Human factors in obstetrics

Paul Young
Kirsty Maclennan

Abstract

The importance of human factors is becoming increasingly recognized in the healthcare profession. Lack of situational awareness, poor communication and inadequate leadership compounded by unfamiliar teams in a rapidly deteriorating clinical situation put obstetric patients at particular risk. There is much to be learnt from other high-risk industries including aviation and the military. Increasing awareness and training in human factors and utilization of communication tools (such as SBAR) and prompts (including emergency checklists) can help to promote a safer environment.

Keywords Communication; ergonomics; error; human factors; multidisciplinary team; non-technical skills; patient safety

Royal College of Anaesthetists CPD Matrix: 1I02, 1I03, 2B05

Learning objectives

After reading this article, you should be able to:

- describe three different levels of situational awareness
- list five core competencies of good team working
- outline SBAR communication

Introduction

It is a widely held belief that in the near future, the advancement of medical practice will be impeded not by pharmaceutical developments or new surgical techniques, but by our abilities to work as an effective team. Industries such as aviation have long recognized the importance of human factor training. Human factor training, in the form of crew resource management training, is mandated for all crew members and flight followers by a federal aviation rule. The healthcare profession continues to learn from such industries.

'Human factors' and 'non-technical skills' are areas of patient care that have exploded into medical education, training, and the hospital workplace over the last 10 years, particularly in complex fields such as anaesthesia. The acceptance of potential pitfalls such as task fixation and poor communication have been highlighted in a number of recognized cases, not least that of Elaine Bromiley.[1]

Since then, multiple training courses in non-technical skills have been developed globally.[2,3] These skills are included as part of many medical and nursing college competencies.

There is an ever-increasing acknowledgement of the importance of human factors when working as a multidisciplinary team, during handovers, and while managing emergencies. All of these are constantly encountered in the obstetric arena.

Paul Young *BM BS is a Core Trainee in Anaesthesia on the North West Rotation, UK. Conflicts of interest: none declared.*

Kirsty Maclennan *MB ChB MRCP FRCA is a Consultant Obstetric Anaesthetist at St Mary's Hospital, Manchester, UK. Conflicts of interest: none declared.*

Emergencies in the delivery suite can be unpredictable, rapidly developing and life threatening. This is further complicated by having two patients, mother and baby, being cared for by an ever-changing multidisciplinary team.

Following on from The Confidential Enquiry into Maternal & Child Health (CEMACH) report,[4] which listed poor teamwork and communication as contributory factors in poor outcomes, and the Clinical Negligence Scheme for Trusts (CNST) recommendations, simulations and 'fire drills' have been widely taken up by obstetric units throughout the country. Various courses such as PROMPT (PRactical Obstetric Multi-Professional Training), Maternal AIM (Acute Illness Management), and other local courses[5,6] have been set up to tackle clinical management of certain emergency obstetric scenarios. However, less emphasis has been placed on the non-clinical elements of safe patient care.

Errors/patient safety

> *to err is human* (Alexander Pope, 'Essay on Criticism').

Reason (1990) described a Swiss Cheese Model of why errors occur[7] and methods we can use to prevent them. Each layer of cheese is a level of protection against error, but each layer has holes, also termed 'latent conditions'. Errors can 'slip through' these holes. This could include low staffing levels, unfamiliar environments and poor training.

> *If latent conditions become aligned over successive levels of defence they create a window of opportunity for a patient safety incident to occur*[7] (Figure 1)

What are human factors?

Human factors, non-technical skills and ergonomics are all terms that are used to describe factors that can impact patient safety, but are not expressions that are easily definable. The International Ergonomics Association Council has adopted the following definition:

> *Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.*[8]

These terms therefore encompass a wide range of dynamics, including interfaces between humans, equipment and the workplace, interactions between team members, and also individual behaviours. These latter elements can be thought of in

Swiss cheese model showing alignment of latent errors

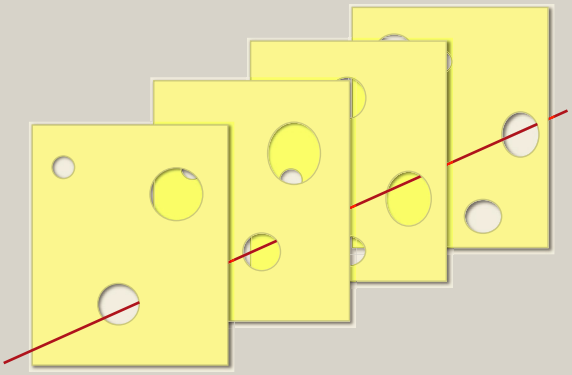

Figure 1

terms of cognitive (situational awareness, decision-making) and social (team-working, task management) components.

Why are human factors important?

The aims of studying these factors are to improve patient safety, healthcare professional performance, and the environment. This is one reason why critical incident reporting and analysis is essential in healthcare, as it may help us to implement new or adapt current systems to prevent or reduce future harm.

Russ et al.[9] describes the importance of human factors awareness (Box 1).

Cognitive elements

Situational awareness describes how we monitor a process. It encompasses how we notice what is happening, why it is happening, and understand the effects that those events may have.[10] This has been explained by Endsley (1995 — accessed from [10]) (Table 1).

There is a limit to the volume of information that a person is capable of registering and processing. This available mental capacity has been termed 'bandwidth'. Delegation of tasks to members of the team helps to clear some of the information, thereby reducing bandwidth overload.

Orasanu & Fisher divided decision making into two stages:[11] identification of the problem and deciding on a management plan. Multiple factors, including the experience of the operator and the type and urgency of the situation, will determine the decision-making mode of a clinician (Box 2).

Situational awareness

Situational awareness	Meaning in brief	Displayed action	Example
Level 1	What?	Perception/ Information gathering	CTG is not normal
Level 2	So what?	Comprehension/ Recognizing and understanding	This could mean that the baby is becoming acidotic. Share the information you have gathered
Level 3	What now?	Projection or anticipation	Anticipate that the team may want to do a fetal blood sample. Think … Is the epidural working well? Is theatre free if there is a need to perform an operative delivery?

Table 1

Social aspects

The concept of a team leader in emergency medical situations is often more fluid than in day-to-day work. In cardiac arrests, an ideal team leader has been identified as: *'easily identifiable … with good communication skills, the ability to distribute tasks, gather information and maintain an overview without getting involved in practical tasks'*.[12]

An effective team requires many different qualities, which have been theorized in different ways by many people. One example is the 'Big Five Model'. This suggests five core competencies for good teamworking.[13] (Box 3).

Another important technique that has been used for many years in the aviation industry is having a shared mental model. To use an obstetric example, a midwife caring for a hypertensive parturient that begins fitting, activates an emergency alarm. On arrival of the emergency team, the midwife shares her mental model: 'this is likely to be an eclamptic seizure'. By sharing her mental model, the team are able to rapidly work towards a

The importance of awareness of human factors[9]

- Understand why healthcare staff make errors and in particular, which 'systems factors' threaten patient safety
- Improve the safety culture of teams and organizations
- 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 can help to lessen the likelihood of patient harm.

Box 1

Decision-making modes

- *Recognition primed* — The clinician draws on their own previous experience
- *Rule based* — The clinician's decisions are guided by the use of available pathways and protocols
- *Analytical* — The clinician's decisions are made following comparison of different options to best fit the situation
- *Creative* — The clinician finds new ways to deal with a problem, or thinking through options to manage an unfamiliar situation

Box 2

Five core competencies for good team working[13]

- Team leadership
- Mutual performance monitoring
- Backup behaviour
- Adaptability
- Team orientation

Box 3

common goal of providing resuscitation while preparing magnesium sulphate to control the seizure.

The use of emergency checklists also helps to reinforce a shared mental model. In order to determine specifically which emergency checklist to use, the leader needs to declare the emergency. At this point, it is important that team members feel empowered to challenge this mental model if they have reasons to believe it is wrong. In addition to aiding verbalization of actions by the team, checklists also help to coordinate the activities of the team, reducing missed steps and preventing duplication of work during the management of emergency situations.[14]

The ANTS training scheme[2] for anaesthetists concentrates on the following areas of task management in their observation and rating scale:

- planning and preparing
- prioritizing
- providing and maintaining standards
- identifying and utilizing resources.

Communication

Handovers between staff occur frequently in the delivery suite, both at shift changes and between different professionals. Poor communication has been highlighted in various maternity reports as a potential causal factor in a number of untoward incidents.[15] Handover is an essential time when critical information can be missed.

A number of tools have been developed to try and minimize these risks and use of these tools is a specific criterion in recent Clinical Negligence Scheme for Trusts (CNST) risk management standards.[16] The most commonly used of these is the SBAR tool.[17] (Box 4).

A number of communication aids used in military and aviation practice are equally relevant to obstetric practice. For example, the use of sit-reps (situational reports) whereby the leader uses brief, regular, structured situational reports to update the team, aid in information sharing. Furthermore, a 'sterile cockpit', mandating cessation of all non-essential talking at the time of specific high-risk tasks (e.g. during rapid sequence induction), also aids team identification and communication of problems.[21]

Any member of the team should feel able to ask for a pause if they are unsure what is happening or if communication breaks down. In our institute we are encouraging the use of our mnemonic: ASK. A — ask for a pause; S — share your mental model; K — keep communication closed loop.

Closed-loop communication has been described as a method of aiding task-performance in a team. This technique requires a specific communication pattern:

Example of SBAR communication

Situation	Hi, I am the shift co-ordinating midwife. Mrs X in room 5 is having a significant PPH
Background	Mrs X is a primip who is normally fit and well. She has been in labour for 20 hours. She has delivered a 4.5 kg baby in the room 5 minutes ago.
Assessment	She is now tachypnoeic with a respiratory rate of 28, tachycardic at 120 bpm and hypotensive at 70/45 mmHg. We estimate she has lost approximately 1 litre of blood. The placenta is intact, there are no perineal tears but she has an atonic uterus.
Recommendation	Please can you come immediately to room 4 to assist with her management. I shall start IV fluids and commence bimanual compression.

Box 4

- The *sender* of information requests an action of the *receiver*.
- The *receiver* repeats the requested action back to the *sender*.
- The *sender* confirms that this information has been received correctly.
- The *receiver* then carries out the task and informs the *sender* when complete.

Use of this form of communication enables clarification, declaration of team member competence (or lack of), alerts the team to the fact that task has been allocated, and prevents duplication of tasks.

Why are human factors especially important in the delivery unit?

Obstetric emergency response teams are a rapidly assembled group of healthcare professionals working together to achieve optimum maternal and neonatal outcomes. Obstetric emergencies are often rapidly progressing and require effective coordination of a large group of trained personnel to achieve a positive outcome. The ever-changing combination of personnel within this team precludes individual team training, but with meticulous attention to human factors, this 'flash team' can work efficiently and effectively.

On examination of 10 years of incidents, the NHS Litigation Authority (NHSLA) found that clinical negligence claims for maternity services remain the highest cost and second highest frequency of all specialities in the UK.[18] Human factors have been specifically implicated as causative factors in many cases reported to the most recent MBRRACE-UK (Mothers and Babies: Reducing the risk through audits and Confidential

Enquiries across the UK), particularly those involving massive haemorrhage and anaesthetic complications, with failings in communication and teamwork emerging in almost every chapter.[19] Similarly, The Each Baby Counts report highlighted a breakdown in communication, team working, and human factors as key reoccurring contributors to neonatal morbidity and mortality.[15] Communication has also been a theme running through previous CMACE (Centre for Maternal and Child Enquiries) and CEMACH reports. Finally, an investigation by The King's Fund into failings in maternity care highlighted team working and communication as key areas that could be improved.[20]

How can we implement these skills in the delivery suite?

Historically, medicine has been hierarchical, with consultants at the peak of this pyramid of professionals. However, after learning from other potentially high-risk professions such as the aviation industry, this hierarchy is slowly being flattened, particularly in emergency situations. In high-pressure situations, any healthcare professional should feel able to state their observations and give their opinions, going someway to protecting against the pitfall of task fixation. Providing human factor training for all staff, preferable in a multidisciplinary forum, will promote better team understanding and functionality.

The importance of communication is paramount. Having communication tools such as SBAR as the institutional norm enables healthcare professionals to respond appropriately and swiftly.

Easy access to emergency checklists for common emergencies (such as post partum haemorrhage, shoulder dystocia, failed obstetric intubation etc.) will encourage verbalization of mental models and help to reduce errors in parturient management.[14]

In-situ, multidisciplinary simulation training is becoming more and more common, particularly in maternity with nationally recognized courses.[5,6] Scenarios are typically designed to test clinical knowledge and decision making, but these scenarios should be expanded to practice team-working and leadership skills, techniques such as closed-loop communication, and learning the roles of other professionals within a team. In our institute, we undertake regular simulations within the delivery suite, involving colleagues from anaesthesia, obstetrics, midwifery, and neonatology.

Conclusion

With the ever-increasing size and complexity of the obstetric population, exemplary human factors are essential for the safe coordination and delivery of care. ◆

REFERENCES

1 Harmer M. Independent review on the care given to mrs elaine Bromiley on 29 march 2005. 2007, http://www.chfg.org/resources/07_qrt04/Anonymous_Report_Verdict_and_Corrected_Timeline_Oct_07.pdf (accessed 27 April 2015).

2 Fletcher G, Flin R, McGeorge P, Glavin R, Maran N, Patey R. Anaesthetists' Non-Technical Skills (ANTS): evaluation of a behavioural marker system. *Br J Anaesth* 2003; **90:** 580–8.

3 Yule S, Flin R, Paterson-Brown S, Maran N, Rowley D. DeMed Educvelopment of a rating system for surgeons' non-technical skills. *Medical Education* 2006; **40:** 1098–104. 2006.

4 The Seventh Report on Confidential Enquiries into Maternal Deaths in the United Kingdom. In: Lewis G, ed. The confidential Enquiry into maternal and Child Health (CEMACH). *Saving mothers' lives: reviewing maternal deaths to make motherhood safer - 2003-2005.* London: CEMACH, 2007.

5 Draycott T, Sibanda T, Owen L, et al. Does training in obstetric emergencies improve neonatal outcome? *Br J Obstet Gynaecol* 2006; **113:** 177–82.

6 Siassakos D, Hasafa Z, Sibanda T, et al. Retrospective cohort study of diagnosis–delivery interval with umbilical cord prolapse: the effect of team training. *Br J Obstet Gynaecol* 2009; **116:** 1089–96.

7 Carthy J, Clarke J. The 'how to guide' for implementing patient safety. 2009. Patient Safety First, www.patientsafetyfirst.nhs.uk (accessed 15 March 2015).

8 Institute of ergonomics and human factors. 2000, http://chfg.org/definition/towards-a-working-definition-of-human-factors-in-healthcare (accessed 15 March 2015).

9 Russ AL, Fairbanks RJ, Karsh B-T, Militello LG, Saleem JJ, Wears R. The science of human factors: separating fact from fiction. *Qual Saf Health Care* 2013; **00:** p1–7.

10 Methods and Measures Working Group of WHO Patient Safety. Human factors in patient safety, review of topics and tools. 2009. World Health Organization, http://www.who.int/patientsafety/research/methods_measures/human_factors/human_factors_review.pdf.

11 Flin R, Youngson G, Yule S. How do surgeons make intraoperative decisions? *Qual Saf Health Care* 2007; **16:** 235–9. 2007.

12 Andersena PO, Jensena MK, Lipperta A, Ostergaard D. Identifying non-technical skills and barriers for improvement of teamwork in cardiac arrest teams. *Resuscitation* 2010; **81:** 695–702.

13 Salas E, Sims DE, Burke CS. Is there a "big five" in teamwork? *Small Group Res* 2005; **36:** 555–99. Read in: Wacker J & Kolbe M (2014) Leadership and teamwork in anesthesia. Making use of human factors to improve clinical performance, Trends in Anaesthesia and Critical Care, 4, p200-205.

14 Arriaga A, Bader AM, Wong JM, et al. Simulation-based trial of surgical-crisis checklists. *N Engl J Med* 2013; **368:** 246–53.

15 Royal College of Obstetricians and Gynaecologists. Each baby Counts: 2018 progress report. London: RCOG, 2018.

16 Clinical Negligence Scheme for Trusts. Maternity. Clinical Risk Management Standards. Version 1. 2013/14. http://www.nhsla.com/Safety/Documents/CNST%20Maternity%20Standards%202013-14.pdf accessed 17/11/15.

17 Haig KM, Sutton S, Whittington J. SBAR: a shared mental model for improving communication between clinicians. *Jt Comm J Qual Patient Saf* 2006; **32**(9)**:** 167–75.

18 NHS Litigation Authority. Ten years of maternity claims: an analysis of NHS litigation authority data. 2012. London, http://www.nhsla.com/safety/Documents/Ten%20Years%20of%20Maternity%20Claims%20-%20An%20Analysis%20of%20the%20NHS%20LA%20Data%20-/%20October%202012.pdf (accessed 17 November 2015).

19 on behalf of MBRRACE-UK. In: Knight M, Kenyon S, Brocklehurst P, Neilson J, Shakespeare J, Kurinczuk JJ, eds.

Saving lives, improving mothers' care – lessons learned to inform future maternity care from the UK and Ireland confidential Enquiries into maternal deaths and morbidity 2009–12. Oxford: National Perinatal Epidemiology Unit, University of Oxford, 2014.

20 Thomas V, Dixon A. Improving safety in maternity services: a toolkit for teams. The King's Fund, London 2012, 2012.

21 Mercer S, et al. Human factors in complex trauma. *BJA Educ* 2015; **15:** 231–6.

