7 Human Factors and Ergonomics in SHOT Error Incidents n=2908

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Definition

Human factors and ergonomics is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system.

Abbreviations used in this chapter

BMS	Biomedical scientist	**BSQR**	Blood Safety and Quality Regulations
CAPA	Corrective and preventative actions	**CIEHF**	Chartered Institute of Ergonomics and Human Factors
HFACS	Human Factors Analysis and Classification System	**HFE**	Human factors and ergonomics
HFIT	Human factors investigation tool	**IT**	Information technology
MHP	Major haemorrhage protocol	**MHRA**	Medicines and Healthcare products Regulatory Agency
NHSE	NHS England	**PACE**	Probe, alert, challenge, and escalate
PSIRF	Patient Safety Incident Response Framework	**RCA**	Root cause analysis
SAE	Serious adverse event	**SEIPS**	Systems Engineering Initiative for Patient Safety
SMART	Specific, maeasurable, achievable, realistic, and timely	**YCFF**	Yorkshire Contributory Factors Framework

Key SHOT messages

- It is encouraging to see an upward trend in the use of HFE frameworks for incident investigations and consideration of systemic factors, and not blaming staff involved
- It is essential that incident investigators recognise that lack of attention to HFE can lead to adverse events. When an error is made, or a process fails, it is often consequential of inadequate system design leading to hazards

SHOT
Serious Hazards of Transfusion

Recommendations

- To improve transfusion safety, effective and sustainable improvement interventions that address all the factors recognised during incident investigations must be implemented. Identifying and implementing appropriate actions are the most important aspect of incident investigations
- Reflective learning by an individual staff member should not be used as a stand-alone action from incidents. This is a weak corrective action in relation to the hierarchy of intervention effectiveness and has potential to be perceived as punitive by the individual. Future incidents of a similar nature may be likely unless more robust preventative actions are also taken
- Where incident investigations demonstrate ongoing risks such as insufficient staffing or poor skill mix, inadequate or outdated resources, lack of IT solutions, these should be highlighted and recorded in the CAPA every time it is relevant, even if they cannot be readily corrected. Such risks should be documented on risk registers and reviewed regularly

Action: Hospital risk departments, hospital transfusion committees, hospital transfusion teams, all staff investigating transfusion incidents

Introduction

Understanding HFE continues to be important when investigating adverse incidents so that system and organisational changes can be made to improve the likelihood of future error incidents being detected before patients are put at harm. Current and previous SHOT recommendations and learning points related to HFE should be heeded throughout investigations to improve patient safety. The CIEHF, the professional body for HFE, has recently published three chapters on HFE in health and social care, based on the institute's professional competencies (CIEHF 2023) and incident investigators may find these to be useful resources.

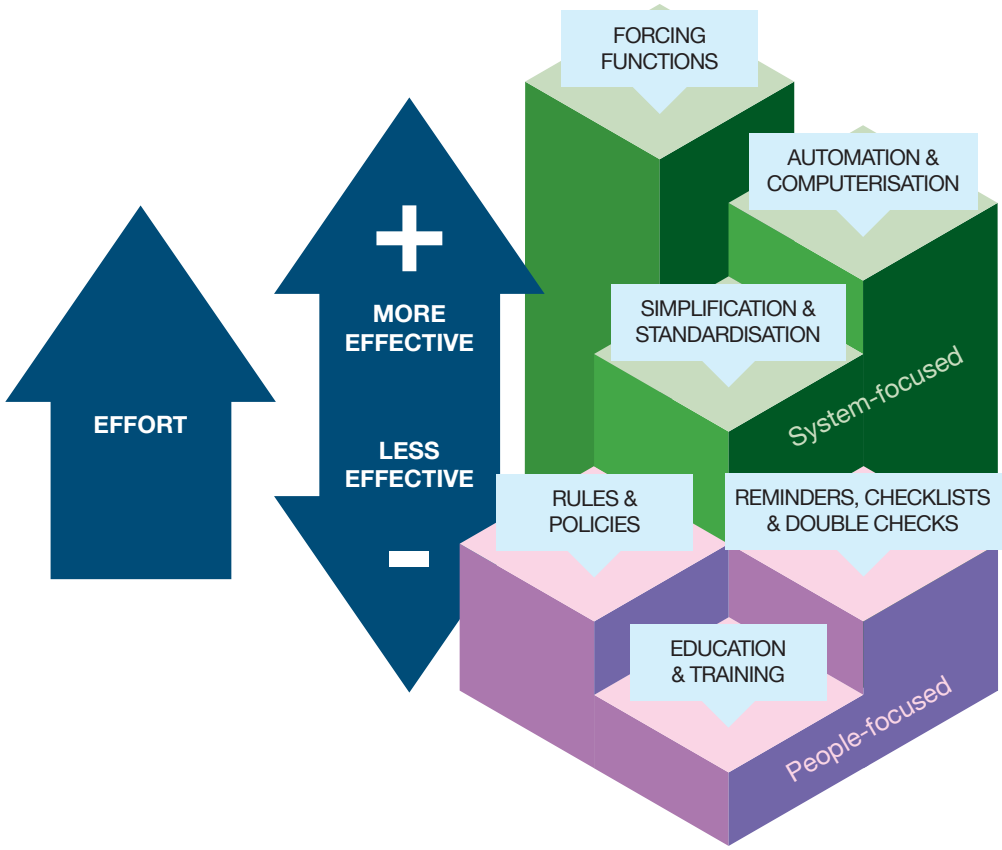


Figure 7.1: Hierarchy of intervention effectiveness

Adapted from the figure in 'From Discovery to Design: The Evolution of Human Factors in Healthcare' by Joseph A. Cafazzo and Olivier St-Cyr in the Healthcare Quarterly 15 (Special Issue) April 2012: 24-29.doi:10.12927/hcq.2012.22845

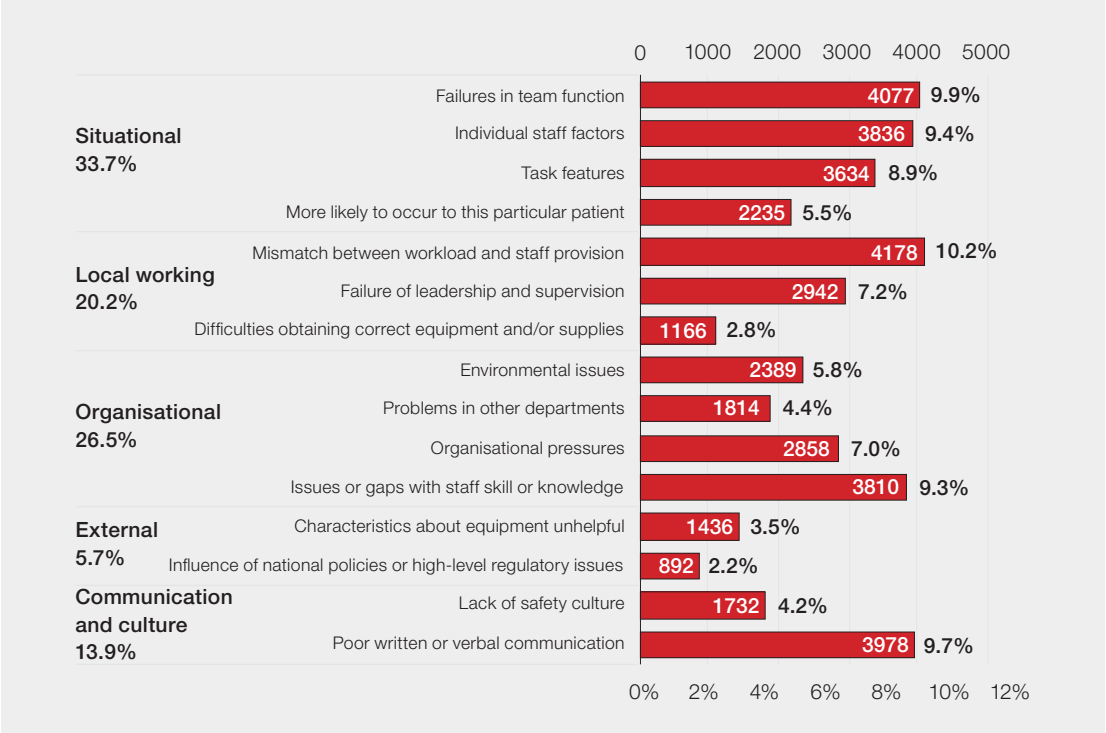
The hierarchy of intervention effectiveness (Figure 7.1) depicts a framework for ranking corrective actions by their effectiveness and deems person-based approaches, such as the use of checklists, policies, and reflection, as weaker than those targeted at the system level (Trbovich and Shojania 2017). Lower ranked interventions may have some value in mitigating errors, but with less impact than more robust systemic solutions, and this can be magnified if human-based interventions are used in isolation. For example, an IT system that forces functions to prevent an incorrect blood component being issued may feature high up on the hierarchy compared to human-based interventions. A multifactorial approach is often required to ensure a holistic approach to incident prevention.

Analysis of the SHOT HFIT

A total of 2908 error cases were included in 2022, which is a considerable increase in the error cases reported in 2021 (n=2569). Throughout SHOT's analysis of human factors, dating back to 2016, there has been evidence of an over-emphasis on individual behaviours, but 2022 has seen a move towards an improved appreciation of system and organisational factor (Figure 7.2).

Figure 7.2 shows an even spread of scoring across the breadth of factors, which is to be expected if all the factors contributing to SAE are examined during incident investigations. This supports the evidence that trying to assign a single root cause is not appropriate (Peerally et al. 2017).

Figure 7.2: Comparative total scores assigned for different system factors



SHOT HFIT has been updated in January 2023 and the need for scoring the factors has been removed. Further details comparing the scores assigned for each factor in 2022 and discussion can be found in the supplementary information on the SHOT website (https://www.shotuk.org/shot-reports/report-summary-and-supplement-2022/).

A recommendation was made in the 2021 Annual SHOT Report that 'a tried and tested human factors-based framework should be applied to incident investigations.' In 2022, 1947/2908 (67.0%) cases specified that HFE principles or a framework/model was used to investigate incidents and a further 428/2908 (14.7%) indicated they were planning to in the future. This is comparable to 2021 (70.0% used and 12.8% planning) but these figures therefore indicate approximately a third of cases might be investigated without a formal process to consider human factors. In 2022 an additional question asked which type of HFE framework/model was used and 1717/1947 (88.2%) of those using a framework/model provided some data. All ten answer options in the SHOT HFIT elicited at least one response,

but by far the biggest majority used the SHOT questions as a framework. The SHOT HFIT was not introduced as a validated incident investigation tool, but it was adapted from the YCFF (Improvement Academy 2023) which is an evidence-based framework, developed following a systematic review of 83 research studies about the causes of patient safety incidents (Lawton et al. 2012).

The top five frameworks/models can be seen in Figure 7.3, which shows that apart from using SHOT questions, in house methods including RCA, are the most commonly used, while specific human factors frameworks/models such as SEIPS (n=30/1717, 1.7%) and HFACS (n=1/1717, 0.1%) were rarely used. SEIPS is a model particularly well-suited to healthcare investigations (Holden et al. 2013) and forms the basis of the recently introduced PSIRF (NHSE 2022). HFACS has been shown to allow important insights into what investigators view as contributory factors (Peerally et al. 2022).

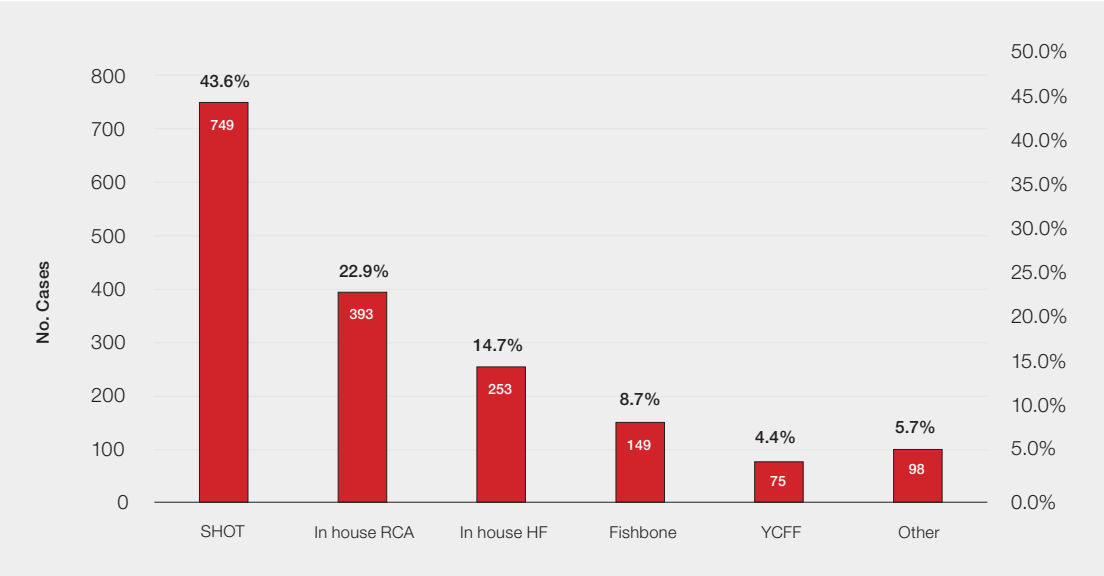


Figure 7.3: Top five human factors frameworks/ models used for incident investigation as submitted by SHOT reporters

RCA=root cause analysis; HF=human factors; YCFF=Yorkshire Contributory Factors Framework
Please note that this relates to individual reports and not organisations

The PSIRF has only recently been introduced, but this framework was selected as the model used in a handful of investigations (n=14/1717, 0.8%). This number is likely to increase as organisations transition from the previous NHSE Serious Incident Framework to PSIRF. A document has recently been released to answer questions regarding the recording, reporting and investigation of transfusion related adverse incidents in England following the introduction of PSIRF (see 'Recommended resources'). It remains important that SHOT-reportable incidents are fully investigated and in the case of MHRA-reportable incidents the BSQR requires an investigation of factors leading to the incident and appropriate CAPA (BSQR 2005). Further details can be found in Chapter 27, MHRA Report on Blood Safety and Quality Regulations (BSQR) in 2022.

Case 7.1: Incorrectly labelled sample used for urgent crossmatch during MHP

A patient with acute bleeding required an urgent red cell transfusion and the sample was accepted out-of-hours by BMS 1 who missed an incorrect date of birth. The sample was used for crossmatch during an MHP activation by BMS 2. The red cell units were issued and transfused to the patient. A second MHP activation was triggered for the patient and the same sample was attempted to be used by BMS 1 who noticed the sample discrepancy during the final check so repeat samples were requested.

The incident investigation identified multiple contributory factors: only one transfusion BMS was on duty out-of-hours, with increased workload pressures over recent months; staff sickness meant the laboratory was short staffed; a senior haematology BMS was covering the late shift; the BMS had covered numerous out-of-hours shifts in close proximity and was carrying out multiple duties in different departments. The incident occurred toward the end of a late shift when staff were tired. As part of the

HFIT on the SHOT database (Dendrite) reporters are asked: 'If you could change one thing to make this incident less likely to happen again, what would it be?' In this case the one thing stated was to increase staffing in the laboratory.

While all the contributory factors were identified including staffing issues, the CAPA actions identified were all at the lower end of the hierarchy of intervention effectiveness and centred around BMS 1 and BMS 2 undertaking reflection. If the staff member(s) made an error due to lack of understanding, that is a training issue and should not be resolved by 'reflection'. If there was no misunderstanding, then individual reflective learning is unlikely to prevent future incidents by the staff involved and may feel punitive. A review of staffing, rostering and recruitment was an additional action, but there were no higher-level escalation processes stated that could help with increasing staff in the laboratory, e.g., inclusion on the risk register, involvement of risk and governance departments or any mitigation for understaffing, such as restricting leave, altering workflow, or modelling how recruiting extra staff could affect managing the workload.

Learning point

- Close the loop by identifying all system and organisational factors that have contributed to an incident and ensuring appropriate CAPA are implemented promptly where possible, or recorded for continuous monitoring where resolutions are not immediately possible

Case 7.2: Incident action plan demonstrates a holistic approach

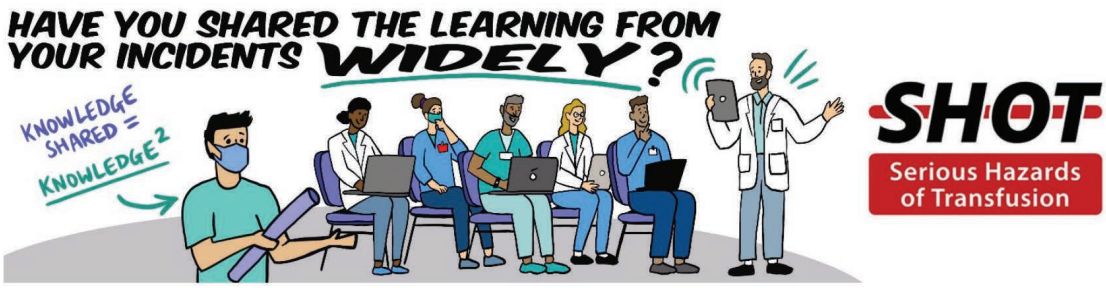
A unit of B D-negative red cells was transfused to the wrong recipient who was group O D-positive. Nurse 2 was asked by Nurse 1 to request collection of a unit of red cells. Nurse 2 requested a unit of red cells for Patient 2, but it was Patient 1 that required the transfusion. The unit arrived in the clinical area and was checked by two nurses outside of the single person room remotely from the bedside. It was then administered to Patient 1 without verbal confirmation. Patient 1's identification band had been cut off earlier in the shift to remove an arterial line. The nurses involved noted that after the COVID-19 pandemic more checks were being performed outside rooms, although at the time of this incident, neither patient was COVID-19 positive. The patient did not have any observable reaction nor evidence of haemolysis and the error was detected by laboratory staff who noticed mixed field reactions in ABO and D grouping tests post transfusion.

There were multiple contributory factors identified in the investigation report for this case. Staff were distracted by other tasks that were deemed to be of greater priority at the time. Nurse 1 was due their break and Nurse 2, who called the laboratory, was more familiar with Patient 2 whom they had been looking after. The incident report recognised that clinical handover with the potential for lost or misinformation, poses a risk. Patient 1 had had previous transfusions earlier in the week and Patient 2 also had blood available in the laboratory. Nurse 1 was familiar with Patient 1 and their familiarity resulted in a confidence that they knew the patient without having to check the ID band, unaware of the errors that had already occurred, because the red cell unit had not been checked at the patient's bedside. It was noted that COVID-19 changes had led to process drift and a culture of checking remotely from the patient had become accepted practice.

The investigation and action plan were comprehensive with a clear escalation process outside the local departments and plans for wider learning to take place. Completion dates were identified and person(s) responsible for each action. The focus was on wider preventative actions rather than the individual staff involved. In comparison to Case 7.1 there was no inclusion of reflection, but there were many SMART actions with clear description of how learning would be shared and fed back to the staff involved.

Learning point

- CAPA is enhanced if actions are SMART and demonstrate escalation beyond the local department



Conclusion

This chapter has highlighted the aim to see a reduction in adverse events that lead to patient harm, with an expected corresponding increase in reports of no-harm incidents, so that learning can continue to be gained from near miss events. See Figure 3.3 in Chapter 3, Headline Data. This outcome should be possible by using a tried and tested human factors-based framework to investigate incidents and thus using HFE principles to introduce CAPA that are at the more effective end of the hierarchy of intervention effectiveness (Figure 7.2).

Case 7.2 highlighted the problem of process drift due to changes introduced during the COVID-19 pandemic. Such drift can gradually become the norm, with systems drifting into failure (Dekker 2016). If the culture of departments is open-minded, this can be monitored actively by colleague observations, with associated discussion, about small changes from normal practice. In Chapter 5, Acknowledging Continuing Excellence in Transfusion (ACE), the concept of PACE is introduced, which can aid staff in communicating deviations from normal practice, especially if faced with a steep hierarchical gradient (see Figure 5.1).

It is constructive to see that there was a fairly even spread of scoring across the breadth of factors, which justifies the decision taken to remove the need for scoring since January 2023. A continued move towards investigating system and organisational factors, with an accompanying reduction in emphasis on staff blame would be welcomed.

Recommended resources

SHOT Videos: Human factors videos
https://www.shotuk.org/resources/current-resources/videos/

SHOT Bite No. 1(a) and 1(b): Incident Investigation
SHOT Bite No. 12: Cognitive Bias
https://www.shotuk.org/resources/current-resources/shot-bites/

SHOTcast: Human Factors
https://www.shotuk.org/resources/current-resources/shot-casts/

SHOT Webinar: Human Factors
https://www.youtube.com/watch?v=ie0UK9R5IbM

Yorkshire Contributory Factors Framework
https://improvementacademy.org/resource/yorkshire-contributory-factors-framework/

Human Factors in Healthcare AI
https://ergonomics.org.uk/resource/human-factors-in-healthcare-ai.html

Patient Safety Incident Response Framework (PSIRF)
https://www.england.nhs.uk/patient-safety/incident-response-framework/

NHS HEE Patient Safety Syllabus
https://www.hee.nhs.uk/our-work/patient-safety

NHS Patient Safety Syllabus training programme
https://www.e-lfh.org.uk/programmes/patient-safety-syllabus-training/

NHSE: A just culture guide
https://www.england.nhs.uk/wp-content/uploads/2021/02/NHS_0932_JC_Poster_A3.pdf

Case Study reworked using updated HFIT and SEIPS framework
https://www.shotuk.org/wp-content/uploads/myimages/HFIT-and-SEIPS-Supplementary-material-2020-.pdf

SHOT Human Factors Tuition Package
https://www.shotuk.org/reporting/human-factors-tuition-package/

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Trbovich P and Shojania KG. Root-cause analysis: swatting at mosquitoes versus draining the swamp. *BMJ Qual Saf*. 2017;**26**:350–353. doi: 10.1136/bmjqs-2016-006229.