An evaluation of high fidelity simulation using a human patient simulator in a new Diploma in Military Medical Care

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Abstract

Introduction The use of simulation in healthcare education has been extensively embraced over the past 20 years. It enables deliberate practice, and it allows immersion in learning tasks. It enables tasks to be structured in staged learning chunks, and provides a controlled environment in which it is safe to learn from errors.

Objectives To evaluate the views of Irish Defence Force personnel participating in their first exposure to the Human Patient Simulator (HPS) in high fidelity simulation scenarios with respect to its relevance, applicability and acceptability as part of the Diploma in Military Medical Care.

Method Following participation in scenarios using the HPS the trainees were then invited to complete a voluntary and anonymous evaluation of the training. They were asked to provide free text written comments to seven open-ended questions and rate ten statements on a seven-point Likert scale.

Results The trainees' responses were overwhelmingly positive for their perceived value of the simulation training, relevance, spacing, teaching resources and level of the content.

Conclusion On the basis of participants' judgment, this study has indicated that the use of the HPS in high fidelity simulation is relevant, applicable and acceptable to Irish Defence Force personnel.

Key Words Military, Medics, Simulation, Education, Training.

Introduction

The use of simulation in healthcare education has been extensively embraced over the past 20 years[1]. This represents a change from the long held traditional use of real patients in healthcare education. There have been many drivers of this change including decreased risk to patients and insurance that the learning outcomes are addressed. It enables deliberate practice, and it allows immersion in learning tasks. It enables tasks to be structured in staged learning chunks and provides a controlled environment in which it is safe to learn from errors[2].

Simulation has been defined as

"..a technique, not a technology, to replace or amplify real experiences with guided experiences, often immersive in nature, that evoke or replicate substantial aspects of the real world in a fully interactive fashion. "Immersive" conveys the sense that participants have of being immersed in a task or setting as they would if it were the real world"[3].

Simulation produces an environment in which learners can successfully master the skills relevant to clinical practice without undue risk to the learner, other staff members or to the patient. It also permits errors of either diagnosis or management to be allowed to develop and be followed through to their natural conclusion. Technology-enhanced simulations, when supplementing traditional teaching methods, are associated with improved learning outcomes in terms of knowledge, skills and attitudes[4]. Computer-enhanced life-sized mannequins have become an integral part in the development of simulation, including the highly sophisticated Human Patient Simulator (HPS). There is a potential for significant learning from error in simulation, and this learning can be transferred to the workplace without harm to either the patient or the healthcare provider[5,6].

The School of Medicine at University College Cork has established a new Diploma of Military Medical Care in partnership with the Academy of Emergency Care Cork University Hospital and the Irish Defences Forces Medical School. In this paper we wish to report an evaluation by Irish military personnel to their first exposure to a Human Patient Simulator as part of their training to become emergency medical technicians (EMT), a core component of the Diploma in Military Medical Care.

Background

High-fidelity simulation is increasingly seen as a training method to improve clinical skills and patient safety across a wide spectrum of disciplines and specialities within many healthcare domains[7,8,9]. The modern era of healthcare high-fidelity simulation incorporating human factors science, and crisis resource management was adapted from high-risk industries, such as nuclear, petro-chemical and aviation[10,11]. This was led and pioneered in the field of anaesthesia in the early 1990's[12,13]. Although unequivocal proof of long-term improved patient outcome has not yet been established, its high face validity has seen this educational strategy spread throughout the modern healthcare system[3].

Much is written in the literature regarding the application of high fidelity simulation to anaesthesia, obstetrics, intensive care, paediatrics, emergency medicine and the operating theatre[14]. However, there is little in the literature regarding the use of the high fidelity HPS for the training of pre-hospital healthcare providers and/or military medics. Traditionally simulation provided to pre-hospital healthcare providers has focussed on skill acquisition through the use of part-task trainers and not high-fidelity team-based training[15]. At other times in has been used as a method of assessment as part of objective structured clinical examination[16].

The UK defence forces have developed a sophisticated pre-deployment simulation exercise to mimic a battlefield hospital in its entirety. There are several layers to the simulation: micro-simulations of patient scenarios focussing on the technical skills of individuals; meso-simulations focussing on teamwork often with multiple patients; to macro-simulation focussing on the organisational fitness for purpose of the battlefield hospital[17,18]. High-fidelity medical simulation is also gaining popularity in the USA, in Australia, Israel, Chile and Germany. NATO Centre of Excellence for Military Medicine in Hungary has begun using high-fidelity simulation since 2011 in their pre-deployment of NATO troops[19].

However, at present mostly what is reported on military medical simulation is either battlefield casualty simulation, computer-based simulation or task-training simulation. Those that report on high-fidelity human patient simulation in military medicine focus on training for specific problems such as exposure to chemical agents[20] and haemorrhage in the battlefield[21]. These are problems that most civilian pre-hospital care providers would rarely, if ever, face, but are certainly beneficial to those working in the defence forces.

The needs of the Irish defence forces may differ somewhat from other defence forces that have reported on their use of simulation.

The Irish Defence Forces overseas activity primarily focuses on the United Nations international peacekeeping and humanitarian missions. Therefore Irish Defence Forces military medics may sometimes face many of the common problems that their civilian counterparts are exposed to, such as assessing and managing common respiratory and cardiac problems. It is envisaged that our Irish Defence Forces trainees will have expanded roles beyond that of combat medical technicians, and engage in a diverse range of military medical activities both at home and abroad, such as military occupational health and assisting the Medical Officer with assessment, diagnosis and management of both civilian and medical personnel. Deployment of Irish Defence Forces will be enhanced by incorporating the university awarded diploma of military medicine trained medics on deployment , as they will have received expanded training beyond that of combat medical technicians within the diploma. This allows for an expanded role with the health issues found in the civilian population during any humanitarian crisis, and also in occupational health. Within the Diploma of Military Medical Care, trainees have been given additional training in spirometry, audiometry, phlebotomy and visual acuity testing for this expanded occupational health role.

On completion of their training, trainees will acquire both a Pre-Hospital Emergency Care Council (PHECC) registered EMT qualification along with a Diploma in Military Medical Care. To our knowledge, this is the only University-based programme of this kind in the world. This course allows for professional career progression that encompasses the equivalent civilian qualification. To qualify for EMT registration with PHECC, healthcare providers must follow a standardised course, with set learning objectives and clinical placements[22]. The EMT course has been developed mainly for civilian healthcare providers and is the first of three modules of the diploma course. This module focuses on teaching and learning to qualify for EMT registration. During this module trainees were exposed to various clinical placements in the military, civilian hospitals and the National Ambulance Service.

We introduced simulation-based learning following the last rotation of clinical placements. The aim was to consolidate the learning including skills training that had taken place in the classroom and in the clinical placements. This was an opportunity for the trainees to contextualise these skills and learning, and allows them engage in experiential learning,

which has meaning and relevance to their everyday work[23,24]. The introduction of HPS simulation at this point in the curriculum was to ensure that the trainees had sufficient medical knowledge and skills sets, onto which the military specific learning could be added. Competency was assessed in summative format at completion of training using various methods including an Objective Structured Clinical Examination (OSCE) with stations based on the scenarios.

Aims

We wished to undertake an evaluation of Irish Defence Force personnel participating in their first ever exposure to the HPS in high fidelity simulation scenarios as part of the Diploma in Military Medical Care. We wished to explore their views with reference to the acceptability, relevance and applicability of the HPS to their training for the Diploma of Military Medical Care.

Context

Ten trainees were drawn from the Army, Navy and Air Corp as the first cohort of the Diploma in Military Medical Care. This number will increase incrementally over a 4-year period in order to train 70 combat medical technicians. None of the trainees had engaged in any military medical training other than the universal occupational first aid award[27]. None of the trainees had previously completed a third level higher education award. One trainee had successfully completed the PHECC NQEMT (National Qualification in Emergency Medical Technology) award previously, and another had just begun similar training with a voluntary organisation at enrolment in the Diploma. The simulated scenarios were designed to incorporate a high degree of fidelity and relate to the everyday work of an EMT. The technical learning objectives were mapped from the PHECC EMT Clinical Practice Guidelines, which set the standards for pre-hospital patient management protocols, algorithms, and guidelines in Ireland[22]. These learning objectives correlated well with NQEMT OSCE assessment with which the trainees will have to pass to qualify for their NQEMT award.

Safe patient outcomes rely not only on competent technical skills but also on communication, teamwork, leadership, delegation, situational awareness, use of all resources and forward planning[25,26]. Human factors science and crisis resource management incorporated into simulation training allow the practice of communication and teamwork skills which are essential in the provision of safe care[8,28]. In healthcare 70% of all adverse incidents relate to communication and teamwork failure[6]. Therefore non-technical learning objectives were incorporated into the simulation training and focussed on communication, teamwork, leadership, delegation and situational awareness, use of all resources and forward planning . The simulation training was designed for learning and not as an assessment; a departure from traditional pre-hospital training which has focussed mainly on the acquisition, testing and assessment of technical skills[16].

Design of simulation

Orientation to the simulation included a pre-briefing and familiarisation session in the morning before the simulations began . All trainees were orientated to the simulated environment, equipment and simulator. The participants were briefed on what to expect and what was expected from them during the simulation training. The actual scenarios were not disclosed to the trainees. Trainees were informed the training was not an assessment of any kind and was a safe environment where errors may and probably will occur[1].

The students worked through scenarios in pairs and each student was exposed to two scenarios, which focussed on patient assessment and the initial treatment of loss of consciousness and common airway, respiratory and cardiac events. Each scenario lasted between 20-30 minutes followed by a 45 minute debrief session immediately after each scenario. Debrief was guided by experienced facilitators and involved the entire peer group, so that there would be shared meaning and learning for the entire group[26]. Exposure to a simulated emergency is of little benefit to trainees without constructive feedback by experienced facilitators[29]. Video-assisted debrief was used to assist with participant reflection. Video replay is an excellent tool to identify and highlight optimal and suboptimal practice; it illustrates learning points and guides discussion on technical and non-technical issues arising during the simulation[26]. Experience can be transformed into learning through reflection, and the facilitator is essential in this process[30,31].

Methods

Following participation in scenarios using the HPS the trainees were then invited to complete a voluntary and anonymous evaluation of the training. They were asked to provide free text written comments to seven open ended questions and rate ten statements on a seven-point Likert scale ranging from 'strongly disagree'[1] to 'strongly agree'[7]. The trainees were also asked to explain their ratings on the Likert scale using free written text. The questionnaire

(Figure 1) was designed to yield both quantitative and qualitative data to evaluate the relevance, applicability and acceptability of this training to military medics in training. This study was exempt from ethical approval as it was an evaluation of an educational method.

Figure1. Questionnaire

1. What were your first impressions of the Simulator teaching and learning session?
2. What are the advantages of using the Simulator in a teaching and learning session?
3. What are the disadvantages of using the Simulator in a teaching and learning session?
4. What do you think about using the Simulator for formal assessments in the Diploma of Military Medical Care?
5. If you had the chance to give advice to the organiser of the Diploma in Military Medical Care about the use of the Simulator, what advice would you give?
6. How useful was today's teaching and learning session for you?
7. What have you learned from today's teaching and learning session?

Likert scale statements

8. I found today's experience valuable
9. I found today's session provided relevant learning experience
10. The content was presented at an appropriate pace
11. The topic content was at an appropriate level
12. This session helped me develop my clinical problem solving skills
13. Teaching materials and resources helped me prepare in advance for this session
14. I would recommend this session to my peers
15. Following today's experience I would be interested in attending further simulation courses
16. I received useful feedback on my performance

Results

Nine of the ten participants completed the evaluation forms. The written free-text comments to the seven open ended questions (Q1-7) of the evaluation were analysed for key words and phrases. These were then counted, clustered and ranked by frequency of occurrence (Table 1).

Table 1. Free text responses

Questions	Common themes
1. What were your first impressions of the Simulator in a teaching and learning session	Realistic, Good for learning, Apprehensive or daunting or nervous
2. What are the advantages of using the Simulator in a teaching and learning session?	Mistakes don't cause harm Learn from your mistakes
3. What are the disadvantages of using the Simulator in a teaching and learning session	Lack of some realism skin colour, bleeding, capillary refill, can't move the patient
4. What do you think about using the Simulator for formal assessments in the Diploma of Military Medical Care?	Agree Used for learning and not for testing
5. If you had the chance to give advice to the organiser of the Diploma in Military Medical Care about the use of the Simulator, what advice would you give?	Use it more often in the course Get the course instructors to demonstrate correct management in scenarios
6. How useful was today's teaching and learning session for you?	Very useful and beneficial
7. What have you learned from today's teaching and learning session?	Teamwork Decision making Assertiveness Don't panic

The statements (Q8-16) were evaluated using a 7-point Likert scale with the option of a free written text comment to explain the rating given to each statement as an option (Table 2).

Table 2. Likert means and explanations of ratings

Question	Mean Likert Rating (1-7)	Explanations for rating
Q8	6.8	Enjoyed, more exposure, learn from mistakes, learn from each other, realistic scenarios, true to life, improved confidence, more aware of patient needs, observe yourself, realistic, good feedback
Q9	6.8	Relevant level, may meet the same scenario in real life, video, help with OSCE exam, improve diagnostic skills, observe yourself
Q10	6.7	Well explained, well ran, followed the EMT CPG, want more exposure, very happy and learned a lot, appropriate, supportive and helpful
Q11	6	Appropriate level, well suited, appropriate level
Q12	6.8	Assess and diagnose, learn from mistakes, cardiac and respiratory skills, think a lot, better assessment of patient, problem solving
Q13	6.6	Learn from mistakes, teamwork, decision making
Q14	6.8	Really worthwhile, relevant, good training, very useful, really enjoyable
Q15	6.7	Learn from mistakes, ability to learn from watching yourself (video), more practical training, more exposure, beneficial and educational
Q16	6.8	Good feedback, useful feedback
Q17	6.8	Learned from mistakes, improve confidence

Discussion

The main themes to emerge in the context of the trainees' first experience of the HPS were in relation to the realistic nature of the experience, though some found it apprehensive and daunting. In relation to the advantages of using the HPS, the main themes were that mistakes made cannot cause patient harm and that it provides an opportunity to learn from mistakes. The disadvantages of the HPS were indicated to be the lack of realism for certain functions in the mannequin, e.g. skin colour changes, not bleeding and unable to move the HPS. Most trainees agreed that the HPS would be useful for simulation though some indicated that it should be used for training purposes only. Others saw value in using this method for assessment purposes. All indicated that there should be more training sessions on the HPS during the course, and some indicated that they would also like the instructors to demonstrate the correct way to manage the scenario as part of the experience. All trainees agreed that the experience of high fidelity training was very useful, and the main themes to emerge in relation to what they learned were: teamwork, decision making, assertiveness and not to panic in the situation.

The trainees' responses were overwhelmingly positive for their perceived value of the simulation training, relevance, spacing, teaching resources and level of the content. Likewise they were overwhelmingly positive on the value of the simulation for developing their clinical problem solving skills, the feedback received, their interest in attending further training using high fidelity simulation and they would strongly recommend this type of training to their peers. This evaluation correlates well with a recent full mission mobile high fidelity simulation pilot with civilian paramedics and advanced paramedics (32).

We present our results with the following caveats: the sample size is small; for all trainees it was their first experience of high fidelity simulation using an HPS; familiarity with faculty members over the diploma course may have produced a 'halo' effect; and our evaluation may have missed out on an important aspect.

We intend to undertake a detailed follow up of the graduates of the diploma as to the impact of the scenario-based HPS training on their work. We will particularly focus on those graduates who have been deployed overseas. It is intended to expand the numbers significantly for the next cycle of the diploma and incorporate portable HPS for 'in the field simulation' which will allow for a more detailed and larger study.

Conclusion

On the basis of the participants' judgment, this study has indicated that the use of the HPS in high fidelity simulation is relevant, applicable and acceptable to

Irish Defence Force personnel, who had no previous military medical training or a third level higher education award, as part of their training for the Diploma of Military Medicine.

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