

Review

Simulation-based Education and Human Factors Training in Postgraduate Medical Education: A Northern Ireland Perspective

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ABSTRACT

With their potential to improve patient safety, simulation based education (SBE) and human factors training are gaining momentum across the spectrum of medical education. There are ever increasing drivers for their integration, in particular within the postgraduate arena. This article aims to provide an overview of both simulation based education and human factors training. The breadth of terminology can be bewildering and our target audience is novice or developing practitioners and policymakers. We focus particularly on a regional setting where the Northern Ireland Simulation and Human Factors Network (NISHFN) is working to advance the field.

Key Words: Simulation; Simulation-based education; Human factors

INTRODUCTION

Medical skills and procedures have traditionally been learnt on real patients, but with the advent of new technology it is possible for trainees to practise and master their skills in safe, simulated environments¹. Simulation is already used as a training tool in many high-reliability industries such as aviation and the military. Its relevance to healthcare relates to an improved learning experience for the trainee which can improve patient safety. Simulation-based education (SBE) is also being used to improve learning from adverse incidents to try and prevent mistakes from recurring. Undergraduate medical education has increasingly moved away from the traditional caricature of “see one, do one, teach one” with simulated venepuncture, cannulation and suturing taking place prior to a student attempting such procedures on a real patient.¹ Similarly, in postgraduate medical education, honing technical skills requires deliberate practice and as it has often been said, “The more I practice, the luckier I get”². We will start by introducing the concept of simulation and establishing some key nomenclature used in the field before setting it in the Northern Ireland context.

WHAT IS SIMULATION?

Simulation has been defined as “a technique—not a technology—to replace or amplify real experiences with guided experiences that evoke or replicate substantial aspects of the real world in a fully interactive manner”³

A number of misconceptions arise concerning which activities constitute ‘simulation’. Many clinicians still think it refers only to interactions with plastic manikins. Simulation

can refer to human cadavers, simulated patients, screen-based simulation, part-task trainers or even virtual reality⁴. For example, in Northern Ireland there has been a recent communication course for post-graduate paediatric trainees on enhanced communication skills where the School of Drama at Queen’s University Belfast provided students as simulated patients.



Fig 1. Postgraduate trainees practising surgical cricothyroidotomy on a task simulator.

Simulation-based education (SBE) has an important role to play as part of a blended approach to learning. The General Medical Council (GMC) document, *Promoting excellence:*

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Standards for medical education and training requires that, “postgraduate training programmes must give doctors in training the opportunity to develop their clinical, medical and practical skills and generic professional capabilities through technology enhanced learning opportunities, with the support of trainers, before using skills in a clinical situation”⁵.

Simulation training is often classified as either high or low fidelity; where fidelity refers to how closely the simulation resembles the actual situation being replicated. There are three categories of fidelity: environmental, equipment and psychological. Environmental fidelity refers to the situation in which the simulation takes place, equipment refers to how closely any tools resemble what is used in clinical practice and psychological fidelity is how faithfully the simulation mimics the emotional and behavioural aspects of the real situation.⁶

It is also useful to consider the importance of realism, “the extent to which the simulation feels and/or behaves the same way as the real-life system”⁷. This can be thought of with regards to physical realism, how much it appears to be a real-life patient, semantic realism, which addresses whether the scenario would play-out like this in the real world and phenomenological realism which refers to how the candidate feels in the scenario. Through a qualitative research study with medical students and post-graduate trainees, Owen discovered that it is issues with semantic realism which are the most poorly tolerated *e.g.* the sequencing of events in the scenario, availability of help and acting out of role⁷. This is important information for educationalists to bear in mind when designing simulation scenarios.

SIMULATION-BASED EDUCATION: TECHNICAL AND NON-TECHNICAL SKILLS

One widely employed SBE technique used to develop technical skills (for example chest drain insertion) is mastery learning. This technique can be used to ensure that each learner reaches a predetermined level of proficiency before progressing, although it is recognised that the time taken to reach this required level will vary depending on the individual. A disadvantage of this process is that it takes considerable faculty time to determine a systematic and validated minimum standard⁸. Consideration should also be given to ensuring the opportunity for *repetitive practice*, which has been shown to produce skill acquisition in shorter time periods than exposure to routine ward work⁹. Eight other aspects have been shown to be important when using simulation as an educational tool; curriculum integration, range of difficulty, being aware of multiple learning strategies *i.e.* different group sizes or with or without an instructor, clinical variation, a controlled safe learning environment, individualised learning, defined outcomes and validity⁹.

SBE has a huge potential to improve skills such as teamwork and communication (conventionally referred to as ‘non-technical skills’) and to identify latent threats in a clinical environment. Simulation provides a unique opportunity for

inter-professional training in a safe learning environment as well as the opportunity to receive immediate feedback from other professionals on the faculty. The relationship between non-technical skills and patient safety is highlighted in the GMC Generic Professional Capabilities Framework which states that doctors in training must understand basic human factors principles and practice at individual, team, organisational and system levels and understand the importance of non-technical skills¹⁰.



Fig 2. Photograph taken at the NISHFN Autumn Conference and published with permission from CAE healthcare. Products featured (left to right): Human worn partial task surgical simulator (cut suit), Replay audio-visual tool used for debriefing, Apollo patient simulator.

DEBRIEFING AND FEEDBACK

It is vital to highlight that SBE acts as an adjunct to clinical experiences and should never be viewed as a replacement. Scenarios must be linked to the curriculum and suitably debriefed to ensure that specific learning outcomes are achieved. Without structured post-event reflective processes the participant’s learning is largely left to chance⁸. Structured debriefing affords the opportunity to explore the candidate’s pre-existing knowledge and to understand the reasons behind any deviation from expected practice. To be most effective SBE feedback should follow the three Ps; the learning outcomes of the session are **p**lanned, the candidates are **p**repared that they will receive feedback in the “safe” environment and finally feedback is **p**rovided. A wide range of debriefing models already exist but dedicated training in debriefing techniques for simulation faculty is of critical importance (8). Previously in Northern Ireland training in debriefing skills has largely been from personal study of the literature and experiential learning gained by observation of skilled faculty. The Northern Ireland Simulation and Human Factors Network (NISHFN) has developed a Faculty Development Course to introduce structured training in debriefing skills.

STATIC CENTRE VS IN-SITU SIMULATION

Releasing staff from their clinical duties to attend simulation training in static training settings has inherent time constraints and *in-situ simulation* has evolved in response



to this challenge. In-situ simulation is a training experience that takes place in the actual clinical environment¹¹. This allows the clinical team as well as the system processes and environment to be observed. Such an approach is not without challenges; technical issues, timing of the simulation (being considerate of times of particular clinical pressure) and showing consideration to other patients and families¹¹. In addition, in-situ SBE must not tie-up vital resources that might be required to address real clinical events. Good advance planning, communication and organisation are vital to the success of this educational approach.

HUMAN FACTORS

Human factors training is based on optimising performance through better understanding of the behaviours of individuals and the way they interact with their environment¹². In 2007 Martin Bromiley, an airline pilot whose wife died due to an anaesthetic patient safety incident which had human factor causes, established the Clinical Human Factors Group¹³. A multitude of systems models have been developed in an attempt to explain the complex relationship that exists between human factors and the patient. The World Health Organisation (WHO) identified ten human factor topics most relevant for patient safety; safety culture, manager's leadership, communication, teamwork –structure/processes and team leadership, situational awareness, decision making, stress, fatigue and work environment¹³. There is a clear relationship between SBE deliberate practice, communication skills and enhanced team working. The simulated clinical environment allows the candidate the opportunity to practise decision making and be critiqued on their situational awareness in a safe environment. Communication failure is one of the recurrent themes in adverse events in the healthcare setting; an awareness of human fallibility has allowed the development of systems and processes designed to address some of these issues e.g. the WHO surgical safety checklist¹⁴.

THE NORTHERN IRELAND PERSPECTIVE

In 2015, the Northern Ireland Medical and Dental Training Agency (NIMDTA) appointed a Simulation Lead and Simulation Fellow, as part of the ADEPT Clinical Leadership Fellows' programme¹⁵ and this development has helped facilitate the development of the Northern Ireland Simulation and Human Factors Network (NISHFN). This organisation aims to support and connect individuals with an interest in simulation and human factors training.

We have already established the importance of debriefing and in Northern Ireland there has been a regional push towards developing a structured approach to de-briefing based on and with the permission of the Scottish Centre for Simulation and Clinical Human Factors model.

When it comes to reviewing adverse incidents, simulation and human factors training can be used to replicate the event in question with the explicit aim of extracting learning points and developing recommendations to help prevent future recurrence. Identifying individual, or indeed recurrent

patterns of adverse events, enables the development of remedial training approaches to be integrated into regular simulation programmes to assist in the dissemination of learning¹⁶. A regional example of this is seen in the Royal Belfast Hospital for Sick Children where scenarios based on local adverse events have been introduced to the paediatric in-situ simulation programme¹⁷. This is not unique to this department and the use of SBE and human factors training to assist in learning from serious adverse incidents is a key part of the vision that the NISHFN has for healthcare education in Northern Ireland.



Fig 3. Anaesthetic trainees experiencing the blended approach to learning through SBE with faculty observing them demonstrate their clinical knowledge as well as non-technical skills such as teamwork and communication.

There is increasing evidence that in-situ simulation has the potential to identify latent threats in the clinical environment¹⁸. In Northern Ireland in-situ simulation is ongoing in all five Acute Trusts and has been integrated into the clinical governance programme in the Northern Trust.

The Northern Ireland healthcare system, like many other regions, suffers from acute financial pressures. SBE is associated with the use of resources in terms of equipment, faculty-training and time away from clinical work. A recent article published in *BMJ Open* highlights that many SBE studies of effectiveness rarely report costs. Researchers are becoming increasingly aware of the need to look at the cost-effectiveness of SBE and a study has recently been approved to look at effectiveness *and* cost-effectiveness of SBE in preventing falls in hospitalised patients. The authors suggest that this will be the first trial to provide an economic evaluation of SBE for a patient safety outcome¹⁹. In times of limited resources in the NHS it is worth being cognisant of this relationship between the cost of training aligned to potential improvements in patient safety.

One of the potential pitfalls when using simulation-based education is in reverting to a 'one size fits all approach'. Feedback analysis following an anonymous survey of medical trainees in Northern Ireland revealed one trainee who wrote, "Personally I don't think simulation training works for me..."

I dread the thought of it"²⁰. Another theme that emerged from this report was the potential for disruption of clinical work during in-situ simulation, especially if performed out-of-hours²⁰. It is critically important that patient safety is not compromised and that arrangements are made in advance for the provision of suitable cover for the clinical environment.



Fig 4. Candidates at a SBE course experiencing communication and decision making in a simulated emergency.

CONCLUSION

There is a growing body of evidence that SBE can have a direct impact on patient safety. This is evident in the published literature including but in no way limited to; improvements in medication administration errors following simulation training²¹ and reduction in complications following central line insertions²². Debriefing focussing on human factors could help to create an open culture and train professionals to discuss near misses, mistakes and adverse events which could have direct implications on patient safety⁴. This is an area of research that may be of increasing interest to healthcare professionals in Northern Ireland.

Recent reports from the GMC and Department of Health make the incorporation of such approaches a priority. There will be an increased drive for integrating simulation-based education and human factors training into both undergraduate and postgraduate healthcare training. The current developments in these areas create an exciting challenge for everyone involved in healthcare education in the region. The NI Simulation and Human Factors Network looks forward to assisting interested stakeholders support and develop simulation and human factors training across Northern Ireland in the coming years.

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