Implementing
HUMAN FACTORS
in healthcare

'How to' guide

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Contents

Introduction

The purpose of this guide is to provide an introduction to the concept of human factors in healthcare and provide suggestions of how its elements can be applied by individuals and teams working to improve patient safety. It aims to build awareness of the importance of human factors in making changes to improve patient safety.

This document provides a general background and then is divided into 2 parts.

Part 1: Organisational management and human factors

This section focuses on those elements of human factors that require executive leadership, such as developing a safety culture and building organisation wide knowledge of human factors as it relates to patient safety. It may be of particular interest to executive and non executive leaders and senior managers but provides a useful overview of what constitutes a safety culture for other staff.

Part 2: Making your care and work safer

This section focuses on how staff can use knowledge of human factors to make their own daily work environment and activities safer. It is hoped it will provide a helpful starting point for any member of staff involved in direct patient care or whose work impacts on other's ability to provide safe care. It also provides a more detailed insight for executive/ non executive leaders and senior managers who would like to understand more about how human factors affect the daily work of their front line colleagues and how they may be able to support them in implementing relevant changes.

At the end of the document there is a 'Useful Resources' section which signposts you to further information about human factors and some of the tools and training discussed in this document.

Background

Human factors encompass all those factors that can influence people and their behaviour. In a work context, human factors are the environmental, organisational and job factors, and individual characteristics which influence behaviour at work.

Every day in the NHS, tens of thousands of patients are treated safely by dedicated healthcare professionals who are motivated to provide high quality and safe clinical care. For the vast majority of patients, the treatment they receive alleviates or improves their symptoms and is a positive experience. However, an unacceptable number of patients are harmed as a result of their treatment or as a consequence of their admission to hospital.

One such patient was Elaine Bromiley.

Case Study 1

Elaine Bromiley was a fit and healthy young woman who was admitted to hospital for routine sinus surgery. During the anaesthetic she experienced breathing problems and the anaesthetist was unable to insert a device to secure her airway. After 10 minutes it was a situation of 'can't intubate, can't ventilate'; a recognised anaesthetic emergency for which guidelines exist.

For a further 15 minutes, three highly experienced consultants made numerous unsuccessful attempts to secure Elaine's airway and she suffered prolonged periods with dangerously low levels of oxygen in her bloodstream. Early on nurses informed the team that they had brought emergency equipment to the room and booked a bed in intensive care but neither were utilised.

35 minutes after the start of the anaesthetic it was decided that Elaine should be allowed to wake up naturally and was transferred to the recovery unit. When she failed to wake up she was then transferred to the intensive care unit. Elaine never regained consciousness and after 13 days the decision was made to withdraw the

On the surface this could appear to be a tragic but unavoidable event resulting from an unexpected but recognised complication of anaesthesia. However, the outcome could have been quite different if human factors had been taken into account by everyone involved in the organisation. It is important to note that every member of the team treating Elaine was experienced and technically highly competent and yet the series of events and actions still resulted in her death. A detailed investigation highlighted some of these factors:

- **Loss of situational awareness** – the stress of the situation meant that the consultants involved became highly focussed on repeated attempts to insert the breathing tube. As a result of this they lost sight of the bigger picture i.e. how long these attempts had been taking. This 'tunnel vision' meant they had no sense of time passing or the severity of the situation

- **Perception and cognition** - actions were not in line with the emergency protocol. In the pressure of the moment many options were being considered but they were not necessarily the options that made the most sense in hindsight

- **Teamwork** – there was no clear leader. The consultants in the room were all providing help and support but no one person was seen to be in charge throughout. This led to a breakdown in the decision making process and communication between the three consultants

- **Culture** – Nurses who sensed the urgency early on brought the emergency kit to the room, and then alerted the intensive care unit. They stated that these were available but did not raise their concerns aloud when they were not utilised. Other nurses who were aware of what was happening did not know how to broach the subject. The hierarchy of the team made assertiveness difficult despite the severity of the situation.

The film of this case study can be viewed at:
http://www.institute.nhs.uk/safer_care/general/human_factors.html

Stress is a recognised contributor in many such incidents/errors. People behave differently in high pressure situations and at such times, sensitivity to other human factors is heightened, in particular those most likely to affect perception and cognitive functions.

In summary, some of the common human factors that can increase risk include:

- mental workload
- distractions
- the physical environment
- physical demands
- device/product design
- teamwork
- process design.

These factors are addressed in more detail at various stages in this document.

The benefits of applying human factors in healthcare

Awareness of human factors such as those above can help you to:

- understand why healthcare staff make errors and in particular, which 'systems factors' threaten patient safety
- improve the safety culture of teams and organisations
- enhance teamwork and improve communication between healthcare staff
- improve the design of healthcare systems and equipment
- identify 'what went wrong' and predict 'what could go wrong'
- appreciate how certain tools mentioned in this guide can help to lessen the likelihood of patient harm.

How errors and incidents occur

Healthcare professionals are human beings, and like all human beings are fallible. In our personal and working lives we all make mistakes in the things we do, or forget to do, but the impact of these is often non existent, minor or merely creates inconvenience. However, in healthcare there is always the underlying chance that the consequences could be catastrophic. It is this awareness that often prevents such incidents as we purposefully heighten our attention and vigilance when we encounter situations or tasks we perceive to be risky.

One human factors model that is increasingly well known in healthcare is the Swiss Cheese Model of organisational accidents (Reason 1990). The Swiss Cheese Model hypothesises that in any system there are many levels of defence. Examples of levels of defence would be checking of drugs before administration, a preoperative checklist or marking a surgical site before an operation. Each of these levels of defence has little 'holes' in it which are caused by poor design, senior management decision-making, procedures, lack of training, limited resources etc. These holes are known as 'latent conditions'.

If latent conditions become aligned over successive levels of defence they create a window of opportunity for a patient safety incident to occur. Latent conditions also increase the likelihood that healthcare professionals will make 'active errors.' That is to say, errors that occur whilst delivering patient care. When a combination of latent conditions and active errors causes all levels of defences to be breached a patient safety incident occurs. This is depicted by the arrow breaching all levels of defence in Figure 1.

Figure 1

Levels of defence

Patient safety incident

Active errors

Latent conditions: poor design, procedures, management decisions etc
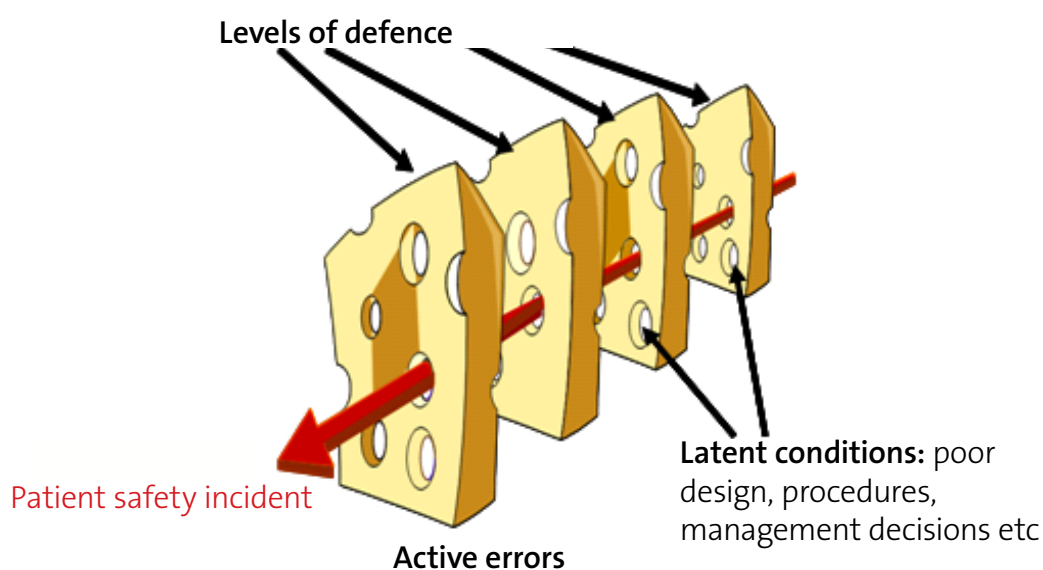
When such incidents occur it is uncommon for any single action or 'failure' to be wholly responsible. It is far more likely that a series of seemingly minor events all happen consecutively and/or concurrently so on that one day, at that one time, all the 'holes' line up and a serious event results. On investigation it becomes clear that multiple failings occurred and the outcome appears inevitable, but for those working in the system it can be shocking as they have often worked with these same environmental conditions and small errors or slips occurring regularly without harm ever occurring as a result.

It is very rare for staff in healthcare to go to work with the intention of causing harm or failing to do the right thing. Therefore we have to ask why there are many incidents where some of the latent conditions are caused by staff not doing the right thing, even when they know what the right thing is. Many processes and policies in healthcare are complex or seem to create difficulties for busy staff thus creating the temptation to take shortcuts or 'workarounds'.

Case Study 2

"Some years ago they made Temazapam a controlled drug. This meant that every time I had to give it, I had to lock up the drug trolley, wait for a colleague to come with me, both of us take the prescription cart to the drug cupboard, count the tablets in the bottle, take out the dose, fill in the book, go and check the identity of the patient and prescription again together and then give it.

On my ward we often had up to 12 patients needing Temazepam so suddenly the evening drug rounds were taking forever. The drug cupboard was right at the other end of ward. In the end we started taking the bottle out of the drug cupboard at the start of the round and putting it in our pocket. We'd then just fill out the book as we went along; we had to check all the controlled drugs later in the night anyway. We all knew we were doing it wrong but it just seemed crazy trying to do it the right way when we were so busy and the reason for changing the policy seemed to be more about it needing to be counted to prevent abuse rather than it presenting a risk to the patients."

In this example we see evidence of why staff may deliberately flout the rules.

There is a perceived benefit. Less trouble for the staff, saves time, reduces distractions while doing the round.

Assumed absent or minimal consequences. Do not consider it likely there will be negative effects for the patient or consequences for themselves. The process or rule may not appear to have value.

The greater the benefits and lower the likely consequences, the more common it is for people to 'migrate' towards working in ways that they know to be wrong or that break the rules. Over time these ways become normalised and are integrated into the culture – "This is how we do it here".

Part 1: Organisational management and human factors

Executive and non executive directors play a critical leadership role in safety and hence in promoting awareness of human factors from within the boardroom to the patient's bedside in their organisations. This section of the guide provides a short summary and examples of work relating to two key themes of human factors that require high level leadership:

1. Developing a positive safety culture
2. Embedding human factors training in healthcare

1. Developing a positive safety culture

 Much has been written about the need for healthcare organisations to create a positive safety culture (Department of Health 2000; 2001; National Patient Safety Agency 2004; Reason, 2000) and human factors research has shown that senior management commitment is core to its development (Pidgeon, 1991; Reason, 2000; Mearns et al., 2003; Flin et al., 2004; Waring, 1996).

Unlike other improvement goals, effecting and measuring cultural change can feel amorphous and challenging. Human factors research has identified what a positive safety culture looks and feels like (Dekker, 2007; Reason, 2000). In essence, when healthcare organisations and national agencies describe wanting to achieve a positive safety culture they are aiming to create organisations that are open, just and informed, in which reporting and learning from error is the norm.

Element of safety culture	Characteristics
Open culture	• Staff feel comfortable discussing patient safety incidents and raising safety issues with both colleagues and senior managers
Just culture	• Staff, patients and carers are treated fairly, with empathy and consideration when they have been involved in a patient safety incident or have raised a safety issue

Reporting culture	• Staff have confidence in the local incident reporting system and use it to notify healthcare managers of incidents that are occurring, including near misses
	
	• Barriers to incident reporting have been identified and removed:
	  - staff are not blamed and punished when they report incidents
	  - they receive constructive feedback after submitting an incident report
	  - the reporting process itself is easy

Learning culture	• The organisation:
	  - is committed to learn safety lessons
	  - communicates them to colleagues
	  - remembers them over time

Informed culture	• The organisation has learnt from past experience and has the ability to identify and mitigate future incidents because it: - learns from events that have already happened (for example, incident reports and investigations)

1.1 Open culture

For staff to feel comfortable discussing safety incidents and issues it needs to become the norm, rather than something that only happens when a serious event occurs and is a part of the investigation. There also needs to be some reassurance that the focus is on learning and prevention rather than identifying poor performance with resultant punitive action.

Actions you can take

• Structured and planned patient safety walkrounds enable healthcare leaders to communicate with frontline healthcare staff about patient safety issues and are a visible sign of a leader's commitment to improving safety. More information on implementing walkrounds can be found in 'The How to Guide for Leadership for Safety' and its supplement document 'Patient Safety Walkrounds' which are available at www.patientsafetyfirst.nhs.uk.

- Having impromptu discussions about safety with staff demonstrates that safety is at the forefront of your minds and prevents safety being compartmentalised into specific meetings or the remit of other managers such as those concerned with governance and risk

- Use of a safety culture measurement tool, focus groups and interviews can help to identify how staff feel about raising and discussing patient safety issues. Such tools will also enable you to identify staff perceptions of whether or not your organisational culture is fair and just i.e. whether staff involved in an incident feel that they are blamed or are supported. There are several safety culture tools available which have been adapted and used in healthcare organisations; a list of these can be found in the 'Useful links' section at the end of this guide.

Remember that the annual staff survey carried out by the Healthcare Commission includes a section on 'Errors, Near Misses and Incidents'. It also contains questions relating to communication between senior managers and staff and on attitudes towards whistle blowing. This can provide information relevant to appraising your local safety culture and also enable you to compare your organisation's results with other similar Trusts.

1.2 Just culture

Cultural change starts with you as an individual and how you behave influences the behaviour of staff working in your organisation. What is your immediate response when something goes wrong? Do you focus on finding out who is responsible? Finding someone to blame can be seen as a simple way to solve the problem as you can take action against the individual(s) concerned and feel satisfied that you have dealt with the situation. Looking beyond the individual to seek out the latent conditions described earlier and how the system failed is a more involved process but is vital if the organisation is to learn from incidents, be seen to treat staff fairly and encourage reporting.

Case Study 3

A nurse was in charge of the night shift on a 29 bed, speciality surgical ward. The shift was incredibly busy due to the acute status of 4 patients and the high nursing care needs of 6 others. An agency nurse who was unfamiliar with the ward and speciality was on duty with her. At 05.00 hours a heparin infusion needed replacing. The nurse was tired, stressed and felt rushed to draw up the infusion so she could return to the sicker patients with whose condition she was quite preoccupied.

She quickly made the calculation and started to draw up the drug. Before she had

completed this she had to attend to a patient so quickly finished drawing it up. As she left the desk, her colleague asked, "Can I set this up?" to which she replied "No, I need to check it again". It was 45 minutes before she got back to the desk where she found it missing and was told that it was being administered to the patient. When she asked if the administering nurse had checked it the answer was, "No, you've already done it". The nurse quickly reperformed the calculation and discovered the dose was incorrect. The error was corrected and no harm came to the patient.

When the Ward Sister arrived at 07.15 hours, the nurse discussed what had happened with her, what had gone wrong and the lessons learned. The nurse was upset and tearful. Once the nurse had left the ward she realised she had not completed an incident form. When she returned for a shift two days later she completed the form. The following day she received a call at home to say the senior nurse wanted to take the matter further, there would be an investigation and she was suspended from drug administration until a formal disciplinary hearing had taken place.

She describes the next six weeks as the worst of her career. She felt humiliated having to constantly explain to colleagues why she could not have any involvement with drug administration as well as guilty for the impact on not only her own colleagues who had to do her medication rounds for her, but on nurses on the neighbouring ward and site practitioners who at times had to help administer intravenous drugs for many patients, multiple times per shift. She was fearful of what the outcome of the disciplinary would be and resentful that the action being taken against her seemed harsh and served little purpose – she had had already learned from her mistake.

At the hearing she was reprimanded for failing to follow protocol by not immediately completing an incident form and, whilst being the nurse in charge of the shift, failing to better supervise the colleague who had administered the drug.

She was given an oral warning to be kept on record for six months and required to be reassessed on drug administration.

Afterwards, colleagues told her she was stupid for having reported the incident as no harm had come to the patient. One colleague told her: "If this is what happens then I'll be keeping my mouth shut if that happens to me". Five weeks later, the nurse resigned.

As in both the previous examples the nurse describing this incident was technically competent and well respected by her colleagues. These examples demonstrate an important consideration: that there is potential for patients to be harmed despite high levels of competence. As Professor James Reason, a world human factors expert has stated, "The best people sometimes make the worst mistakes." Therefore disciplinary actions and further training are not always the optimal solutions, even though they are often the most commonly applied.

Many other latent conditions need to be taken into consideration. If we consider the earlier example in Case Study 2 where ward staff were not checking Temazepam according to the protocol, training would not have fixed the problem – staff knew the right way, they were choosing not to do it. Disciplinary action may then be considered an effective action on this nurse in getting her, and possibly some colleagues to do it the right way, but will not address the problem of why it was being done the wrong way. The practice described was happening in many other ward areas at the time, just as many unsafe or 'illegal' practices extend beyond one area. Fear of disciplinary action could result in staff becoming more secretive about what they are doing or finding another workaround that has less likelihood of discovery.

Whilst formal proceedings may be necessary the emotional impact of errors on the staff involved should not be underestimated. Case Study 3 took place 11 years ago but the nurse describing the event still admitted to being upset when she recalled the incident and subsequent process – even though the patient did not experience harm. In the case of her organisation it is unknown how far reaching the effects were or for how long they would be felt in terms of creating a culture of fear and perceived blame that would prevent other staff being open and honest about errors.

One of the important aspects of a just culture is balancing the recognition of latent conditions and impact of punitive measures with being fair. Therefore when dealing with incidents where staff competence or behaviour is not of a required standard, staff need to see appropriate action is taken. If they do not, it can be a seen as a 'green light' for others to behave the same way and deter others from reporting incidents or raising concerns feeling such action is pointless. Therefore, it is not necessarily about creating a 'no blame' culture, rather a 'fair blame' culture.

Actions you can take

- Various tools and guidance have been published to ensure that the response following an incident is just. Some useful tools and training which can be used as interventions can be found in the 'Useful links' section at the end of this guide

- There is a natural human tendency to look at the final cause in isolation of other contributing factors and to blame the last healthcare professional who treated the patient. Consider the focus and balance of the discussion in light of this tendency

- Surveying patients and staff involved in patient safety incidents to identify their

perceptions of the response following the incident can be helpful. Some of the safety culture tools mentioned earlier will provide you with an indication of whether or not staff feel that your culture is just

- As a healthcare team, discuss a patient safety incident/investigation in a clinical meeting. Allocate one consultant or senior nurse the role of listening to the discussion and identifying positive and negative indicators of a just culture. For example, discussion focused on whether the systems are in place so good staff cannot make catastrophic errors is a positive indicator. Discussion focused on individual blame, where no attempt is made to understand the systems factors or circumstances surrounding the incident, is a negative indicator. Consider the focus of the discussion the team is having. Is it focused mainly on the final healthcare professional who treated the patient and the error(s) that they made? Ask 'the listener' to feedback their perceptions at the end of the discussion and self-reflect as a team on what needs to change the next time an incident is discussed.

1.3 Reporting culture

When the organisational and team culture is open and just, healthcare staff are more likely to report incidents via local incident reporting systems. In Case Study 3 the nurse's colleagues questioned why she had reported the incident. This is indicative of a poor reporting culture. It is essential for healthcare leaders to instil a positive attitude towards incident reporting amongst all staff groups.

Actions you can take

- Take a baseline measure of the number of reports submitted to your local incident reporting system at a specific time (quarterly or annually). Include a breakdown of the type and severity of incidents reported and also measure the profile of departments and staff groups reporting (i.e. what percentage of reports are submitted by doctors, nurses, allied healthcare professionals etc..)?
  - Compare these incident reporting rates and practices in your organisation to those of other similar organisations (using the NPSA's extranet data and feedback reports) to identify whether you are a high reporting organisation. If not, ask yourself why this is the case and what could improve rates of reporting in your Trust
  - If you are not amongst the top five reporting organisations, set a one year goal to increase the overall number of incidents reported to your local incident reporting system and the frequency with which reports are submitted to the Reporting and Learning System
  - As a longer term goal (e.g. five years) strive for a high proportional incident reporting rate by all professional/staff groups and aim for the number of incidents resulting in severe harm and death to reduce over time as lessons learnt are fed back, embedded and sustained

- Ask the following questions:
  - **Do we have a high proportion of near misses reported?** If your reporting profile does not comprise 70% near misses/no harm events there is a need to raise awareness of the importance of reporting near misses; they are free safety lessons!
  - **Do some departments and/or staff groups report more than others? If so, why?** Multi-professional reporting across all departments is a key indicator of a robust reporting culture. Low reporting rates amongst doctors are a feature of most local incident reporting systems. Demonstrable improvements in reporting rates amongst doctors have been shown with the introduction of electronic reporting, using email reminders, carrying out thematic analysis of incidents, working with consultants to develop a specific list of incidents that should be reported and accompanying doctors on ward rounds (Welsh et al., 1996; Evans et al., 2007; King et al., 2006)
- Ensure that staff understand that reporting is welcomed and encouraged. Look at ways in which you can make sure this message is conveyed at all levels of the organisation.

The NHS Confederation and NPSA's 'Act on reporting' (June 2008) provides some useful case studies from other Trusts.

1.4 Learning culture

Actions you can take

- In a mortality and morbidity, local clinical governance or Board meeting, review the recommendations from an incident investigation carried out in your department over twelve months ago. Discuss with your colleagues whether the recommendations were implemented and have been sustained over time. Check whether new colleagues and junior staff who have joined your team after the investigation had been completed are aware of the incident and understand why the recommendations made in the report are important.
  - Repeat this self-reflection task on a bi-monthly basis – it can help avoid organisational amnesia of previous lessons learnt
  - Challenge and confirm what data is available to the board to evidence that recommendations have been implemented and sustained over time. Remember that you are looking for evidence that recommendations are being monitored and sustained – verbal assurances are insufficient
- Consider how you integrate improvement actions and review in the daily work of the organisation to ensure that better results are sustained, and spread throughout the organisation.

1.5 Informed culture

In other high technology industries, carrying out prospective risk assessments to identify risks before they materialise, is embedded in everyday practice. For example, the nuclear power and chemical process industries risk assess new plants and hardware early in the design stage. This enables them to re-design high risk processes and to ensure that adequate risk controls and barriers are in place.

In healthcare, prospective risk assessment tools, such as Human Failure Modes and Effects Analysis, can carefully examine clinical processes to identify factors that could contribute to patient harm. These tools are important because they enable healthcare staff to identify what could go wrong before patients are harmed. This leads to early identification of potential patient safety risks and therefore allows clinical processes to be re-designed and controls and barriers to be put in place.

Actions you can take

- Calculate how many patient safety risk assessments have been carried out in a specific department or by a specific healthcare team over the last year (if any)?

- Plan to increase the number of high quality patient safety risk assessments that are carried out in your organisation over the next six months

- Aim to ensure reporting of patient safety risks to senior management occurs on a quarterly basis. Include tracking progress against proposed actions to reduce risks*

- Feedback to staff who complete risk assessments, so that they can see that their efforts are resulting in patient safety improvements.

Experienced healthcare professionals acquire a degree of 'error wisdom' or foresight which enables them to become effective error catchers. Patient safety can therefore be improved by training in this skill.

- Consider utilising the Foresight Training Resource Pack (developed by National Patient Safety Agency). It aims to:
    - improve awareness in nursing and midwifery of the factors that combine to increase the likelihood of patient safety incidents
    - increase local learning through sharing experiences
    - improve understanding of 'risk prone situations'
    - improve understanding of situations that could be considered as a 'near miss'.

  If you increase the number of risk assessments performed without having a subsequent process for reporting upwards and tracking progress on actions, changes may not be made in a timely manner and staff may feel there is an increased administrative burden that adds little or no value.

2. Embedding human factors training in healthcare

Healthcare teams are usually trained in technical aspects of their job but typically receive no human factors training. Hence, the lack of attention to training in non-technical skills and raising awareness of common error traps explains why the research literature and major incident reports are replete with examples of leadership, situational awareness, communication, coordination and teamwork failures. In Oxford, a detailed before and after training study has shown that staff exposed to teamwork training based on aviation Crew Resource Management (CRM) made 30-50% less technical errors after training (McCulloch et al., 2009). The effect was variable, but it is likely that changing team culture in the operating theatre will reduce harm to patients. The MedTeams project in the USA (Morey, Simon et al., 2002), reduced errors and improved performance in Accident & Emergency and emergency medicine departments and is probably the largest and best example of how developing teamwork can make a difference.

Actions you can take

- Review corporate induction and statutory and mandatory training to see where human factors training is addressed. If it is not then this could be a separate session included as part of induction or incorporated into a relevant session such as risk and incident reporting

- Work with directors of quality and safety/clinical governance to ensure that existing risk management training includes a core focus on human factors

- Monitor the delivery of human factors training over time. A simple measure such as the % of staff who received human factors training in the last year can help you monitor your progress in increasing this number over time.

A list of examples of training already available or in development can be found in Appendix 1.

Other points for consideration

Efficiency v safety. When we look at processes with the aim of improving efficiency we first look to find the steps that are considered to be 'wasteful' in terms of value or duplication of effort (rework). This is an important element of making processes safer as it is well acknowledged that the greater the number of steps in a process, the greater the likelihood of it failing. Safer systems tend to contain 'redundancy' steps (steps which may pick up an error or slip after it has happened but before it reaches the patient, therefore acting as a buffer). The cautionary note is that we should take care not remove a step that acts as an important redundancy having mistakenly seen it as duplication.

If you want to know whether or not to remove or add such a step, work on the principle that of all the patients/staff using this step only about 5% should be experiencing the error it was designed to catch. If the number is higher, the earlier process steps are poor and need to be reviewed; if it's lower, the step is not that useful and you can remove it.

Part 2: Making your care and work safer

Staff do not want to hurt patients, yet often end up doing so. Expertise, competence and hard work do not always safeguard against errors and omissions that result in harm. There are times when we can clearly see how a particular action results in an incident or near miss but often our actions merely breach layers of defence, creating unseen conditions of increased risk. This section offers some questions and suggestions relating to each of the common elements of human factors which can help you to look again at your workplace and the things you do with a fresh perspective – one which focuses on 'error proofing'. We hope that this will help you to make your practice, and that of your colleagues, safer.

The first step is to accept that we all make mistakes or forget things regardless of our experience, technical ability or seniority. It may be as simple as forgetting to take a patient's X-ray when you take them to theatre and have to go back for it, or catastrophic, such as picking up the wrong syringe and giving a fatal drug dose. Every one of us is human and that means we are never 100% perfect, 100% of the time.

The list below outlines the main areas covered in this section. There is a greater emphasis here on the human factors at play in team dynamics as it so often identified as a contributing factor in many patient safety incidents.

1. Cognition and mental workload
2. Distractions
3. The physical environment
4. Physical demands
5. Sevice/product design
6. Teamwork
7. Process design

In 2008 the NPSA produced a series of booklets called 'Design for patient safety' which show, in more detail, how a number of human factors can create greater risk errors. The series is focused on medication safety but the principles are applicable to all. You can find the series at http://www.npsa.nhs.uk/nrls/medication-zone/design-for-patient-safety-medication-topics/.

1. Cognition and mental workload
Stress
Remember – we bring our whole selves to work. Other life pressures can be intermittently forgotten if we are busy but ultimately they are still with you as you work. Stress may be a result of these personal factors or due to the high pressure exerted by our workload or an emergency situation but can result in a lack of focus or concentration, or becoming overly focused on details at the expense of the wider context.

- **Be self aware.** If you're feeling stressed and having trouble concentrating consider yourself at a greater risk of making a mistake. Focus first on the tasks in your day that are high risk or where it is particularly important that you get it right - where and when might you get help from someone else to check your work? Can you make extra time to double check yourself? If you find yourself constantly having to do this, think about what is causing the stress, and consider how it might be addressed; for example, by raising issues of staffing or work demands with colleagues or managers

- Do a similar thing when you are busy or rushing. Take a few seconds 'time out' before administering a drug or after making an important decision to ask yourself or a colleague "Let me just check I've got this right". It sounds simple but we frequently fail to do it thinking that the few seconds it will take will slow us down further – it won't

- **Think about what happens in emergency situations.** Do you quickly allocate a clear leader? Is someone keeping track of time, drugs and doses used etc? Are you clear about the recommended algorithms for likely emergencies in your area? Familiarise yourself with likely scenarios, check and if necessary delegate team roles the next times there is an emergency, suggest a proper debrief after an emergency situation so the team can discuss what happened

- **Consider simulation**. A few hospitals have highly technical simulation training facilities but this is not accessible to everyone. Simulation is highly effective in creating learned responses to situations where the pressure may affect a person's ability to think as clearly as normal. Consider if there is a way of running a simulation with your team as part of away day or other training opportunity

- **Where appropriate, train as a team**. This can improve the communication when the situations happen for real. It can also demystify the roles of others as all members of the team are following the same process and each one's contribution is clear to see.

Complex calculations
Having to calculate dosages of drugs, equipment settings etc introduces the risk of error.

- If you have to do this a lot find out if there is a precalculated list available that you can keep in your area. If there isn't, ask for one to be made available in your clinical area and double check all the content is correct before the whole team begin to use it

- Before you start the task, think about ways of managing or avoiding distractions. For example, ask a colleague to take your bleep for a minute, pick a quieter time to do it or agree with colleagues a place in your clinical area which is set aside for carrying out tasks which is free of distractions

- Look at the dose strengths of ampoules in your drug cupboard. Do you keep larger or high strength ampoules when the most common doses do not require these? If you do, consider removing them from your permanent stock and access them from pharmacy on an as required basis or keep them in a separate place clearly labelled as 'Caution: High Strength'

- Is it possible to get prefilled syringes for drugs that are seen as high risk?

- When asking someone to check drugs or a calculation for you, ask them to check it themselves first rather than reading out the details or talking them through your workings out. It is not uncommon for people to see what they are expecting to see instead of what is actually there and the risk of this is increased if someone is telling you what it should say.

Reliance on vigilance and memory

The human brain can only have 7 or 8 things at its forefront at any one time, despite many of us feeling that we often prove otherwise! Asking staff to be more vigilant is a weak improvement approach to providing safer care.

- When you have a large number of tasks or things to remember making lists can be a helpful prompt or a reassuring check that you have done everything you needed to. Asking others to remind you or applying post it notes in relevant places can be helpful prompts but are not necessarily reliable methods!

- Checklists or visible permanent reminders that are incorporated into routines are more helpful. For example, one busy surgical ward did not rely on the checks nurses made for their patients before theatre; they put a large whiteboard up with columns for all the things that needed to be complete in order for a patient to be considered ready for theatre – e.g. relevant test results, patient prepared, bed changed, pre op checklist completed. As each one was completed they were ticked off. This kind of visual information was useful for the nurse in charge, a prompt for the responsible nurse and helpful for any other nurse who needed to take over or escort the patient.

Seeing what you expect to see

One common error trap is that humans interpret information from the environment in terms of their expectations. That is to say, human beings have a tendency to see what they expect to see. In human factors study this is known as 'involuntary automaticity'.

Case Study 4

Mr Jameson was a patient on an acute ward in a prison. In a prison environment there is increased pressure to dispense drugs quickly on a ward round because of the possibility of drug misuse. One of his prescription charts was written by a doctor with poor handwriting, who did not usually treat him. The prescription chart was faxed to a pharmacist, Mr Cryer, who was busy because it was the Friday before a bank holiday weekend. Mr Cryer dispensed hydralazine (for hypertension) instead of hydroxyzine (for itching). The medicine was sent to the ward in a bottle labelled with the patient's name.

Mr Jameson was given the wrong drug three times a day for five days before the error was recognised by another pharmacist, who was checking prescription charts on the ward. All the staff treating Mr Jameson had given him the drug over the five days but no-one had noticed that it was the wrong drug. Fortunately, Mr Jameson did not have any side effects.

In this case the healthcare staff involved in administering the drug to the patient had an expectation that the correct drug had been dispensed. Therefore during the routine checks that they carried out before administering the drug to the patient, staff saw what they expected to see. Furthermore because checks had been carried out by other staff members beforehand, it reinforced their perception that the medicine bottle contained the correct drug.

2. Distractions

Peripheral noise levels or interruptions at points where concentration is required

Distractions are accepted as inevitable in busy health environments. There are situations however where this can and should be minimised.

- Think about the tasks you do that require your focus and concentration and/or things that if they were done incorrectly could result in harm to a patient (examples could be giving a blood transfusion, drug prescribing and administration, giving treatment advice to a patient, performing a procedure on a patient). Ask yourself "How can I ensure this gets my full attention?"

- As part of the Releasing Time to Care (Productive Ward) Programme, one ward identified that a nurse doing a drug round could get interrupted up to 30 times. They created a tabard that the nurse doing the round would wear saying "Do not Disturb". This meant that the drug rounds finished quicker and were less likely to lead to errors as a result of loss of concentration. Similarly, in some community pharmacies, the pharmacist stands on a coloured mat when carrying out the final dispensing check. This signals to other staff in the dispensary that the pharmacist should not be interrupted whilst the check is being carried out. How could you apply these principles to the tasks you have thought of?

3. The physical environment

Poor lighting

Look at the lighting in the areas where you need to perform detailed or complex tasks such as a drug cupboard or at the bedside during night duty. If the lighting is poor, packets or instructions could be misread.

Clutter

Sometimes we feel this is an unfortunate fact of our working environment as insufficient storage space is a common complaint. However, it needs to be addressed in some way as aside from the issues of cleanliness, it can impact on patient care in cases that require urgent action.

Overstocking is a common culprit. Cupboards, trolleys and surfaces are frequently overloaded. This can be due to a desire to have to restock less often or a worry that your supply will run out. Make the routine to only replenish trolleys with an amount that is

likely to be used in a 24 hour period. If you are only ever likely to use 3 of a particular size tube in a day, there is no need to keep 9 in the trolley. Overstocking can lead to people taking the wrong item if overfilled cartons spill into each other. It can also give the illusion that the trolley will contain everything you need, until you need an item quickly and find it isn't there.

- Clear out all receptacles for 'stuff'. Be ruthless – discuss with colleagues if necessary but try to only keep what you need in the store room and a day's worth of supply on smaller trolleys in the work areas

- Once you have cleared out, make a checklist of what items and how many should be in each area. The person stocking up can then do this more quickly especially if the item containers or drawers are clearly labelled

- Where checklists are used remember to update them if things change. Make a rule that it is the responsibility of whoever changes the content requirements to update the checklist accordingly. It is also a good idea to check intermittently that they are used effectively. Are they being ignored? If so, why? If it's used to perform a routine safety check, are staff just 'ticking the boxes'? How many of you have ever checked an emergency trolley and found items missing or out of date only to find the corresponding box on the form has been neatly ticked and signed on many previous days?

- Labelling is helpful. Not only is it quicker and easier for staff to find what they need on a daily basis, it is helpful for those unfamiliar with the area. It is of particular value in emergency situations where things need to be found in a hurry.

Storage
There are other ways in which good practice in storage can help minimise the occurrence of human factors, for example, where packets or items that could be mistaken for others.

- Look at the products you use and have stored. Look in particular for the following:
  - Look-alike packaging. (common with branding of drugs)
  - Look-alike/sound-alike names (Dopamine/Dobutamine, Ephidrine/Epinephrine)

In these situations it is easy to take the wrong packet or ampoule by mistake or return an ampoule or blister pack into the wrong packet. The latter creates a breach in a defence and increases the risk that the next person will see what they what they expect to see when they take the drug out to check it.

Some pharmaceutical companies and pharmacies now make efforts to make packets, drug names and strengths more distinctive. An example of this is 'Tall Man lettering'

Dobutamine	**DoBUT**amine
Dopamine	**DOP**amine
Vinblastine	Vin**BLAS**tine
Vincristine	Vin**CRIS**tine

If you label your own shelves or receptacles, consider using this technique. Your pharmacy department will be able to help you identify which drugs this is appropriate for and the correct lettering. Colour coding is also useful in helping to distinguish between similar drugs or items.

- Think about the order in which items are stored. A-Z can often aid in finding something quickly but on occasions it may lead to picking up the wrong thing inadvertently if shelves are crowded or something is put in the incorrect place. What is best for your area? Is A-Z order or other method, such as grouping by drug action most appropriate?

4. Physical demands

Physical tiredness

Refer to the comments in the section on stress regarding being aware of what it means for you to be tired and how that could impact on your cognitive abilities. Dawson and Reid (1997) found that loss of 2 hours sleep could have a negative effect on performance equivalent to drinking two or three beers.

Demands exceeding capability

Most people at some time or another overestimate their abilities or underestimate their limitations. This may be in terms of technical skill, physical capability or ability to manage a particular workload or number of tasks. Consider someone who exceeds the speed limit when driving – it may be due to a perception that they are a more skilled or experienced driver and therefore able to do this safely or due to pressure (needing to be somewhere urgently). Either way we know this is not a safe practice. There is no shame listening to the opinions of others on their perception of your capability. Regularly seek out constructive feedback – encourage others to speak out if they feel something might not be right.

5. Device/product design

Healthcare equipment is often not designed with human cognitive limitations in mind. Design creates error traps and is a frequent cause of patient safety incidents. Furthermore, when a healthcare organisation uses a large number of different medical devices there is an increased risk that staff will make errors resulting from applying their understanding of how one device functions to another device. So minimising the variability and number of different medical devices available and ensuring staff are trained in their use is important.

Refer back to the earlier points on drug package design. Consider how the design of packets and labels in your area may contribute to the risk of mistakes occurring.

6. Teamwork

For the most part staff working in healthcare go about their work in a competent, conscientious manner. However, as we have seen from previous case studies here (particularly Case Study 1) how the human factors involved in how teams function and communicate can lead to patient safety incidents. Multiple patient handovers, hierarchy, cultures that discourage challenge and stress responses can all contribute to poor outcomes. Furthermore, where team members do not feel that they can speak up and be listened to if a situation is unsafe there is an increased risk of patient harm.

There is a growing recognition in healthcare that training and tools which address cultural barriers and non technical skills can have a positive effect on working environments' patient safety.

Briefing and debriefing

Briefing and debriefing can help teams develop a shared mental model of a planned procedure or a patient's clinical status and to review individual and team performance. This enhances the development of shared goals and agreed expectations of what should happen. It also enables staff to understand the competences of the colleagues they will be working with and to plan for threats or emergencies before they occur. Some hospitals have introduced routine briefing and debriefing sessions at the start and end of shifts that take only a few minutes each and have found it helpful in identifying risks and raising awareness.

The list below outlines the steps involved in a good briefing and debriefing .

Briefing

- Introduce names and roles
- Define objective
- Identify major steps
- Check critical treatment and equipment
- Ask "What if?"
- Check understanding by read back
- Preview the debrief (i.e. discuss what you will talk about in the debrief).

Debriefing

- "How did we do?"
- "How did we feel?"
- "What went well?"
- "What went not so well?"
- "What should we do next time?"

- "How did we do?"
- Team leader sums up at the end of the debrief to reiterate what has been discussed and check there is a shared understanding in the team.

The World Health Organisation's (WHO) Surgical Safety Checklist

In January 2009 the NPSA issued an alert which made use of the Surgical Safety Checklist, a requirement for surgical procedures by March 2010. The Checklist contains three sections: Sign In, Time Out and Sign Out, and aims to improve teamwork and communication in operating theatres. As with briefing and debriefing, if used appropriately it can open up the lines of communication and create an environment where any member of staff feels able to speak out if they are unsure that certain important steps have been missed or are concerned an error may be imminent. It is particularly effective when used in conjunction with pre list briefings and post list debriefing.

For more information on implementing the Checklist see 'The How to Guide for Reducing Harm in Perioperative Care' available at www.patientsafetyfirst.nhs.uk.

SBAR (Situation, Background, Assessment, Recommendation)

Communication tools such as SBAR can greatly improve team communication by making conversations more succinct with greater clarity of information and expectations of actions required. They have been found particularly helpful in communications where staff are expressing concerns about deterioration in patient condition but can be used to structure any conversations (clinical and non clinical, verbal or written) to ensure adequate, useful communications are given and expectations of action are clear.

For more information on implementing SBAR see 'The How to Guide for Reducing Harm from Deterioration' available at www.patientsafetyfirst.nhs.uk.

What can you do to improve teamwork?

Do you have situations where you find it difficult to challenge colleagues when you see actions or omissions that increase risks of errors occurring? If so consider if the use of briefing and debriefing or a communication tool such as SBAR could be useful in your area. Even if you work in a non clinical environment such practices can be highly effective in improving communication so everyone is clear on what the potential risks and priorities are for that day and know exactly what they are expected to do. You can also anticipate potential problems and plan for them – always having a 'Plan B' can reduce stress and improve responsiveness when problems actually occur.

7. Process design

Where healthcare processes are designed so that they involve complex task sequences there is an increased risk that safety critical steps will be omitted. As stated earlier, human memory is resource limited and we can only remember a finite amount of information at a time. Therefore it is important to ensure that clinical processes are simplified to reduce the potentially negative impact of memory limitations on human performance.

- Think about mistakes you have made, situations where important information hasn't got through or times when important steps have been missed. Write down all the steps involved in what should have happened. Then think about why this has happened using the 'five whys?' This means just keep asking 'why?' until you get to the root cause of what happened. Once you have done this you can identify the step(s) that failed and think about how this could be prevented in the future. This might mean simplifying the process if it is complex, or putting in a checking step if things were forgotten and no checking step is currently in place. Great care needs to be taken when considering adding checking steps. Whilst they can be valuable it should be remembered that the more steps a process has the more likely it is that the process will fail. In addition, a process with too many checking steps can encourage over-confidence and complacency that the person upstream will have already carried out the check, so may get omitted or completed without adequate attention. If you are unsure how to go about making changes to a process contact your change/service improvement team who can help you. If your organisation does not have one there are a variety of improvement tools available on the NHS Institute for Innovation and Improvement website at www.nodelaysachiever.nhs.uk.

Many of the suggestions covered in this section may seem obvious but they often do not happen in everyday practice and there are many reasons why this may be the case. We may feel that acceptance of our fallibility is suggestive of failure - an inability to cope with demands we perceive as manageable for others. This feeling can be exacerbated when we work alongside (and are impressed by) colleagues who seem to cope with large workloads and multiple concurrent tasks that we ourselves would find a strain. We may also feel that we do not have the time or authority to make the necessary changes that support a new way of doing things.

Improving patient safety ultimately requires a collaboration between staff at all levels. Many changes are well within the gift of a committed team of staff and where they are not, the role of an organisation's leaders in empowering and supporting them is crucial.

Paying attention to all the things we personally forget or almost get wrong can give us an insight into potential causes of harm to our patients. Being willing to share these experiences with colleagues can then help to create an environment that is more open about errors and begin to break down the myth that making mistakes or having near misses is negative reflection on competence rather than normal human fallibility. When we change our culture in this way we can review our work behaviour and practice more honestly and improve the safety of the care we provide for our patients.

Useful Links

Open culture

- Incident decision tree. http://www.npsa.nhs.uk/nrls/improvingpatientsafety/patient-safety-tools-and-guidance/incidentdecisiontree/

- 'Being open' e-learning toolkit and training workshops. http://www.npsa.nhs.uk/nrls/improvingpatientsafety/patient-safety-tools-and-guidance/beingopen/

- When things go wrong. http://www.ihi.org/NR/rdonlyres/A4CE6C77-F65C-4F34-B323-20AA4E41DC79/0/RespondingAdverseEvents.pdf

- Sorry works. http://sorryworks.net/

- NHS Annual Patient Survey

- The North Carolina Hospitals Association Just Culture Community initiative has produced a training video of the journey they have taken to develop a just culture in their hospitals. There is also a just culture benchmarking tool available which enables organisations to self-assess their organisational culture. Both available at: www.justculture.org.

Just Culture

- The Manchester Patient Safety Framework (Kirk, Parker et al., 2007). Available at: www.npsa.nhs.uk/nrls/improvingpatientsafety/humanfactors/mapsaf/. MaPSaF is available in versions for acute, mental health, primary care and ambulance trusts. There is also a version available for community pharmacy

- The Safety Attitudes Questionnaire (Sexton, Thomas and Helmreich, 2000). Available at www.uth.tmc.edu/schools/med/imed/patient_safety/survey&tools.htm (registration required)

- Operating Room Management Attitudes Questionnaire (Flin, Yule et al., 2006)

- Hospital Survey on Patient Safety Culture (Sorra and Nieva, 2004). Available at: http://www.ahrq.gov/qual/patientsafetyculture/hospsurvindex.htm

- Working with care: improving working relationships in health care. Self assessment tools for healthcare teams. (2005) Royal College of Nursing Publication code 002 487 available via www.rcn.org.uk/direct or tel 0845 772 6100

- Safety Climate RCN Safety Climate Assessment Tool for more information contact linda.watterson@rcn.org.uk

Safety at the sharp end: a guide to non-technical skills. Rhona H. Flin, Paul O'Connor, Margaret Crichton (2008)
The IHI recorded a session introducing the concept of human factors which can be found here: http://www.ihi.org/IHI/Programs/IHIOpenSchool/OnCallHumanFactorsYourBrainonAutopilot.htm

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Appendix 1: Types of training available in human factors/non technical skills

Crew/Team Resource Management Training
Crew Resource Management Training focuses on training healthcare staff with key non technical skills required to perform safely. Originally developed in the aviation industry, CRM training is now increasingly being tailored and delivered in healthcare organisations. For example, it is a key element of the Productive Operating Theatre project and the human factors surgical curriculum proposed by the Royal College of Surgeons.

The Productive Operating Theatre (NHS Institute for Innovation and Improvement)
The focus is on teamwork and leadership. As part of the pilot, they are carrying out observations of operating theatre teams and will deliver a human factors training intervention to improve non-technical skills and awareness of human factors amongst theatre team staff. The product is expected to become available by the summer of 2009. Further information is available at: www.institute.nhs.uk/quality_and_value/productivity_series/the_productive_operating_theatre.html

The Royal College of Surgeons human factors training curriculum
The Royal College of Surgeons of England has designed a human factors training curriculum (Hirst, Dale and Giddings, 2008). The curriculum was developed following a project entitled, 'Defining Surgical Safety and Human Factors Training in the Intercollegiate Surgical Curriculum Project (ISCP). The curriculum comprises modules on (i) teamwork and communication (ii) leadership, (iii) situational awareness, (iv) decision making, (v) briefing and debriefing and (vi) returning to work. Further information on the RCS curriculum is available at: http://www.rcseng.ac.uk/education/courses/safety_and_leadership_intervention.html and http://www.rcseng.ac.uk/rcseng/content/publications/docs/leadership_management.html.

The Royal College of General Practitioners E-learning for Health modules
The Royal College of General Practitioners has been working on a Department of Health led project in collaboration with an organisation called E-learning for Health. The aim of this project is to develop a series of twenty minute e-learning modules on key patient safety themes. These primary care focused modules include (amongst others):

· Introduction to patient safety

· Human factors and patient safety

· Creating an open, fair and informed culture

· Error wisdom and patient safety

· Incident reporting

· Human factors in practice.

The Royal College of Nursing

The RCN currently has a module on Patient Safety as part of its Learning Zone resource for members. This gives an overview of patient safety themes including the crucial area of 'human factors'. The RCN is also in the process of publishing a public facing online resource about patient safety on its website that will highlight RCN programmes of work, relevant reports and strategies from the four countries and internationally. It will also include 'tasters' of what is in this member only area on the public site.

Making the safety of patients everyone's highest priority