems, which support statistical analysis. 'Workable reporting systems' may well be an oxymoron in workplaces where a blame culture prevails.

Change and Public Perception

The human-human interaction aspects of human factors in healthcare rely on principles of clear and accurate communication, support, and cooperation. Mistakes should be readily admitted and dealt with for the greater good. Anyone who has participated in a team building exercise will recognise these powerful principles.

However, cultural change requires leadership at the highest levels, including government. The political arena is vitally important, but although it allows healthcare to manage and draw strength from our social diversity, it may not be such an easy place to explain human factors.

The tide of blame that can flow from media reports of adverse events does little to encourage the positive qualities of healthcare workers. No one can doubt the power of the media to shape public opinion. Perhaps, given the opportunity to attend a healthcare human factors training program, a health correspondent would find it difficult to report in anything other than positive terms the willingness of health systems to improve.

The Cost of Commitment

Just as preventive medicine involves spending money now to save money later, human factors has up-front costs. Resources are needed to analyse why mistakes happen, where they have occurred in the past or may occur in the future, then to come up with solutions, and to implement them. In healthcare, there will be training costs as staff are taught to leave behind the name, blame, and shame tradition and move to a more productive approach to patient safety.

These systemwide changes require support at the highest levels of management, as well as political leadership. As with the introduction of any new tool or skill, it is

clearly more cost-effective to promote human factors at a state or national level than to have individual practices, hospitals, or districts design and deliver individualised training programs. A national approach also allows an easier transition for healthcare workers moving from one healthcare jurisdiction to another.

Section Two

Objectives, Structure and Key Themes of the Human Factors in Health Care Workshop

The Human Factors in Healthcare Workshop: Do the Lessons from Aviation Apply? was held in Sydney on 6 December, 2003. This one-day, interactive workshop formed part of Sixth International Australian Aviation Psychology Symposium.

The Australian Aviation Psychology Association hosted this Workshop as part of its Symposium because research suggested some human factors issues that aviation had been looking at for some time would also be applicable to healthcare.

The Australian Council for Safety and Quality in Healthcare helped sponsor the Workshop. The Council, whose role includes leading the way in national efforts to improve the safety and quality of health care, saw the Workshop as an opportunity to increase awareness of the role of human factors in patient safety, to update participants on the latest patient safety concepts and research nationally and internationally, and to promote discussion of whether and how safety concepts from aviation, with its exemplary safety record, could be adapted for use in medicine.

The Workshop was attended by 150 people.

The Objectives of the Workshop

The objectives of this workshop included:

- Increasing the sensitivity of practitioners to human factors issues in healthcare;
- Making a contribution to the body of knowledge about human factors in healthcare;
- Expanding the understanding of human factors issues which might impact upon the safety of healthcare delivery.

The Workshop was designed to foster debate on a central question: can healthcare learn from aviation, ie. can some of the approaches and techniques developed by the aviation community assist the healthcare community in achieving safer and better product and service delivery?

In the first part of the workshop, invited speakers outlined the latest developments in human factors theory and practice, both in aviation and healthcare. In the second part, focus groups provided delegates with the opportunity to debate issues and sketch potential solutions for human factors problems thought to have an impact on safe outcomes.

Workshop Structure

The Workshop was structured to facilitate healthcare's own learning about human factors, so a structure that encouraged participant input was chosen. This also allowed participants to realise some of the tacit knowledge about human factors already present in the system.

The Workshop consisted of plenary sessions from subject matter experts run throughout the morning. These were designed to promote a broader understanding of potential human factors issues in healthcare.

They were followed by parallel, small group focus groups in the afternoon. Experienced aviation and healthcare facilitators moderated the focus groups. The facilitators performed inductive analyses of the discussions, presented this data to the group members, and incorporated their responses. The findings were later reported to all Workshop participants.

While the results of the focus group discussions were being collated, participants heard papers outlining contemporary efforts to integrate human factors into healthcare, including how to train staff in human factors and how to collect appropriate data on patient outcomes.

The structure allowed participants to be updated by a variety of Australian and international patient safety experts and to discuss the implications of the latest ideas with colleagues.

Key Themes

1. The human element in medicine cannot be ignored

Throughout the Workshop, national and international experts described how and why human factors issues are major contributors to adverse events in healthcare.

Human error occurs in all high-risk industries at remarkably consistent rates, and few types of human error belong exclusively healthcare. All errors have the potential to cause harm in measures varying from the inconsequential to the catastrophic. The vast majority of healthcare professionals are neither reckless nor careless, but this in itself is not enough to make healthcare safe because the system they work in is extremely error provocative.

When comparing healthcare with other industries whose work involves high levels of technology, high levels of risk, and high levels of professional commitment, some Workshop presenters drew an extraordinarily simple conclusion: accidents and adverse events are not due to pilot errors, or engineering errors, or medical errors – the problem is human error.

Healthcare has traditionally regarded error as a moral failing, placing an unsustainable burden of perfection onto its practitioners. This attitude has impeded efforts to identify where errors occur, how common they are, what effects they have and how best to protect patients against the disease we know as human fallibility.

2. Aviation has faced similar problems - successfully

Aviation sees human error as normal and inevitable. Rather than relying on a perfectibility model – at best a vain hope, at worst an exercise in futility – it builds safeguards into the system. These are specifically targeted to provide layered

defences. They have also generated open channels for reporting which allow fellow practitioners to learn from near misses as well as adverse events. The result is an enviable safety record.

The techniques aviation has developed include:

- Training crews to confront their own fallibility and simultaneously providing them with simple tools which help in the everyday management of hazards, threats, risk, errors, and unexpected complications. Training begins by giving practitioners start with a vocabulary for talking about error, then educating them in reliable communication techniques which reduce the potential for misunderstanding, misinterpretation, and mistakes.
- Developing standard operating procedures, checklists and challenge/response practices which reduce the likelihood of important steps being inadvertently omitted from a planned sequence of actions;
- Developing robust reporting systems designed to increase learning in a just culture. These systems not only require pilots to report those errors which produced adverse events but also encourage them to report errors which resulted in close calls. This kind of healthy reporting culture is possible only when practitioners feel they work in a just culture.
- Developing incident investigation strategies, which identify all of the causal factors leading to an adverse event or near miss, and placing responsibility for the investigation of adverse events in the hands of qualified, neutral third parties.
- Circulating the results of incident investigations, and any accompanying recommendations for action, widely;
- Encouraging a system with “porous boundaries” so that practical solutions can be shared across the industry, so reducing the chance of similar mishaps occurring elsewhere.

The aviation industry operates in a complex, multidisciplinary, environment which uses multiple layers of defence to reduce the risk of serious adverse events. Protecting staff and consumers in a hazard-rich environment such as air travel has required a great deal of commitment from the industry in time, energy, and financial resources.

3. Pilots share some important similarities with clinicians

Both pilots and clinicians are highly dependent on technological innovations.

Both face multiple sources of danger and risk.

Both have the mastery of technical skills as a historic priority.

Both have evolved within national, organisational, and professional cultures.

Both have limited mental capacity and processing capability.

Both suffer from critical performance impairment when exposed to excessive levels of stress, fatigue, or other adverse physiological factors.

4. Healthcare face some distinct disadvantages compared to aviation

When it comes to dealing with human error, healthcare faces some distinct disadvantages compared to aviation, particularly because of:

- Its diversity – each patient encounter is unique;
- The nature of its activities – for example, one patient may have many healthcare providers involved in her care, while hundreds of airline passengers share the same pilot;
- Routinely accepted levels of uncertainty.

Healthcare also suffers from relatively low levels of standardisation in equipment and protocols, the absence of formal training in team skills, and a traditional culture of name, blame, shame, and (if you're lucky) retrain. It is also a culture which, in a world of increasingly sophisticated interventions, still tolerates the 'see one, do one, teach one' approach to learning which aviation has long since discarded.

5. Some aviation lessons are relevant to healthcare

Experts presenting at the Workshop pointed to many such lessons. Practical recommendations included that healthcare should:

- a) Define a clear policy regarding human error, one that accepts error but not intentional noncompliance.
- b) Develop formalised procedures and practices, where appropriate.
- c) Develop checklists to reduce the risk of inadvertent omissions in complex sequences.
- d) Use confidential incident reporting systems for near misses to uncover threats to safety.
- e) Provide appropriately designed, formal training on threat and error management.
- f) Use the error data from reporting systems for organisational intervention, ie. develop effective, practical strategies for dealing with known problems.

Other suggestions included that healthcare education routinely teach:

- The inevitability of error in human-controlled systems;;
- The nature of human error and how to manage it;
- Countermeasures to threat and error, such as conflict resolution or how to manage fatigue.

- The effects of culture on safety;
- Processes for expert decision-making.

6. Some aviation-inspired human factors initiatives are already underway in Australian healthcare

Examples given included:

- The Australian Incident Monitoring System. This is a computerised system for monitoring, analysing, reporting, and managing problems ranging from near misses to sentinel events across the entire spectrum of healthcare.
- Medical simulation centres across the country. These high-fidelity medical simulators allow staff to practice soft skills, like effective communication, and hard skills, such as newborn resuscitation, in a variety of situations without putting patients at risk.
- The NSW Safety Improvement Program. Features include: compulsory root cause analysis of serious incidents and subsequent de-identified reporting to the Department of Health; a risk register keeping track of the recommendations produced by root cause analyses and the success of their implementations; and patient safety managers trained in human factors in each area health service.
- Queensland Health's Human Error and Patient Safety program, modelled on the EroMed program, which has trained over 1,500 staff in human factors and proven to be effective in changing workplace cultures.

7. However, more needs to be done

Among other things, Workshop focus groups recommended:

- Increasing awareness of human factors problems in the system, and committing resources to improving the situation;
- Providing practical training in human factors concepts and non-technical skills such as assertiveness, teamwork, and communication;
- Standardising operating procedures and developing suitable checklists;
- Focussing on common problems, not isolated issues;
- Routinely checking performance against accepted standards; auditing systems; benchmarking;
- Addressing the issue of fatigue in healthcare workers, especially senior staff;
- Developing a central incident reporting system, supported by an open reporting culture and using this information to improve patient safety;
- Using structured incident investigation processes, which include a review of human factors and gender issues, with appropriate debriefing and support processes.

Section Three

The Human Factors In Healthcare Workshop Presentation Summaries

This section briefly outlines the content of each Workshop session. Two of the papers presented at these workshops have not been summarised in this report. These are:

- “Crisis Resource Management (CRM) training for health care teams using high-fidelity simulation” by Dr Brendan Flanagan, Monash Medical Centre; and
- “Triaging unsafe acts” by Professor Jan Davies

Plenary Session Presentations

Background and introduction.

Professor Bruce Barraclough, Australian Council for Safety and Quality in Health Care

In many states, workers involved in healthcare are already being taught about human factors; examples include the aviation-inspired human factors in medicine training program run by ErroMed; a human factors component to some state-based root cause analysis training programs; human factors briefing documents for state ministers for health; and courses run by medical simulation centres throughout the country.

Human factors problems, such as staffing or teamwork issues, are a major cause of adverse events in healthcare. However, while aviation views error as a normal, inevitable part of human interaction, and has designed systems to cope with this, healthcare regards human error as a moral failing deserving of punishment. To change this attitude, mandatory undergraduate training in human factors for all healthcare students will be necessary.

A vital issue is how to develop a culture where people freely report errors. This is a difficult problem in the current political climate.

Lessons from aviation: the good, the bad and the ugly.

Professor James Reason, Dédale

Healthcare is unique, so many of the lessons learnt by aviation do not apply. Furthermore, some aviation practices provide bad examples of how to run things. Nevertheless, aviation has some good lessons to teach medicine.

In many ways, aviation sets a good example for medicine. It:

- Manages safety by assuming errors will happen – even the Wright brothers used checklists;
- Builds in multiple layers of defence against error, rather than relying on a single barrier, such as individual expertise, to provide perfect protection;
- Builds barriers against both system failings and individual errors;
- Teaches staff how to deal with, and recover from, unexpected emergencies;
- Looks at all the causal factors when investigating adverse events, even those factors which are distant in time and space;

- Encourages system-wide learning from local mistakes. This happens because aviation has a reporting culture. Strategies which have helped develop this culture include:

- Building staff trust that the organisation will produce justice by treating unacceptable unsafe acts and honest mistakes appropriately, rather than veering to the extremes of blame or no-blame;
- Treating near misses as important learning opportunities;
- Separating incident investigation bodies from disciplinary bodies;
- Providing pathways to disseminate information across the system.

In general, the aviation focus is on changing systems rather than blaming people, on asking not who screwed up but what safeguards failed and what can be done to stop future occurrences. It does not rely on “should-haves”, which are usually only identifiable with hindsight. Aviation is also acutely aware of the importance of cultural influences on safety.

Some bad examples provided by aviation:

- Not all airlines have achieved the same level of safety, because not all have appreciated in full the effects of workplace culture on safety;
- Not all safety initiatives maintain long-term momentum, for example, continuing to be adequately resourced long after the initial trigger event;
- An inappropriate focus on the categorisation of causal factors leading to adverse events, such as weather or proximity to airports, can hide important interactions between different factors;
- Some staff, mainly infrastructure workers, are treated badly.

There are some important differences between healthcare and aviation, including that:

- It is easier to make serious errors which cause harm in the complex world of healthcare delivery than in aviation, where there are fewer variables;
- The sick, injured, very old, and very young are an exceedingly vulnerable population compared with jetsetters;
- There is little standardisation in healthcare, eg. different parts of the system use different versions of the same type of equipment, unlike aviation, which is dominated by two manufacturers;
- Healthcare is “hands on” and very personal while pilots and aircraft maintenance crews are hidden from passengers;
- It is not possible to build defences into all healthcare practices equally well, eg. surgical outcomes necessarily vary with the skill and confidence of the surgeon;

- Every patient is different, so healthcare is riddled with uncertainties.

Managing threat and error in medicine.

Professor Bob Helmreich, University of Texas

The US Institute of Medicine has recommended healthcare look to aviation for lessons in how to improve safety. Overlaps between the two industries include: having safety as a primary goal; needing to keep costs reasonable; the use of technological innovations; a need to work in teams; a need for good interpersonal skills; and marked effects of workplace culture (ie. the values, beliefs, and behaviours shared by members of the organisation) on behaviour, including behaviours which affect safety.

In healthcare, organisational culture has a real impact on safety. It influences such things as whether staff feel obligated to follow the rules, how committed they are to safety, and whether they trust management. Workplace culture is reflected in such problems as a lack of concern for safety, feeling pressure to get things done even when tired, conflict with management, or poor morale. Overall, pilots and doctors have similar professional cultures, which is why some aviation lessons are pertinent to medicine. On the positive side, both sets of professionals are hugely motivated to do well, committed to excellence, and proud of their training and abilities; on the negative, their training can stress the need for perfection and inculcate a sense of personal invulnerability which leads to such inappropriate beliefs, such as that their decision-making is as good in emergencies as in normal situations, or that workplace performance is not influenced by personal problems. Pilots, however, have a more realistic attitude to fatigue than doctors do.

In medicine, many threats to safety have been identified, including the:

- Characteristics of the patient;
- Characteristics of the individual professional, such as proficiency, motivation, fatigue levels, or beliefs about personal vulnerability to error;
- Characteristics of the system, eg. staffing, rostering, whether patients requiring primary healthcare can access appropriate services or are forced to turn to emergency departments, or how different healthcare teams interface with each other;
- Characteristics of the professional culture, eg. a tendency to repress discussion of error for fear of litigation, tolerance of detrimental behaviours such as illegible handwriting, tolerance of a high variability in how people practice, or rules about workloads which vary with different workplaces.

We know human error is there, and we know why human error occurs. Humans make mistakes because they have inbuilt limitations, such as a limited memory capacity, limited information processing ability, and a vulnerability to stress and fatigue.

The University of Texas Threat and Error Management Model looks at how medicine deals with threats and manages individual and team errors, as well as how to analyse superior and suboptimal performance. It acknowledges that threats to patient safety do exist, and identifies them. These threats can lead to errors, which can then cause

adverse events, or they can be managed and rendered inconsequential - ideally, errors are prevented but, once errors have occurred, the immediate task is to manage the problem to prevent or minimise damage.

Tools for managing threat include developing a culture that:

- Is committed to proactive safety activities rather than relying solely on trying to recover or cover up when things go wrong;
- Recognises the inevitability of error;
- Learns from error.

There are six steps to building a safety culture.

1. Define a clear policy regarding human error, one which accepts error but not intentional noncompliance.
2. Institute formal procedures, where appropriate.
3. Develop checklists, and recognise the dangers of fatigue.
4. Use confidential incident reporting system to uncover threats to safety and sources of error, and then develop strategies for dealing with them. Analyse the near miss and sentinel events, eg. through the systematic use of the threat and error management model.
5. Provide appropriately-designed, formal training on threat and error management.
6. Use the error data for organisational intervention. For example, if staff routinely violate a particular procedure, this suggests the procedure is poorly designed or inappropriate; if there are lots of procedural or task errors, this may indicate poor workload management; if communication breakdowns are commonplace, this may reflect inadequate teamwork training; if there are unacceptable numbers of decision errors, with people making unnecessarily risky choices, staff may need training in expert decision-making and risk assessment.

Some interventions can have hugely positive effects, particularly the introduction of checklists and standardised operating procedures. There is a risk, as aviation has found, of becoming over-proceduralised, and this can lead to violations becoming routine, but at present health care is under-proceduralised.

Medical education must teach: that human limitations are a source of error; the nature of human error and how to manage it; and the effects of culture on safety.

Staff must be trained in expert decision-making and countermeasures to threat and error, such as conflict resolution, how to ask questions when they are uncertain, communication skills, and how to manage fatigue.

Healthcare can follow the example of aviation in using the careful analysis of incident and accidents, both those that are managed well and those that are poorly handled, to learn from mistakes.

Australian human factors initiatives in healthcare.

Dr Ian O'Rourke, Institute for Clinical Excellence, and Ms Maureen Robinson, NSW Health

Human factors training and skills development are a very important part of NSW Health's quality agenda.

In 1999, NSW Health published a high-level framework for managing the quality of health service in NSW. This was followed by toolkit for coalface clinicians on how to improve patient care. The toolkit focussed on three main strategies:

- How to obtain information about care, eg. through incident monitoring or morbidity and mortality reviews;
- Understanding the importance of human factors in patient safety;
- How to incorporate information and concepts from the first two strategies into actions plans which can be applied to patient care. This process uses the clinical practice improvement method.

The NSW Safety Improvement Program has introduced a consistent approach to the management of incidents and sentinel events, so that statewide learning can follow. The purpose of the Program is to bring about improvement, not develop yet another incident reporting system.

There are two phases:

- Through statewide teaching and training, developing a culture where all incidents can be recognised, reported, investigated, analysed, and acted on;
- Identifying information systems to aid these activities.

One component of the Program is the compulsory reporting of serious incidents to the Department of Health. This will enable the State to determine what policies need to be introduced, what changes need to be made, to improve the system. After staff making reports have been given feedback, the reports are de-identified before being sent to the Department. All serious incidents must have a root cause analysis done, and its results, recommendations, and the outcome of subsequent actions reported. A risk register keeps track of the recommendations and the success of their implementations.

As part of the Program, root cause analysis training, which includes human factors training, has been carried out in 20 area health services and involved 2,000 healthcare professionals. Each area health service now has a trained patient safety manager funded half by the area and half by the Institute for Clinical Excellence.

In addition:

- Formal courses in human factors in medicine are being run; for example, all NSW neurosurgeons have attended an ErroMed human factors in medicine training course;
- There are plans for courses to train people how to coach teams;

- A Flow and Safety Collaborative is working on reducing pressure ulcers and falls;
- A program will be developed to impart the principles of clinical governance to ensure staff are qualified, credentialled, supervised, and their performance assessed appropriately. This will involve the training of boards, executives, team coaches, and clinicians.

Embedding human factors in a national patient safety database.

Professor Bill Runciman, Royal Adelaide Hospital

Adverse events in healthcare require:

- Detection: what, who, when, where;
- Characterisation: who, why, mitigating factors;
- Collection and classification which must be detailed and use all sources, domains, and levels;
- Analysis which is rapid, comprehensive, useful, and accessible;
- Management of individual cases and generic problems.

The Advanced Incident Management System is a computerised system for monitoring, analysing, reporting, and managing problems ranging from near misses to sentinel events across the entire spectrum of health. It looks at:

- Who or what was involved;
- When it happened;
- Where it happened;
- What happened;
- What actual or potential harm was done;
- The likelihood of it happening again.

A more detailed dataset is compiled following certain triggers, such as high risk or bad outcomes. This looks at:

- How defences were breached;
- What actually happened;
- What minimised the harm;
- What aggravated the harm;
- What harm was done to the subject and/or to the facility;
- What actions were taken, immediately and long term.

There is a single point of entry for sentinel events, adverse events, near misses, complaints, medico-legal cases, occupational health and safety cases, and coronial recommendations, as well as audits, registers, and the published literature, so all relevant data can be analysed.

The human factors of human factors: initiating human factors training in the healthcare setting.

Professor John Cartmill, Nepean Hospital

Human factors has its basis in biology - after all, humans are living things. Man-made systems can look to nature for illustrations of the principles of human factors, from the importance of good communication to the need for clear leadership.

Living things have certain characteristics:

- The ability to communicate is one. Even the simplest of organisms need all of their parts to communicate and cooperate in a coordinated way. In nature, communication is specific and directed. It uses graded assertion (escalating the strength of the communication where necessary), feedback, and challenge-response (has the message been understood and how do you know that?). This is as true of individual organisms using neural and hormonal mechanisms as it is of social animals using more sophisticated techniques. Effective communication may also call for situational awareness (the ability to be sensitive to and respond to the environment), leadership (coordination), and collaboration.
- Living things grow, but their growth has regard for their environment - form follows function in a natural form of ergonomics.
- Organisms have to be fed: they need resources, and a lack of resources, with subsequent competition for what is available, causes stress.
- Living things are driven to reproduce; likewise, if man-made systems of understanding, such as human factors, learn from each other (cross-fertilise) and multiply (if they are any good).

There is a parallel between the characteristics of life itself and human factors that helps explain the resonance human factors seems to enjoy with healthcare workers. It seems to stick where other safety and quality programs leave many cold. An engineer may see a hospital as a well-oiled machine, but a healthcare worker is more likely to see a living, breathing, caring organisation, an organism just like them. People are the basic units, the cells, of the organism. In health, these people are intelligent, well-intentioned, and highly motivated, and healthy cells with good communication skills can form good organisations.

A team is a multicellular organism, a unit of cooperation defined by communication. Where communication stops, the team ends. The more sophisticated the communication, the greater the potential of the team. A team is also a powerful organism for taking on and making the most of diversity - team members see things through different eyes, agreeing on some things but not everything. The way teams manage these disagreement can be strength or a weakness. Collaboration is most fun when it is mutual, and seems to work best when acknowledged and appreciated.

It is easy to communicate when everything is going well, but, as soon as things start going badly, an invisible barrier to communication goes up. Suddenly, there are multiple teams, each defined by its own communication pathways, each competing with one another. At a time when cooperation is needed more than ever, the exact opposite occurs.

When things are going badly, sophisticated human factors communication techniques are needed to maintain communication, to keep the organism, the team, alive and working well together. A lack of words impairs communication, and this is a particular problem with medical mishaps as many healthcare workers have only a limited vocabulary to describe error. If staff don't have the words, they can't talk about it, can't understand it, and can't disclose problems or do anything about them.

Human factors invites us to consider our environment, the context for work. In the case of hospitals, the workplace is dangerous and diverse and alive with a huge database of technical and non-technical skills. The scalpels are sharp and the drugs really work, but at the same time every drug is a potential poison, every instrument a weapon, and every healthcare worker a potential killer.

Fortunately, living organisms have a strong sense of self-preservation. Human factors takes advantage of the self-preserving safety mechanisms which are already there, eg. by including the patient as a team member. Patients and their relatives love to be on the same team as their healthcare workers, and they provide their team with a huge amount of energy and motivation.

Suspend reality and accept momentarily that hospitals are like living things and have human properties. It follows that they have feelings and that these feelings affect their performance. Just as bullying and harassment in the workplace have negative effects on individuals, so must consistently negative media portrayals of hospitals affect morale and performance.

A human factors approach works – Preventing laparoscopic bile duct injury.

Dr Thomas Hugh, St Vincent's Clinic

In developed countries worldwide, laparoscopic bile duct injury occurs in 0.3% of cholecystectomies. This is a systems problem, characterised by a hitherto intractable frequency. Duct misidentification is thought to be the usual mechanism, but this is a false hypothesis: three out of four injuries are unrecognised at operation, and postoperative biliary drainage/jaundice is frequently ignored.

The traditional surgical teaching on preventing bile duct injury is that no structure should be divided until it is clearly identified; in other words, surgeons should always identify the cystic duct/common bile duct junction before cutting. The traditional surgeon is thought to be decisive, self-reliant, authoritarian, and unafraid of (the patient's) blood loss, and to operate speedily, never be fatigued, and remain uninfluenced by personal problems.

A systems approach to laparoscopic bile duct injury suggests contributing causal factors may arise from multiple sources, not just the surgeon's hands. Examples include the equipment, assistance, surgical training, the surgeon's attitude, personal

problems, fatigue, and time pressures. A low risk surgeon, for example, recognises the effects of stress and worry, is willing to revise hypotheses, expects unpleasant surprises, accepts input from others, is frugal with blood loss, and sees speed is an accomplishment, not an aim.

At Sydney's St Vincent's Hospital from 1993 – 2002, there were no cases of bile duct injury during the 2000 laparoscopic cholecystectomies performed.

Parallel Focus Group Findings

Is teamwork telling a nurse what to do? Application of Crew Resource Management training for healthcare: challenges and solutions

The features that make a team perform well or badly are known.

High-performing healthcare teams have:

- The trust and respect of team members;
- An open environment;
- Members who have the confidence to speak up if they have concerns;
- Members who support each other and collaborate;
- Clear roles and goals throughout the whole process, from planning, preparation, action, and subsequent evaluation, which ensure everyone heads in same direction.

High-performing healthcare teams are:

- Responsive and effective in their behaviours, especially at times when the plans go awry;
- Flexible, with an ability to cope with change;
- Effective in their ability to evaluate and learn after events.

Poorly functioning healthcare teams display:

- Inappropriate behaviours;
- Misuse of power;
- An inability to listen;
- Poor cooperation;
- A shaming and blaming culture;
- A lack of respect for other team members;
- A preparedness to violate rules;

- Poor role and goal clarity;
- A poor understanding of what is expected of them;
- An inability to say: “We can’t do this!”

The focus group recommended the following strategies to improve teamwork in healthcare:

- The development of team player competencies;
- Implementation of a common language acceptable for teams;
- Detailing of common behaviours through an accepted list of behaviours;
- Provision of assertiveness training for all team members;
- Enhanced conflict management through training;
- Clarification of the roles and responsibilities of team members, including determining what skill mix a team needs;
- Development of appropriate systems and processes to maximise team performance;
- Development and implementation of guidelines, policies, and procedures, and, importantly, some standardisation of operating procedures.

Human error or system failure? Application of just culture/open safety reporting concepts: challenges and solutions

Healthcare does not have to choose between the human factors and personal accountability models of managing error – both are important.

Specific problems and solutions in healthcare include the following:

- The complexity of the health structure needs to be accepted as a reality, and reduced where possible;
- Common problems need the most attention, not one-off issues;
- There is a lack of resources. If the aviation industry was funded or delivered its services in the way healthcare does, would it be functional?
- Change requires knowledge, but this raises its own problems. Does the healthcare industry have expertise in change management? How much evidence is needed before changes should be implemented?
- Communication is the perennial problem. Given that healthcare consists of multiple systems, what is the best way to produce good communication and, thereby, achieve better outcomes?

An important issue is that healthcare comprises systems within systems, and often the public health system is focussed on to the exclusion of other elements of healthcare provision.

How do we develop and maintain human factors standards for healthcare? Training and assessment standards for human factors in healthcare: challenges and solutions

Healthcare professionals are adept at compensating for inadequacies within the system. One of the main strengths of the healthcare system is that so many people display an outstanding level of commitment. However, this can also have detrimental effects; while many professionals are good “stand-alone practitioners”, this does not necessarily make them good team players.

Routinely checking performance against accepted standards is not done well in the health services. Auditing systems and benchmarking (both nationally and internationally) are not what they should be, and this makes it difficult to gather the data needed to justify requests for appropriate resources to improve outcomes. In particular, training in communication and human factors skills is unsatisfactory, and there is no reward for human factors skills.

Healthcare systems need to:

- Educate the masses. All current education programs need to move beyond the introductory and awareness phases to rigorous, practical training programs;
- Make administration acknowledge the human factors problems in the system, such as poor team communication skills or inadequate staffing, and commit resources to improving the situation;
- Agree on definitions of good and bad behaviour in the work place for all healthcare disciplines.

Is working until you drop a badge of honour? Fatigue management in healthcare: challenges and solutions:

Research shows 24 hours of wakefulness impairs cognitive performance to the same extent as a blood alcohol level of 0.10%. However, the actual onset of fatigue occurs somewhere in the spectrum between well-rested and over-worked, it varies between individuals, and it can be affected by other factors, such as state of mind or motivation. At present, some factors in healthcare decrease motivation and, therefore, can bring on fatigue at an early stage. Some of these negative factors include: continuing demands for increased output; the undervaluing of healthcare workers; and the many inefficiencies which prevent people from working smarter.

There is an awareness of the relationship between fatigue and risks to the safety and quality of patient care, and the problem of excessively long working hours has largely been solved for junior medical officers. However, a culture of excessive workloads still exists, and juniors are protected at the expense of more senior staff. Some specialist training programs have still not addressed the need for safe working hours because of concerns that reduced working hours will necessitate longer training periods.

While healthcare can learn some lessons about the effects of fatigue and the need for safe working hours from the aviation industry, healthcare faces a problem aviation has no answer for: continuity of care. The fewer hours worked, the more staff are involved in a patient's care and the more handovers between staff take place, with attendant risks of miscommunication.

Recommendations for a national action plan include:

- An education campaign on fatigue to change the culture of the health system;
- Colleges and specialist societies re-engineering training programs to take account of the need of trainees to adhere to safe working hours;
- A national workshop on managing the problem of continuity of care which arises from adherence to safe working hours.

Doctor, you must listen! Authority gradients in healthcare teams: challenges and solutions

Assertiveness training is needed to empower junior staff to successfully challenge the actions of seniors when those actions could lead to patient harm.

The benefits of assertiveness training include:

- Codified responses and reduced variability to challenges to authority;
- Improved team confidence;
- A distribution of responsibilities;
- An avoidance of loss of face;
- Reduced ambiguity;
- An avoidance of poor communication resulting from individual personalities or assigned positions within the team.

Potential problems associated with assertiveness training, include:

- Blurring of the line between assertiveness and aggressiveness;
- Impaired decision making at crucial points;
- Bossiness and perhaps bullying in a downward direction;
- Clashes between the older traditional culture and the new assertive culture;
- Loss of patient confidence if they see juniors challenge decisions by seniors;
- Career jeopardy following authority challenges, as seniors make career decision for juniors.

Recommendations:

- An agreed syntax is needed, ie. agreed wordings and meanings for what is said when there are conflicts of opinion;
- Statewide or national training is desirable and should start with senior people, as they are the culture block. Senior people must be encouraged to invite input from juniors.

Do gender differences impact upon healthcare outcomes? The influence of gender: challenges and solutions

Gender has important effects on how systems, and teams in particular, function. In healthcare, this has led to a demarcation of roles where, predominantly, women process and men outcome. Gender issues are addressed in undergraduate and some postgraduate healthcare training programs, and younger staff are less likely to have stereotypical attitudes about gender; however, some older staff may need specific training.

Recommendations include:

- Integrated, multidisciplinary, team training;
- Mentoring programs for all, including men;
- A central incident reporting system, supported by an open reporting culture and robust data collection. This information can be used to educate the public and politicians on the link between human factors - such as safe workloads and staffing issues - and patient outcomes, and to make changes;
- Debriefing and other support processes to be included as reasonable parts of an acceptable workload for all;
- Structured incident investigation processes which include a review of human factors and gender issues;
- Crew Resource Management-style training for healthcare professionals, followed by research into its influence and outcomes. This research must explore gender and power issues.

Parallel Research Paper Presentations

Team operations: non-technical competencies in surgery.

Rebecca Atkins, Peter Pfister, and Alan Spigelman, University of Newcastle, Australia, Steven Smith and Mark Fleming, Saint Mary's University, Canada

This paper describes an Australian research initiative investigating the role of nontechnical competencies in medical team performance in order i) to identify those nontechnical skills which are crucial in overall performance and patient care and ii) to develop, implement, and evaluate national CRM and human factors training interventions to assist in the management of error.

Parallel studies will be conducted at the University of Newcastle in Australia, Saint Mary's University in Canada, and the University of Aberdeen in Scotland.

In total, there will be four studies, commencing with a pilot study involving surgical teams in each of the three nations. The pilot study will measure the attitudes of a sample of surgical staff and examine differences between occupational groups. A set of nontechnical behavioural markers associated with effective team performance will be identified through the use of questionnaires and interviews which can be used to develop human factors training programs.

This will be followed by two larger studies conducted with multiple surgical and nonsurgical teams. This will involve assessment, intervention, and evaluation (and revision) stages. The assessment phase will replicate the pilot study with other medical teams. The behavioural markers identified in the pilot study will form a supplementary scale of the questionnaire used when re-surveying participants. The intervention phase will involve developing and implementing a national Crew Resource Management training program based on the outcomes of the pilot study and the initial phase of the larger studies. The third stage will evaluate the impact of the training intervention by re-surveying participant attitudes and assessing their self-reported experiences of incidents of medical error.

Breaking the sound barrier: can we engage health professionals in discussing human performance?

Dr Richard Morris, EroMed and the Sydney Medical Simulation Centre

This paper describes a training program designed and delivered by EroMed on behalf of the Quality and Clinical Policy Branch of NSW Health

Human factors and Crew Resource Management training have a well-established place in aviation training, but remain novel to many in the health domain. In 2002, the NSW Department of Health agreed to extend medical indemnity coverage for the State's neurosurgeons, provided they undertook a basic one-and-a-half day human factors awareness course. The course topics were grouped into:

- Lessons from aviation,
- System and cultural issues,
- Teamwork issues, and
- Individual issues.

The format was a 24 participant workshop with interactive and didactic presentations, video-based case discussions, syndicate tasks, and games. The course started with dinner followed by an evening session, then ran on for all of the following day using a team of three presenters. In addition to specialist neurosurgeons, participants included theatre and ward nurses, junior medical staff, medical secretaries, and hospital managers.

Despite an initial reluctance to attend by some, there was active participation by all attendees. Feedback revealed particular enthusiasm for the lessons from aviation and the use of interactive adult education techniques. On written evaluation, there was agreement or strong agreement to the statements:

- It will change the way I work (82%);

- I would recommend this course to others (95%).

In summary, there was enthusiastic participation in a course introducing human factors and Crew Resource Management concepts into the health domain with clear perception of its relevance by doctors, nurses, and managers.

Give 'em HEAPS! Implementation of the human error and patient safety program at Queensland Health.

Dr Peter Lee, Queensland Health

Human error in medical care costs thousands of lives and millions of dollars, as well as immeasurable trauma to both patients and staff. However, human error is inevitable. Queensland Health's Human Error and Patient Safety program now has 18 months experience in running training courses to address this problem, and more than 1,500 Queensland Health staff have now attended presentations of this material.

Starting with an analysis of errors, these courses lead clinicians into considering issues of teamwork and open communication. Participants are given practical workplace tools to avoid, trap, and mitigate errors, and are helped to look beyond the culture of blame in analysing incidents.

Queensland Health has steadily taken over from ErroMed, with local clinicians training to be both presenters of the material and resource people in the area of human factors. The Queensland Health-run courses are as well received as the initial ErroMed ones, and data shows that long-term retention of the concepts is high and that changes in the culture of blame are both achievable and measurable.

There is a need for flexibility in devising presentation formats that suit the needs of different institutions. There have been a large number of requests for shorter presentations on human factors, such as at grand round sessions for medical staff or the half-day course that we designed in-house. Feedback from these shorter sessions has been highly positive.

Where to start: achieving a just culture in healthcare.

Bernadette Woods, Stavros Prineas, and Ravy Thavaravy, Western Area Health Service; Graham Beaumont, Institute for Clinical Excellence; John Cartmill, University of Sydney

Safe, high-quality healthcare requires an open, transparent, and just culture where people are willing to discuss errors and system problems and do something about them. Experience of existing safety and human factors programs suggests that medicine has much in common with aviation and other safety-critical industries. Recognising this, Wentworth Area Health Service in Sydney has developed a coordinated program around patient safety to build on the aviation experience. Prior to implementing the program, the Service conducted a survey to establish the existing attitudes of staff towards the following components of a just, human-factors-aware culture:

- Organisational culture: staff appeared satisfied with their jobs and with the performance of managers in their work areas but not with higher-level management. There were concerns about the provision of adequate support, supervision of trainees, and feedback on performance;

- Teamwork: there was a general trend towards satisfaction with teamwork;
- Communication: less than half the respondents felt briefings were common in their work area, and a high proportion of staff were unaware of the names of coworkers during resuscitation;
- Assertiveness: over a third of nurses felt unable to disagree with medical consultants, and a quarter felt unable to speak up about perceived problems with patient care;
- Error: staff believed strongly that medical errors are uncommon;
- Performance-shaping factors: doctors were more willing than other groups to admit the effects of stress on performance.

Conclusions: Human Factors in Healthcare - Do the Lessons from Aviation Apply?

Healthcare and Aviation: The Similarities

The Workshop speakers, including both national and international safety experts, researchers, and members of the focus groups, were unanimous: many of the valuable lessons learned about safety in aviation are also applicable in healthcare settings. Several reasons were given for this conclusion.

The first is the evidence of significant overlaps between the two professions. These include: the nature of the work, such as dependence on technological innovations and a requirement for long periods of technical training; a need to work in teams and within national, organisational, and professional cultures; and a work environment where everyday human error poses a significant risk of serious adverse events.

Staff in both industries share fundamental human characteristics. Both have limited mental and information processing capabilities. Both suffer from critical performance impairment when exposed to excessive levels of stress, fatigue, or other adverse physiological factors. And both are fallible. Even staff in high performing jobs like piloting or surgery simply cannot maintain a perfect level of performance or display impeccable judgment on all occasions, no matter how hard they try or how much they want to.

The history of medicine and aviation has followed similar paths in trying to reduce the rate of serious harmful events. Both have improved the safety and reliability of the technologies they use and the technical training staff undergo. These measures have certainly had positive effects, but - as both industries have found - they are not in themselves capable of producing an acceptably safe environment. The effectiveness of technology will always be tempered by the people who design and operate it.

Learning from Experience - The Healthcare Response

Statistically, one in ten patients admitted to Australian hospitals will suffer harm, perhaps even lose their lives, as a result of the care they receive. Healthcare, in seeking to improve this unhappy record, faces the daunting challenge of funding

improvements and changes in culture across a nationally distributed workforce. Where there has been a traditional ‘blame and shame’ response to harm caused through error, the perception of that workforce has been that the beatings will continue until morale improves.

Learning from Experience - The Aviation Response

Since the mid-eighties, aviation has accepted human fallibility as inevitable and, rather than demand a level of perfection which cannot be consistently achieved, has designed systems which minimise the impact of human error. This approach to safety is an applied version of a field of study known as human factors.

The results speak for themselves: the aviation safety record is the envy of other high-risk industries. Despite an average 10 million take-offs and landings annually, since 1965 there have been less than ten fatal crashes a year worldwide in commercial aviation, and many of these occur in third world operations.

The aviation community has achieved this across an international workforce. Its major investments have been in smarter technology accompanied by smarter training, coupled with continuous improvement through error reporting systems. It is certainly still possible for a pilot to lose his or her job - or even the license to fly commercially - following an accident. However, such punishments occur when that is the most appropriate response of a just work culture to the behaviour displayed, for example, deliberate recklessness or malicious behaviour rather than honest mistakes.

The Value of Aviation Lessons to Healthcare

Aviation has almost twenty-five years experience in developing their human factors approach to safety. Current levels of content have built on early trial and error program which established what is now the sixth generation of Crew Resource Management. Crew Resource Management is routinely included in pilot training in most western countries, and mandated in many. The modules can be delivered separately or combined in courses of up to two days. Content focuses on non-technical skills, such as teamwork and communication, why errors occur, personal potential for error, and performance-shaping factors which increase the risk of error. One of the most important techniques taught in Crew Resource Management is graded assertiveness, a pattern of communication in which junior staff can convey critical safety concerns to more senior, possibly intimidating, colleagues by focussing on *what* is wrong rather than *who* is wrong. None of these skills are routinely taught in healthcare.

Pilots are also trained to use systemic tools, such as standard operating procedures and checklists, to avoid and trap their own errors, to mitigate harm flowing from error, and to learn effectively from the errors of others as well as their own. Defences against human error are multiple and layered, so that no one defence is relied on exclusively. A variety of levels of simulation, from desk top to full flight, are also used to safely rehearse strategies for dealing with unexpected emergencies.

In an industry with a clear requirement to perform safely and consistently, Crew Resource Management has proved to be an effective way of producing safe

behaviours. It generates and fosters a culture where safety and efficiency are the two major priorities.

Aviation Error in A Just Culture

Aviation does not treat Crew Resource Management as not a total solution for the problem of human error. There must also be also a strategy for organisations, not only individuals, to learn from errors. Aviation has created a work culture which encourages the reporting of mistakes, even those that do not lead to harm. Australia has an aviation reporting system for voluntary near-miss reports and reports of errors with insignificant levels of harm which are treated in strict confidence. De-identified summaries are circulated widely as penalty-free lessons. Reports are not accepted where there is evidence of negligence or deliberate violation. The system adds a further layer of defence against avoidable recurrence, and allows the industry to monitor itself for undesired trends and identify appropriate corrections.

In addition, the body responsible for investigating aviation incidents and accidents where harm has occurred is kept wholly separate from the body responsible for discipline. Criminally negligent behaviour will be identified and treated as such, but the primary focus of an investigation is to establish cause, not blame; to find out why an error or series of errors lead to harm; and to identify whether the system needs to be adjusted to prevent a recurrence.

Does the Aviation Experience Import Directly Into Healthcare?

The short answer is no. Even within the aviation industry, Crew Resource Management programs are not cloned between airlines. The Civil Aviation Safety Authority says this about human factors training for pilots joining an airline: ‘An operator should ensure that initial CRM training addresses the nature of the operations of the company concerned, the associated procedures, and the culture of the company’. Culture can be defined as ‘the way we do things around here’, and it varies from one organisation or industry to another.

Even within the ambit of a single healthcare practice, every patient is unique and levels of uncertainty are much higher than in aviation. Nevertheless, expert opinion at the Workshop suggested that the aviation experience can be adapted provided there is integrity in the material and credibility in the trainers. Culture varies – but human behaviour is remarkably consistent.

Has Healthcare Completely Ignored Human Factors?

A human factors approach to error is already being applied to healthcare in some areas in Australia, but present efforts are sporadic and uncoordinated. Examples include:

- The Australian Incident Monitoring System, a computerised system for monitoring, analysing, reporting, and managing problems;
- Medical simulation centres, which have been established in major centres across the country; Human factors training, such as the Human Factors in Medicine Training Program developed by Australian clinicians at ErroMed. ErroMed

material has been used to provide the human factors component of the root cause analysis training provided by the NSW Institute for Clinical Excellence, to train all NSW neurosurgeons in human factors, and by Queensland Health to develop their own training program.

“Human Factors in Healthcare - Do the Lessons from Aviation Apply?”

The consensus opinion Workshop participants, organisers, and experts from Australia and abroad was that these lessons do apply, not wholesale, nor piecemeal, but selectively and with due regard for essential differences in the working environment and culture.

A/Professor John Cartmill.

Section Four

Appendices

1. Workshop Program

Morning: plenary sessions from subject matter experts

- 08.45-09.00 *Background and introduction.* Prof Bruce Barraclough, Safety and Quality Council
- 09.00-09.30 *Lessons from aviation: the good, the bad and the ugly.* Professor James Reason, Dédale
- 09.30-10.00 *Managing threat and error in medicine.* Professor Bob Helmreich, University of Texas
- 10.00-10.30 *Australian human factors initiatives in healthcare.* Dr Ian O'Rourke, Institute for Clinical Excellence
- 11.00-11.30 *Embedding human factors in a national patient safety database.* Professor Bill Runciman, Royal Adelaide Hospital
- 11.30-11.50 *Crisis Resource Management training for health care teams using high-fidelity simulation.* Dr Brendan Flanagan, Monash Medical Centre
- 11.50-12.10 *The human factors of human factors: initiating human factors training in the healthcare setting.* Professor John Cartmill, Nepean Hospital
- 12.10-12.30 *A human factors approach works: preventing laparoscopic bile duct injury.* Dr Thomas Hugh, St Vincent's Clinic

Afternoon: Parallel Focus Groups

- 13.30-13.45 *Summary of key challenges.* Professor Bruce Barraclough, Safety and Quality Council
- 13.45-15.00 Parallel focus groups
- Workshop One. *Is teamwork telling a nurse what to do? Application of CRM training for healthcare: challenges and solutions*
- Workshop Two. *Human error or system failure? Application of just culture/open safety reporting concepts: challenges and solutions*
- Workshop Three. *How do we develop and maintain human factors standards for healthcare? Training and assessment standards for human factors in healthcare: challenges and solutions*
- Workshop Four. *Is working until you drop a badge of honour? Fatigue management in healthcare: challenges and solutions*

Workshop Five. *Doctor, you must listen? Authority gradients in healthcare teams: challenges and solutions*

Workshop Six. *Do gender differences impact upon healthcare outcomes? The influence of gender: challenges and solutions*

Afternoon: Parallel Research Papers

15.00-15.30 Parallel Papers

Triaging unsafe acts. Professor Jan Davies

Team operations: non-technical competencies in surgery. Rebecca Atkins, Peter Pfister, Alan Spigelman, Steven Smith, Mark Fleming

Breaking the sound barrier: can we engage health professionals in discussing human performance? Dr Richard Morris, ErroMed and the Sydney Medical Simulation Centre

Give 'em HEAPS! Implementation of the human error and patient safety program at Queensland Health. Dr Peter Lee, Queensland Health

Where to start: achieving a just culture in healthcare. Bernadette Woods, Stavros Prineas, Ravy Thavaravy, Graham Beaumont, John Cartmill.

15.30-17.00 *Reports from workshop chairs and closing remarks from Professor Bruce Barraclough, Safety and Quality Council*

2. Subject Matter Experts Presenting At the Workshop

The Workshop brought together a range of national and international experts on safety in medicine and other high-risk industries.

Professor James Reason, Dédale

Psychologist Professor Reason has 25 years research experience in the field of human error in such areas as commercial aviation, nuclear power generation, process plants, railways, marine operations, financial services, and healthcare institutions. His error classification and models of system breakdown are widely used, particularly by accident investigators. His recent work focuses on developing error management techniques; for example, he assisted the Great Ormond Street Hospital for Sick Children investigate the ways human and organisational factors affect the outcome of neonatal cardiothoracic surgery. He is currently looking at how people maintain the safety of complex systems by timely adjustments to unexpected and potentially threatening events. He is the author of *Human error*.

Professor Robert Helmreich, University of Texas

Psychologist Professor Bob Helmreich is director of the University of Texas Human Factors Research Project. This Project investigates issues in staff selection, training, and performance in aviation, medicine, and aerospace. Their research looks at the effects of national, organisational, and professional cultures on group dynamics in the aviation cockpit and the medical operating room. In particular, his team is actively investigating the nature and effect of human error in aviation and medicine. He is coauthor with Ashleigh Merritt of *Culture at work in aviation and medicine: national, organizational, and professional influences*.

Prof Bruce Barraclough, Australian Council for Safety and Quality in Health Care

Professor Barraclough is chair of the Australian Council for Safety and Quality in Health Care and of the Institute for Clinical Excellence and a past president of the Royal Australasian College of Surgeons.

Dr Ian O'Rourke, Institute for Clinical Excellence

Former surgeon Dr O'Rourke is the chief executive officer for the Institute of Clinical Excellence.

Ms Maureen Robinson, NSW Health

Director of Quality and Clinical Policy Branch, New South Wales Health Department.

Professor Bill Runciman, Royal Adelaide Hospital

Intensive care physician Professor Runciman is the founder and president of the Australian Patient Safety Foundation, a non-profit organisation dedicated to advancing the cause of patient safety.

Dr Brendan Flanagan, Monash Medical Centre

Anaesthetist Dr Flanagan is director of the Monash Simulation Centre.

Professor John Cartmill, Nepean Hospital

Colorectal surgeon Professor Cartmill is an associate professor of surgery at the University of Sydney and founding chair of ErroMed, which offers patient safety training programs for health professionals nationally and internationally.

Dr Thomas Hugh, St Vincent's Clinic

Heptaobiliary surgeon Dr Thomas Hugh is a clinical senior lecturer in the department of surgery at the University of Sydney.

Research paper presenters

Professor Jan Davies, University of Calgary

Ms Rebecca Atkins, University of Newcastle

Dr Richard Morris, ErroMed and the Sydney Medical Simulation Centre

Dr Peter Lee, Queensland Health

Ms Bernadette Woods, Nepean Hospital

3. Workshop Sponsors

The Australian Aviation Psychology Association



The Association, founded in 1981, aims to promote the exchange of information and the advancement of knowledge in the fields of aviation psychology and human factors in order to expand their contribution to the safety and efficiency of the aviation industry in the Asia Pacific region.

Website: www.home.vicnet.net.au/~aavpa

The Australian Council for Safety and Quality in Healthcare



The Council, established in 2000 by Australian Health Ministers, leads national efforts to improve the safety and quality of health care provision in Australia. It's roles are to:

- Develop a national strategy for improving safety and quality;
- Define national standards and influence others to act to improve safety and quality in health care;
- Define a framework for action by identifying national priorities and recommend specific actions that address the priorities;
- Form partnerships by working with health care professionals, the Commonwealth, States and Territories, professional associations, private, non-government, and consumer organisations;

- Coordinate existing activity to better achieve action in priority areas;
- Put consumers first by making sure that safety and quality measures are practical and will make a real difference;
- Encourage public understanding and increase the community's confidence in the steps being taken to improve the safety of health care;
- Promote monitoring and research to address challenges with safety and quality and how to fix them.

Website: www.safetyandquality.org.au

The Institute for Clinical Excellence



The Institute for Clinical Excellence, founded in 2001 by the NSW Minister for Health, aims to make healthcare better and safer for patients by:

- Working collaboratively on high-priority clinical projects run across multiple sites which are orientated solely on improved patient outcomes;
- Driving implementation of Clinical Practice Improvement and championing the lessons learnt across the system;
- Providing education and training to support the implementation of improvement projects;
- Supporting targeted health services research.

Among other things, the Institute develops, provides, and promotes training and education programs; identifies priorities for and promotes the conduct of research into better practices; and evaluates strategies, in collaboration with area health services and others.

Website: www.ice.nsw.gov.au

NSW Health



The NSW Health system comprises:

- The NSW Minister for Health,
- The Minister Assisting the NSW Minister for Health (Cancer),
- The NSW Department of Health,
- Public health organisations including 17 Area Health Services, the Ambulance Service of NSW, the Children's Hospital at Westmead, the Corrections Health Service, and the Institute for Clinical Excellence. These organisations plan, deliver and coordinate local health services, and are responsible for providing services such as public and community health, public hospitals, psychiatric hospitals, emergency transport, acute care, rehabilitation, counselling, and many community support programs.

Website: www.health.nsw.gov.au