Implementing Human factors in healthcare
‘Taking further steps’

Case studies & Implementation tips
Introduction

About this document

This document contains extracts from the ‘How to’ guide to implementing human factors in healthcare, Volume 2 - ‘Taking further steps’

You can download the full ‘How to’ guide at www.chfg.org.

The Clinical Human Factors Group

In the last five years, the Clinical Human Factors Group (CHFG), amongst others, has raised awareness of the importance of applying human factors to the design of healthcare systems. The Clinical Human Factors Group is a broad coalition of healthcare professionals, managers and service users who have partnered with experts in human factors from healthcare and other high-risk industries to campaign for a healthcare system that places an understanding of human factors at the heart of improving clinical, managerial and organisational practice. You can find further information on the work of the CHFG at www.chfg.org.

Implementation tip

Are you faced with clinical or management colleagues who are sceptical about the importance of human factors in healthcare or who do not understand how human factors impacts on their performance?

Consider photocopying Dr Petropolous’s letter on the following page and share it with your colleagues You could also write your own letter that relates to your role and use it to explain the importance of human factors to your work colleagues.
A letter to oneself by Dr Petropolous, a clinical director

Dear Self

1. Mind Body and Soul

It is important to remember that in order to look after a team and/or a service you need to be in good nick yourself and feel that your personal life is as in control as it can be. If your home life is in chaos, this will spill over into your professional life. With this in mind, I would recommend the following to try and maintain a work life balance:

• Put aside some protected time every week for yourself whatever it is you are into, be it fly fishing or zumba dancing
• Prioritise time with your family…and make sure that your childcare arrangements are as robust as they can be
• Think about who you will turn to for emotional and practical advice. Coaching and mentoring? People in the same role in another organisation? One size does not fit all.

2. As long as you put the patient at the centre of everything you do, you will succeed

How can you implement positive change without upsetting your own or outside teams where you think improvements can be made?

• Sometimes you just have to be firm if something is not right and face the fall out – remember that it is for the greater good!
• Never let a serious incident go to waste – if you feel passionately about what went wrong, offer to investigate. Remember the recommendations are yours to create, (within reason – you need to check that they are realistic) and they go straight to the top. Locally, try and use existing structures- education, M&M, grand rounds to maximise your audience {so lessons are learnt}.
• Learn from families as much as possible and use this to create change.

3. Learn the governance structures in your organisation and department and how to access them

Most departments have local governance arrangements that are sometimes not well understood by junior members of the team. Do try and engage.

• Use incident report forms whenever you can. Remember the value of incident reporting
• The importance of an open and honest culture in teams is of real importance here – everyone must feel safe to speak out. Sometimes you need to test this by asking people their opinion or by giving them permission to speak out
• Try and resolve issues face-to-face without ‘shroud waving’ – try and help to find the solution.

4. Make sure you have the right team around you, know their strengths & how to get the best out of them

A team needs a good leader but you also need the right people around you.

• The better you get to know your colleagues and their strengths, the sooner you can delegate to them
• Treat everyone the same – some will be more vocal than others- make sure everyone has a voice. The quietest person may make the best point
• ‘Special colleagues’ (i.e. disruptive colleagues) are a challenge. Try and keep cool with them and remember to consider: Are they looking after themselves? Are there health problems? Is the patient safe? Is the governance around their practice and the way they behave safe? Does HR need to be involved?
• You need to be squeaky clean yourself – you need to walk the walk.

5. Time management – plan your diary and manage your email

Learn how to manage your time effectively, always plan ahead and try not to minimise your time on emails. Before you send ask yourself, ‘Is it easier, quicker and less likely to cause upset if you have a conversation?’ Keep your cool if the email has wound you up – almost always you will have got the wrong end of the stick Allocate the time that you need to do things properly.

6. If you snooze you lose – learn how to schmooze

To lead your team you need to know what’s out there, who is doing what, where your department’s strengths and weaknesses lie and strategically what makes sense. This is important both internally and externally.

7. Don’t go native

Always remember why you took on this role in the first place; to improve patient care and facilitate the creation of something really good. If people start revolting, disengaging or generally seem unhappy you won’t have followed the points above and may well have gone native. Don’t do it!

Regards, You.
Introduction

Human factors methods and applications

To support teamwork
- Training needs analysis
- Crew resource management & human factors training
- Non-technical skills competency
- Assessments
- Checklists

In simulation
- Performance observation
- Questionnaires
- Physiological measures
- Mental workload assessment
- Non-technical skills assessment (situational awareness, communication and teamwork)

In healthcare facility design
- Anthropometry
- Environmental assessment
- Task analysis and system modelling
- Prospective risk assessment
- Safety cases
- Mock ups and prototyping
- Hazard identification
- Human reliability analysis
- HF based procedure design

In technology and device design
- Allocation of function analysis
- Usability assessment
- Interface design and analysis
- Anthropometrics
- Mental workload assessment
- Task analysis and system modelling
- Safety cases
- Mock ups, prototyping and walk throughs
- Simulation

In re-organising healthcare services
- Task analysis and system modelling
- Prospective risk assessment
- Hazard identification
- Human reliability assessment
- Environmental assessment
- Workload assessment
- Safety cases
- Shift design

To support Boards to lead
- Safety culture & climate tools
- Strategic risk assessment
- Strategy for patient safety
- Error taxonomies
- Organisational accident models & concepts (e.g. organisational drift)
- Staffing assessment
- Task analysis and system modelling

In allocating staffing and resources
- Aptitude testing
- Psychometric testing
- Non-technical skills assessment
- Shift design
- Fatigue assessment
- Workload assessment

In investigation & learning
- Interviewing techniques
- Investigation approaches & methods
- Error taxonomies
- Organisational accident models
- Safety performance measures
- Performance variability analysis
- Incident modelling

In selection and recruitment
- Aptitude testing
- Psychometric testing
- Non-technical skills assessment

In developing safe protocols & procedures
- Task analysis and system modelling
- Prospective risk assessment
- Human reliability analysis
- HF based procedure design
Oil and gas platform control room versus operating theatre design

The Oil & Gas Platform Control Room
One company operated a number of fixed oil and gas platforms with 20-year old control rooms. Many had been modified and upgraded over time and the design of the working environment caused difficulties for Control Room Operators. A review found that the layout of the controls, displays and annunciators made it difficult for Control Room Operators to understand developing situations. Control rooms were hot and noisy making concentration difficult. Lighting caused glare and reflection on display screens. Alarms weren’t prioritised making it possible for operators to miss a crucial alarm. There were too many alarms during normal operations many of which were “nuisance” alarms.

The company redesigned the control room layout, lighting and air conditioning. Alarms were prioritised so that important information was easier to spot and nuisance alarms were engineered out. The company recognised that the control room design was compromising the CROs ability to guarantee the integrity of the systems barriers. Failure to integrate human factors science into successive control room modifications was corrected with a complete redesign. This improved the ability of the control room operators to manage the platform safely (Step Change in Safety, 2010).

The NHS Operating Theatre
Now compare the above scenario to the design and working conditions in a typical NHS operating theatre: The placement of monitors displaying a patient’s haemodynamic status sometimes means that not all members of the operating theatre team have good visual access to this information. Glare from theatre lights sometimes compromises visibility of information on monitors.

The design of anaesthetic machines means that nuisance alarms occur frequently, leading theatre teams to disable them to reduce distractions and interruptions. Alarm systems design is often not discriminatory – making it difficult to differentiate high importance alarms from less important ones.

For the majority of surgical teams, who often carry out long cases with a full theatre list, there is no sit-stand workplaces, meaning team members have to stand for long periods of time. Fatigue therefore becomes an issue.

Operating theatres are usually an ergonomics nightmare; cables, monitoring leads and equipment create accessibility problems but these are tolerated because this is the working environment theatre teams are accustomed to.

Overlaid onto these design issues are defective working practices; external distractors are an accepted fact of theatre life (for example, colleagues coming to the operating theatre door to ask consultant surgeons and anaesthetists to make decisions about other patients). Short turnaround times between cases sometimes make it difficult for theatre team members to eat lunch – especially where there is no designated theatre coffee area within the theatre suite. Poor operating theatre suite design puts team members into situations where they make ‘trade-off decisions’: ‘Do I un-scrub, take off my theatre greens and go and buy lunch, OR do I skip lunch knowing I have two more cases this afternoon OR do I violate infection control policy by walking to the hospital canteen in my theatre greens?’
Human factors in design

Integrating human factors into device design: The EpiPen

Anaphylaxis is a life threatening allergic reaction which affects the respiratory and/or cardiovascular systems (Muraro, Roberts et al., 2007). Whilst anaphylaxis may be triggered by exposure to latex rubber, insect venom and medication, the most common cause is exposure to foods including peanuts, nuts, fish, milk and eggs (Ewan, 1998). In the UK, there was a seven fold increase in hospital admissions due to anaphylaxis between 1990/1 and 2003/4 (Gupta, Sheik et al., 2007; Sheik et al., 2008). The treatment of anaphylaxis is a prompt intramuscular injection of epinephrine, typically administered by the patient themselves.

In the MATCH study, fifteen patients who had been prescribed EpiPens were interviewed. The study explored the patient perceptions and use of prescribed epinephrine auto-injectors to support patients to self-care and manage anaphylaxis.

The findings showed that some patients were reluctant to carry their Epipen because its design made it look like a ‘weapon-like’ device. As well as poor device design, limited patient education led to patients choosing not to carry their EpiPen: Some of the patients interviewed were confident that the emergency services would provide them with the appropriate care they needed, and therefore did not carry the device in urban areas.

Patient quotes from the interviews clearly show the importance of considering the context in which a medical device will be used when it is being designed. For example, one of the patients’ interviewed stated:

“Well, when I go to football, once a week... you get searched going into every away game, these days, and I didn’t want to be sitting there causing a scene because I’ve got an EpiPen, you know, in case I’m going to sort of run on the pitch and stab one of the players with it. That’s obviously what they think. You’re not allowed knives, not allowed anything in, so why not this, you know?

Another patient commented:

I think...I think there’s the reliance of, oh, I’m in the city, I’m going to be okay, there’s so many hospitals, there’s ambulances...you’re covered kind of thing, compared to if you was in the middle of the mountains in Scotland or something like that.

Supplied by the MATCH team. University of Nottingham. UK
The NPSA report, Lessons from High Hazard Industries for Healthcare (NPSA, 2010) has more detailed information on user-centred design. The report describes key human factors design considerations including standardisation, usability, functionality, flexibility, simplicity, visibility, workflow and focus on systems, not individual elements. It also outlines seven steps for a user centred approach to designing safer healthcare facilities, based on learning from other industries. These steps are:

Step 1: Determine the project scope  
Step 2: Identify users and key activities  
Step 3: Identify the safety issues  
Step 4: Analyse and prioritise the safety issues  
Step 5: Develop potential design options and solutions  
Step 6: Evaluate design solutions  
Step 7: Implement the design.

Reading ‘Lessons from High Hazard Industries for Healthcare’ (NPSA, 2010) will provide you with a more detailed understanding of how to integrate human factors into healthcare system design. Both a summary and full report are available at: http://www.nrls.npsa.nhs.uk/resources/?EntryId45=74930

Implementation tip

Stop and reflect for a moment about the procurement process in your own healthcare organisation. Consider the IT system and the clinical environment in which you work. Where are the error traps caused by the design of healthcare pathways, IT systems and medical devices? Do you tolerate and work around poor design? If so, consider using the following mechanisms to escalate the problem to senior managers:

- Discuss the potential patient safety risks posed by poor design during executive walk rounds
- Invite the directors of Facilities, Procurement and IT to the clinical area in which you work so they can see the problem for themselves
- Report design related issues through your local incident reporting system and encourage others to do the same. Remember there is value to be gained in reporting near misses and no harm events related to healthcare pathways, IT systems and medical devices
- Be proactive. If a clinical area is being reorganised to improve efficiency or if new equipment is being procured, volunteer to be on the project team leading the work. Provide an ‘end user’s perspective’ and insist that some of the human factors methods described in Chapter 3.0 are applied to systematically assess patient safety risks.
Using human factors methods to safely implement organisational change in air traffic control

The changes brought about by the expansion of London Heathrow airport when terminal five was developed were complex. The organisational change bought about by introducing the new control tower meant changes to procedures, lines of sight, transition to computerised flight data input and display, different communication methods, and a very different spatial layout.

Approach

To safely manage this major organisational change, the National Air Traffic Service (NATS) prepared a full system safety case, applying a ‘human error safety assurance process’ (HESAP), a five-step iterative process that is applied throughout the lifecycle technical systems changes. The five steps are:

Step 1. Understand – understand the changes to the system and context, and determine the possible effects on task performance.

Step 2. Identify – identify and assess the potential human hazard risks associated with the changes, and set safety requirements to achieve an acceptable residual risk.

Step 3. Mitigate – specify, plan and (where appropriate) facilitate the specific mitigation activities to meet the safety requirements.

Step 4. Demonstrate – gather evidence to provide assurance that the safety requirements have been met and that human hazard residual risks are tolerable prior to implementation.

Step 5. Monitor – gather evidence to provide assurance that the human hazard risks associated with implementation remain adequately identified and mitigated in service.

Applying HESAP involved carrying out a detailed task analysis, hazard analysis, human factors literature review and performance observation. The process identified HF safety issues that would not have been identified without such a focus on human performance. The process also delivered a set of safety requirements and specifications, and provided assurance that the safety requirements had been met.

Applying HESAP was a resource intensive but successful process. But the analytical approach could not provide a robust argument that task performance would be acceptable and NATS recognised that usability and acceptance issues could emerge once the control tower opened. Therefore, prior to the opening of the new tower, an observational study was conducted to collect pre-operational data on controller performance, focusing on workload, situation awareness, and teamwork. An HF specialist observed controllers during team-based 360 degree real-time simulation training and ‘shadowing’ exercises in the new tower. The observational data showed no negative indicators for task performance. Observation and debriefs suggested that behaviours were consistent during shadowing and simulation. Indicators of workload, situation awareness and teamwork showed signs of improvement from the start of shadowing. The output of the exercise provided evidence that the safety requirements had been met for HESAP Step 4 (‘Demonstrate’). A second set of observations was later conducted during live operations. The output of the exercise was used as evidence in the HESAP Step 5 (‘Monitor’).

Outcome

Overall, the process provided robust assurance of both safety and human performance in the tower. In the early hours of 21 April 2007, the team successfully transitioned to the new control tower.

Human factors in design

Designing healthcare systems – the need for a human factors based approach

Patient pathways which cross secondary, primary and social care boundaries are the major highways that patients travel (Eason, Dent. Waterson, Tutt, Heard and Thornett, 2012). Communicating patient information and coordinating care across organisational boundaries that form part of the pathway is challenging.

One human factors study, carried out at the University of Loughborough, examined the implementation of large-scale electronic patient information systems that aim to communicate and coordinate care across primary, secondary and social care boundaries. The study examined whether the sharing of e-Health records between two Primary Care Trusts (PCTs) and related agencies within Local Health Communities (LHCs) can contribute to improved clinical care and better management. The study also explored factors in the design, implementation and evolution of these systems that have facilitated or acted as barriers to the successful inter-organisational uptake of the systems by all healthcare partners.

The research team used a mixture of observation, task analysis of nine care pathways (i.e. mapping key tasks and processes using human factors techniques), interviews and workshops with IT and healthcare professionals.

The study’s findings were:

- Firstly, where top down, national strategies are used, there is often insufficient attention paid to the requirements of the front line staff that need to share information to co-ordinate care in the pathway.
- Secondly, the patient’s views were not sufficiently considered when the health record systems were developed.
- Thirdly, the domination of the top down, national strategy approach meant that the information sharing needs by frontline staff working is different organisations was given insufficient attention when the electronic health record systems were designed. As a result frontline healthcare staff developed ‘workarounds’ to achieve information sharing and, after implementation, modified the system so that it evolved in a way that met their needs.

The authors concluded that there is a need to create more mature health care systems development processes that can cope with the many challenges of bringing together a diverse set of stakeholder interests across different healthcare organisations (Eason, Dent et al., 2012). In short, there is a need to integrate human factors into the design and implementation process for electronic patient records.

Involving staff in using a human factors analysis tool

Case study: Hospital at Night handover at Great Ormond Street Hospital NHS Foundation Trust

In the GOSH H@N study, applying FMEA helped the team identify over twenty different types of communication, workload prioritisation and decision making errors that could occur during Hospital at Night handover. The FMEA was facilitated by a human factors expert who supported members of the H@N team to review the hierarchical task analysis and to identify:

- What could go wrong?
- What causes this type of error to happen?
- What are the consequences, likelihood and predicted severity if a particular failure mode occurs?
- How could we redesign the handover to reduce the chances that this type of error will occur?

Table 1 shows an example of one of the failure modes identified which relates to acutely unwell patients not being handed over from the day junior doctors to the night team at the H@N handover. By using hierarchical task analysis and FMEA, the H@N team members involved were able to stop and reflect on the current handover process, discuss its flaws and identify how it could be improved. The task and error analysis methods used in this study informed the redesign of a H@N handover protocol grounded in human factors science (McQuillan, Carthey, Catchpole, McCulloch and Goldman, 2013).
Table 1: Failure Modes and Effects Analysis example from the Creating a Safer Hospital at Night study (McQuillan et al., 2013)

<table>
<thead>
<tr>
<th>HTA task step</th>
<th>Failure mode (i.e. What could go wrong?)</th>
<th>Cause (why?)</th>
<th>Consequences</th>
<th>Current controls</th>
<th>Current risk score</th>
<th>Recommendations (i.e. suggested improvements to the handover process)</th>
<th>Risk score following implementation of improvements</th>
</tr>
</thead>
</table>
| 1.1 Select flagged patients | Patient who should be prioritised by the H@N team overnight is not identified at H@N handover. | • Memory lapse  
• Workload  
• Handing over multiple wards (e.g. MEGA).  
• Poor team communication  
• Change in patient’s condition since last clinical review | Acutely medically unwell patient is not handed over to the H@N team. H@N team are unaware that the patient should be prioritised for clinical review overnight because of the potential risk of sudden patient deterioration overnight. | CSP knowledge and leadership acts as a safety net, but this is not full proof. | 5  
4  
20 | 1. Develop and implement prioritisation criteria to assist junior doctors to identify patients who should be prioritised overnight (include these ‘flagging criteria’ in the H@N standard operating procedure).  
2. Introduce a standard operating procedure (SOP) which includes early flagging of patients at ward rounds to enable consultant level engagement in decision making.  
3. H@N induction training for new junior doctors to teach what constitutes a ‘flagged patient’. | 5  
2  
10 |
Applying human factors and improvement methods in primary care

Case Study: An example of implementing NICE guidance for febrile children

NICE recommends all febrile children should have their temperature, heart rate, respiratory rate and capillary refill time measured and their subsequent management be based on a traffic light system to identify those with potential serious illness. This project was conducted in a large GP surgery, specifically aiming to improve the assessment using ALL four of assessment criteria. The project went beyond conventional audit and used the principles of improvement science to make it easier for clinicians to do the right thing and harder to do the wrong thing, and if they did forget to create systems spot and stop the omission.

The first phase was a diagnostic phase to understand why the assessments were not taking place. A combination of staff questionnaire, direct observation and “leadership walk-rounds” were used to develop a real understanding of the reasons that the assessment was not being conducted.

A series of interventions were then considered and tested using the PDSA methodology. The series of interventions included:

- Making the equipment available (a workplace organisation tool from Lean methodology know as 5S was used)
- A human factors intervention of a visible prompt on the tympanic thermometer just below the screen with a picture of the child and a checklist
- Mouse mats with a picture of the same child having her temperature checked and a table of the normal values was placed in each room
- The traffic light table was placed on the practice intranet site for ease of reference.
- A recording template was created on the clinical system making it easier to code and record the assessment
- An electronic algorithm was created on the clinical system (EMIS LV), so that if a code was entered for a child that would suggest a condition with a fever e.g. OTITIS MEDIA the computer system would check to see if the four items had been recorded and if not it would create a ‘forcing’ function reminding the clinician to conduct these components of the assessment, and would then automatically call the data recording template. Those clinicians persistently not conducting all four features of the assessment would be sent a personalised postcard reminding them of the guidance.

Results and evaluation

The progress was monitored using another tool from improvement science (known as a Statistical Process Control {SPC} chart). Each patient was given a score of 1, 2, 3 or 4 depending on how many components of the assessment they had conducted. Each patient was then plotted on the SPC chart and the chart was annotated with the interventions. This clearly demonstrated the interventions were leading to an improvement. In addition, a balancing measure of length of consultation was measured. The data clearly demonstrated that there was no increase in consultation length.

Paresh Dawda, Whilst a GP Principle at South Street Surgery

Abstract and supporting material at:
http://www.nice.org.uk/usingguidance/sharedlearningimplementingniceguidance/examplesofimplementation/eximpresults.jsp?o=564..
Human factors and teamwork

North East Strategic Health Authority’s human factors training programme

As part of the Safer Care North East Programme (2008 – 2011), NHS Northeast established a Human Factors Faculty which developed a human factors education package for healthcare teams. Initially the training was developed in collaboration between aviation experts, senior clinicians, nurses, midwives and AHPs, led by a consultant neurosurgeon and the Programme Manager for Nursing, Midwifery and Patient Safety at the Strategic Health Authority.

To support healthcare teams understand human factors within their own clinical context, a human factors e-learning programme was developed. The e-learning comprised examples of how non-technical skills influence our behaviour and includes everyday life examples and those set in the context of clinical scenarios. The purpose is to complete the e-learning prior to more in-depth training to provide a useful foundation which enables healthcare staff to develop a preliminary understanding of what human factors is.

The education package also consists of a trainers’ manual and handbook on human factors which includes information on cognition, personality type, situational awareness, decision making, leadership, teamwork, stress and communication. The content of the train the trainers’ manual has been validated in collaboration with experts at Durham University, funded by a Health Foundation grant. This work has also involved training the trainers’ initiative to develop a core faculty of staff who are able to deliver training on non-technical skills to healthcare teams.

Future work is planned to implement human factors training with the Safeguarding Adults team, where issues like cross-team communication is essential to ensure safe patient care. The Human Factors education package developed in the North East will be available free of charge to NHS organisations.
Luton and Dunstable NHS Foundation Trust’s human factors training programme

Between 2008-2010, the Associate Medical Director at Luton and Dunstable NHS Foundation Trust led a multi-disciplinary human factors project in the maternity unit at the Luton and Dunstable Hospital. Following on from the success of this training, the Associate Medical Director is now leading another human factors training project in the hospital’s Emergency department. The project has clear aims, a project plan and a built in evaluation strategy. The outline project plan is shown below and has been included in the Guide so that others who are planning to deliver human factors training can learn from the approach:

**Project design**
- Understand context
- Understand nature of problems
- Wrap around Human factors knowledge and expertise

**Funding**
- Seek and secure

**Evaluation**
- Appoint research psychologist to evaluate the programme
- Select evaluation measures
- Liaise with evaluator throughout the project

**Clinician engagement**
- Obtain buy in with key stakeholders
- Raise awareness amongst staff through talks in different staff forums
- Run monthly meetings with Champions

**Immersion event**
- Source external trainers
- Organise and co-ordinate event

**Monthly team training**
- Train a team of trainers to deliver multi-disciplinary simulation training
- Aid new trainers in developing educational content for simulation training
- Develop educational content for half day course in the human condition, HF, teamwork and communication
- Train in the use of specific interventions developed

**Work place interventions**
- Observe existing practice for diagnosis of development opportunities
- Decide the purpose of the intervention required
- Develop interventions working alongside Champions
- Introduce interventions and modify based on feedback
- Obtain initial evaluation of interventions in order to gain evidence of the value of interventions to use for further influencing to enable spread
- Measure compliance
- Develop a quality standard against which to measure quality
- Measure quality against agreed standard
- Communicate results in order to drive up quality of interventions

**Evaluation**
- Teamwork and Safety culture
- Evaluation of efficacy of interventions
- Evaluation of value of training
Introducing SPLINTS to scrub practitioners

My experience of implementing SPLINTS showed that barriers to application of non-technical skills assessment of scrub practitioners occur at numerous levels. The first barrier is the introduction of the concept to practitioners who are not aware of the influence of non-technical skills on their ability to effectively practice. The application of non-technical skills in scrub practice is a new context for scrub nurses and Operating Department Practitioners. The skills of communication and situational awareness are developed ad hoc through experiential learning and are held as tacit knowledge by scrub practitioners. From holding informal corridor conversations with colleagues it became evident that this deficit in explicit knowledge made it difficult to explain the relationship between effective application of non-technical skills and effective scrub practitioner performance during surgery.

I felt that this barrier was overcome by developing a short teaching session introducing generic aspects of human performance such as automaticity and confirmation bias and how they contribute to accident and incident development. The session introduced aspects of non-technical skills specific to scrub practice and how they promote situational awareness and effective communication to prevent the psychological stressors which may trigger automaticity and confirmation bias at the level of the scrub practitioner and affect the performance of the surgical team.

The second barrier I experienced was trying to deliver the teaching session. The organisation where I am employed as an ODP has a monthly audit session which can be used for staff training and development. I was allocated a session on an audit programme but this was later taken away because the manager felt that another training issue was more important and should be covered in the allocated time. The barrier of tacit awareness and application therefore exists at a management and practitioner level.

The audit sessions are also subject to stressors which reduce staff attendance at training events, i.e. releasing staff to attend the training session proved problematic. If I had not been given the opportunity to deliver the session again since the initial opportunity, I estimate that I may have only reached two or three of the scrub practitioners working in the operating department.

The third barrier is based on my experience of trying to deliver a session and recruit staff to undertake the assessment process. Co-ordinating off duty to ensure contact time between the assessor and assessed practitioner during an actual operating session may be difficult to organise. To allow the process to work at an optimal level I also believe that the assessor should be supernumerary from the operating theatre to optimise observations and assist collection of data for feedback to the assessed practitioner. Supernumerary status would also provide protected time to allow immediate feedback and assist with the process of critical reflection. This dialogue seems to be the most crucial part of the process by exploring positive and practice during the assessment to trigger behavioural change.

What I learnt from introducing SPLINTS to colleagues

Developing my knowledge of generic human performance and those non-technical skills specific to scrub practice has allowed me to become critically reflective of my scrub practice. This has enabled me to recognise latent threats generated by the surgical team, patient conditions and organisational systems and how they impact on me and increase stressors I experience during the intraoperative phase. Explicit recognition of these stressors has allowed me to increase the barriers to prevent an incident developing. Essentially, my practice has been transformed from actions based on automaticity to a cognitive process where I feel that I have greater control of my actions and awareness of the impact of those actions on the surgical team.
Introducing SPLINTS to scrub practitioners continued...

I have also been able recognise positive and negative behaviours in my colleagues. Reassuringly, the vast majority display overtly positive behaviours and application of non-technical skills at all times. However, my major concern with experiential learning through implicit knowledge is that this is not through critically reflecting on practice and does not develop the ability of the practitioner to recognise and respond appropriately when latent threats become more apparent in the clinical environment. SPLINTS provides the framework to introduce and embed critical reflection in to clinical practice and allows an observer to challenge negative behaviours.

What I would advise others to do differently

I believe that using an assessment tool is just one part of the process and practitioners intending to use SPLINTS need to consider introducing the concept of human performance, coordinating the assessment and secure protected time to feedback. One of the factors which may have prevented my ability to embed the tool within my organisation is a lack of personal power or influence. Practitioners wishing to try the assessment may find it useful to strategically recruit practitioners with influence. My operating department does not benefit from a Training and Development co-ordinator but practitioners may consider increasing their personal influence by gaining allies with influence (and potentially supernumerary status beyond clinical practice) to develop the process to embed the tool.

Personally, SPLINTS is not only about producing an assessment but promoting the psychological safety by having a colleague who you feel comfortable to discuss incidents with and help develop practice. This safe environment is often missing from contemporary healthcare.

*Supplied by Guy McLelland, Lecturer, School of Health. UCLAN.*

Implementation tip

Thinking about how to persuade colleagues about the importance of enhancing non-technical skills?

**Observe and reflect**

Share the SPLINTS framework with a couple of senior consultant surgeons who you know are open to accepting new ideas. The next time his/her surgical registrar is leading a case under supervision, ask each consultant surgeon to observe the interaction between the scrub nurse and the surgical registrar. Ask each surgeon what he/she observed. They will invariably flag up issues with poor coordination, disruptions in surgical flow caused by anticipation, leadership, teamwork and communication problems. One senior consultant surgeon who recently carried out this task commented that it was apparent that his surgical registrar was reaching the limits of her performance because of non-technical skills issues he observed. The observation was a quick way to ensure buy-in from a key champion.

Remember there are non-technical skills frameworks for surgeons, anaesthetists and other healthcare professionals so you can tailor the observational exercise above to meet your local needs.

**Presenting an evidence base**

Collate evidence from the last ten or so serious incidents that have been investigated in your organisation, preferably in your department. If you don’t have many incidents in your own department start keeping your own detailed accounts of examples or near misses. Incident investigation reports often identify safety culture, teamwork, leadership, communication and lack of clear roles and responsibilities as contributing to patient harm. Collating and presenting this data makes the link between non-technical skills and patient harm transparent. It will help you to avoid a ‘that does not happen here’ type of response from colleagues and to get buy in.
Integrating Human Factors to improve the quality of incident investigation

The Yorkshire Contributory Factors Framework

Lawton, McEachon et al., (2012) have developed an evidence-based and standardised list of contributory factors that can be used as a basis for understanding causation. Previous frameworks to understand factors that contribute to incidents (known as contributory factors) have the limitation that they have often been adapted from non-healthcare settings that are very different in their structure and function to the healthcare domain. Although these frameworks have a theoretical basis, they are not empirically-based. The Yorkshire contributory factors framework overcomes this issue because it was developed from a review of previous studies carried out in healthcare.

By reviewing ninety-five studies, representing 83 different datasets, Lawton and her research team showed that the overwhelming majority of contributory factors that were identified in the review (irrespective of hospital setting or methodology) were active failures or individual factors. Hence, healthcare is still focusing on the proximal causes of incidents and not drilling down to identify the underlying systems factors that increase the chances doctors, nurses and allied healthcare professionals will make errors that harm patients. Lawton, McEachon et al., (2012) states ‘…a focus on individual responsibility for errors is likely to be ineffective as an incident reduction strategy.’

The Yorkshire Contributory Factors Framework has been applied to the investigation of 9 related serious incidents within Bradford NHS Hospitals Acute Foundation Trust. Applying the framework improved the focus of the investigation on ‘systems factors’ or ‘latent failures’ rather than ‘active errors’. Applying the framework also demonstrated the challenges of embedding human factors into incident investigation when working with colleagues who are not human factors experts.
After Action Review

After Action Review (AAR) supports healthy team behaviours like listening and asking questions and uses the “free lessons” of everyday events, as well as serious incidents, to improve the safety and quality of patient care. It supports the creation of a ‘culture of reflection’ where staff learn why things did or did not go according to the way they planned and what they might do the same or differently next time. Central to the AAR process is the belief that lessons can be learnt and shared without the need to blame others.

Every AAR follows the same structure with the ‘AAR conductor’ (i.e. facilitator) getting agreement for the ground rules at the outset and ensuring everyone is clear about the specific purpose of the AAR. AAR uses the four questions shown in Table 3 to structure the analysis:

Table 3: After action review

<table>
<thead>
<tr>
<th>The Four After Action Review Questions</th>
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<tbody>
<tr>
<td>1. What was expected?</td>
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<td>2. What actually happened?</td>
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<td>3. Why was there a difference?</td>
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<tr>
<td>4. What have we learnt?</td>
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By implementing AAR through a multi-professional training programme, the Trust has improved reflective learning when things go wrong: 53% of externally reported Serious Incidents last year had an AAR conducted (as well as the formal incident investigation). Integrating AAR early on in the incident investigation process helps to create collective insights and reminds teams that the purpose of investigation is to learn, not to blame.

‘The culture of attaching blame to others for the problems which we encounter in everyday work is a ‘comfort zone’ which we all show varying degrees of reluctance to leave. To leave our default position of others being to blame means we have to risk the reality that we ourselves may be part of the “problem”.’ (Walker, Andrews et al., 2012).

Integrating human factors into investigation

The Quality Manager and Safeguarding Adults Lead at NHS Bedfordshire and Luton Cluster recently completed a MSc. thesis which evaluated how to integrate human factors into incident investigation (Saunders, 2012). The research adapted an investigators quality tool, originally developed in aviation, to examine the quality and the continuity of identifying human factors in the RCA process. The key findings showed that human factors were often not identified by the root cause analysis process. Mismatches were also identified between a contributing factor identified in the investigation and the recommendations, and action plans. That is to say, there was no logical flow between the underlying causes of the incident, the recommendations that were made and the action plans that had been developed (Saunders, 2012). Saunders’ findings are supported by external human factors reviews of incident investigations which some healthcare organisations have commissioned to review the quality of local investigation processes.
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Implementation tips

Executive and non-executive directors

Seek assurance that your organisation has a robust system in place for investigating and learning from incidents. The following assurance-seeking questions provide a useful framework for executive and non-executive directors:

i. Have staff in your organisation that take on the role of lead incident investigators received formal training in root cause analysis or a similar investigation technique?

ii. Is peer review between lead-investigators commonplace?

iii. Do lead investigators have protected time to carry out incident investigations or are they fitting it in around their ‘day job’? (the latter shows there are problems with the infra-structure to support robust investigation).

iv. Does your organisation use a team approach to investigation (versus a single investigator)? Where a single investigator model is used, your organisation increases the risk that investigations will be based largely on the assumptions and interpretation of one person.

v. Ask your Risk Management team to review serious incident investigation reports from the last three years to identify:
   - The proportion of ‘root causes’ that identify underlying ‘systems factors’ versus the proportion that focus on ‘active errors’ and ‘non-compliance.’
   - The percentage of recommendations have been implemented and sustained over time
   - The proportion of investigations where statements and perspectives from patients and carers were fed into the investigation
   - The number of near misses that had the potential to cause severe patient harm or death that have been thoroughly investigated using a structured incident investigation technique like RCA (if the proportion subject to thorough investigation is low this may show that your organisation does not have sufficient investigation capacity and/or that you are missing the opportunity to learn systems lessons from near misses)
   - The types of serious incidents or near misses with potentially severe harm which keep recurring. Recurrent incidents are indicative of weaknesses in the investigation process. They suggest that weak recommendations have been developed and/or that the implementation process has somehow failed.

vi. Think about how your Board seeks assurance that recommendations from incident investigations have been implemented and sustained? Do you rely solely on information presented in Board summary reports on incident investigations? If so, remember that executive walk rounds or informal ‘coffee mornings’ between executives/non-executives and clinical staff’ provide an opportunity to cross check this information.
Integrating Human Factors to improve the quality of incident investigation

**Implementation tips**

**Incident investigators**

- When carrying out an investigation, check that your analysis does not stop at identifying active failures and non-compliance by healthcare professionals. Have you identified and described WHY errors and non-compliance occurred?
- Apply the Yorkshire Contributory Factors framework in your next investigation
- Remember that applying lessons from human factors can improve the quality of investigations. Consider the types of recommendations that you have made as a result of your investigation. Human factors research has shown that different types of barriers and recommendations are more or less effective (Trost and Nertney, 1985) whereas re-training staff, writing or amending a policy or telling people to do things differently do not provide long-term, robust solutions that will prevent an incident from recurring. All too often in healthcare investigations, recommendations are put forward that do not address the underlying cultural, workplace and equipment design, workload, teamwork and leadership issues. Consider asking a peer reviewer to cast fresh eyes on your recommendations with this in mind
- Don’t forget to elicit the patient or carer’s perspective on what went wrong and why.

**Risk Managers and/or Patient Safety Leads**

- Review the last ten incident investigation reports. How many root causes are focused on active failures (i.e. errors and non-compliance committed by healthcare professionals in the direct provision of healthcare treatment)? How many address ‘systems factors’ that conspired to create the error traps which healthcare professionals fell into?
- Now read through the recommendations from the last ten incident investigation reports. Do the recommendations focus on writing or amending a policy, re-training a member of staff or reminding groups of staff that their behaviour is unsafe? If the majority of recommendations fall into these three categories, the chances are that the incident will recur because the recommendations focus on solutions which human factors research tells us are the least robust or failsafe
- Does your organisation use a serious incident investigation recommendation action tracker where all of the key findings and recommendations from investigations are collated in one document? By locating all of the key findings and recommendations into a single source document, you will simplify the system in place locally for tracking what recommendations have been implemented and which have not
- Carry out a review of the quality and comprehensiveness of local incident investigations. Make sure that whoever leads this work is independent.
Understanding the human factors of non-compliance

Using human factors methods to improve policy compliance

One London acute Trust applied human factors analysis to understand non-compliance with policies and procedures.

The work involved a human factors specialist carrying out an aggregate analysis of claims, complaints and incident report data to identify the frequency with which non-compliance was a contributory factor and which healthcare policies and procedures had high levels of non-compliance. Task analysis and interviews with a cross-section of healthcare staff were also carried out to understand the challenges they faced when accessing and understanding policies and procedures.

The aggregate analysis findings acted as an impetus for the Executive Board to invest in work to change the way that policies and procedures were developed, implemented and monitored. Search terms on the Trust’s intranet site were changed so that they matched the expectations of healthcare teams and the process for writing and approving policies was simplified.

The organisation’s culture and approach to managing non-compliance also improved. When the study started, writing a policy or procedure was the knee jerk response to a problem. As a result of the study, senior managers realised that this was ineffective and actually increased the likelihood of non-compliance.

Implementation tips

Risk Managers and/or Patient Safety Leads

- Openly discuss with your healthcare team the challenges they face when accessing and using healthcare procedures. Such discussions provide valuable intelligence about how workable procedures are in the real world.
- Review a sample of complaints, incidents and claims to identify the frequency with which non-compliance contributes to these events. Having baseline data on the frequency and nature of non-compliance in your own organisation will help to convince senior managers and senior clinicians to change current practice. It will also mean you can measure improvement.
- Engage a human factors professional to apply task analysis, walk-throughs etc... when developing healthcare procedures.
- Consider holding non-compliance workshops, like those used with maintenance engineers in the oil and gas industry, to learn about the challenges people face when implementing policies and procedures and to feedback lessons learnt from incidents, claims and complaints.
- Use Patient Safety executive walk rounds as an opportunity to discuss procedural non-compliance with healthcare teams. Ask if the procedure is workable in practice. If not, find out how it needs to be revised to make it workable in the ‘real world.’
- Raise awareness amongst Human Resources and Workforce teams that non-compliance is a ‘systems problem.’ Remember that all too often in healthcare organisations, staff are disciplined for not following policies and procedures. As part of the drive to develop an open and just culture, it is important to understand the reasons for non-compliance. Where procedures were inaccessible and/or unworkable in the ‘real world’ it may not be appropriate to impose sanctions against individuals.
The key elements of a Safety Management System

What is a safety management system?

“An organized approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures” (International Civil Aviation Organisation, 2006.

High risk and other industries have evolved their approach to measuring safety by implementing an overarching Safety Management System (SMS) and measuring performance against it. SMS’s combine data from reactive (for example, incident reporting, incident investigations) and proactive indicators (prospective risk assessments, walk rounds) to measure, monitor and manage safety performance on an on-going basis (Waring, 1996).

<table>
<thead>
<tr>
<th>Elements of a Safety Management System</th>
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<tbody>
<tr>
<td>1. A safety policy.</td>
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<td>2. Organisational arrangements to support safety (i.e. the organisation, supervision, recruitment, and training of staff to support the safety policy and processes).</td>
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<tr>
<td>3. A safety plan, i.e. standards and processes for safety, including using risk assessment</td>
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<tr>
<td>4. A means of measuring safety performance. Processes and data are required in order to monitor the current and past safety performance</td>
</tr>
<tr>
<td>5. A means of reviewing safety performance. Able to assess and understand safety performance against the safety objectives e.g. incident investigation, safety surveys, audits and reviews</td>
</tr>
<tr>
<td>6. A feedback loop to improve safety performance, i.e. mechanisms to ensure that any lessons learnt, or changes needed are properly accounted for and communicated.</td>
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Understanding the human factors of non-compliance

Monthly performance data from St Elsewhere NHS Trust’s safety dashboard showed that the frequency and severity of HAPUs had increased in the intensive care unit. This indicated the gradual erosion of good practice following implementation of the SKKIN bundle throughout the Trust. The safety dashboard data did not inform healthcare managers about why safety performance had deteriorated. Root cause analysis findings for Grade 3 and 4 HAPUs identified the root causes as ‘non-compliance with the SKKIN care bundle’ and ‘too few ICU staff trained about the SKKIN bundle’. Triangulating performance and root cause analysis data with ‘soft intelligence’ gathered from conversations with ICU staff provided further insights about why the erosion of good practice had occurred.

The prevailing culture in the intensive care unit was that ICU patients get pressure ulcers because it is difficult to turn them regularly. In short, HAPUs were viewed as an inevitable side effect of treatment rather than as patient safety incidents. Furthermore, the ‘soft intelligence’ showed that ICU ward sisters had been provided with the SKKIN bundle and told to implement it. When the ward sisters asked if they could adapt the SKKIN bundle locally to fit their patient’s needs, nursing managers said ‘no’ because they wanted a standardized bundle used across the whole organization. Thus, an opportunity to empower the ICU ward sisters to lead the implementation of the bundle was lost. The new result was short term compliance and a gradual erosion of good practice over time.

SKKIN care bundle example

Implementation tips

How is ‘soft intelligence’ on organisational drift gathered? And what can you do to ensure your department/organisation learns from it?

Soft intelligence can be gathered in several ways. Some examples were recently gathered from sites that participated in the Health Foundation’s Measurement and Monitoring of Safety report (Vincent, Burnett and Carthey, 2013) (see www.health.org.uk):

- Gathering soft intelligence about the gap between work in the real world versus work as imagined by having informal conversations with junior doctors
- Non-executive directors and executive directors hosting informal coffee mornings with front-line healthcare teams and discussing safety threats as part of the conversations held.
Human Factors resources available to download

Available to download at www.patientsafetyfirst.nhs.uk

Available to download at www.chfg.org
Acknowledgement

Although Dr Carthey is the principal author of this ‘How to’ guide it is important to acknowledge the collective effort and teamwork that contributed to its production. Healthcare teams, human factors researchers and consultancy firms, working in healthcare and other domains, responded to a request from the Clinical Human Factors Group to provide illustrative case studies. On behalf of patients we would like to thank everyone who has shared their insights and information - without their respective contributions, we would not have been able to produce this ‘How to’ guide.