International Emergency Nursing xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

International Emergency Nursing

journal homepage: www.elsevier.com/locate/aaen

How effective is trauma simulation as an educational process for healthcare providers within the trauma networks? A systematic review

Donna Barleycorn[a,*], Geraldine A. Lee[b]

[a] Kingston University and St Georges, University of London, London, UK
[b] Florence Nightingale Faculty of Nursing, Midwifery & Palliative Care, King's College London, London, UK

ABSTRACT

Background: Major trauma is a significant public health problem and a leading cause of death for several age groups. To address this issue, Major Trauma Networks were introduced in the UK from 2010, consisting of Major Trauma Centres (MTCs) and a network of linked Trauma Units (TUs).

Objective: The aim is to undertake a systematic review to examine how effective is trauma simulation as an educational process for healthcare providers within trauma networks.

Methods: The databases searched included Medline, Embase and Cinahl from 2010 to 2016. This time frame was chosen to reflect more contemporaneous research into simulation training since the advent of trauma networks in 2010 and the publication of national trauma guidelines (NICE). Seven observational studies were selected for narrative review. The screening and selection process followed the PRISMA guidance. The method used to assess the selected studies is based on the Scottish Intercollegiate Guidelines Network (SIGN) handbook.

Results: Overall, the studies showed benefits of simulation in trauma training, with some statistical evidence that non-technical skills and overall trauma team performance improved after simulation training, which appears to be effective. Although no studies found any specific correlation of simulation- based learning in trauma to wider effects such as patient outcomes, length of stay or morbidity. Some studies have found that time to diagnosis and treatment arising from improved non-technical trauma team skills from simulation, are a valid surrogate indicator of improved patient outcomes.

Conclusion: Overall, it is evident from this review that trauma simulation is an effective educational tool, which can aid trauma learning, develop team's non-technical skills and increase task completion, having a positive impact on the trauma network. Trauma units should therefore benefit from increased trauma simulation training and accessibility to repeated simulation based courses or workshops.

1. Background

The World Health Organisation (WHO) [1] recognises traumatic injury is a public health problem in both high income and low to middle income countries and Kehoe et al. reported trauma to be the leading cause of death in people between the ages of 25– 50 years and the second leading cause for those over 75 years [2].

International comparisons demonstrated that the United Kingdom (UK) were lagging behind other comparable high income countries in the treatment of trauma patients [3]. The NCEPOD concluded that more than 50% of UK patients with major trauma received sub-standard care [3]. In 2000, the Royal College of Surgeons of England [4] recommended that within each geographical region, there should be a network of Major Trauma Centres and Trauma Units to treat trauma patients with life-threatening conditions. Trauma Networks were then finally introduced across the UK in 2010, initially in London, and since then implemented in other parts England and Wales [5].

Each network has one Major Trauma Centre (MTC) and a number of Trauma Units (TUs). MTCs are equipped to treat severely injured patients 24 h a day. The supporting Trauma Units (TU) are responsible for managing patients with less severe injuries, including the assessment and transfer of those trauma patients requiring major trauma level one care [6]. Patients who trigger the major trauma triage tree will be conveyed to the nearest MTC by pre-hospital staff [7]. An evaluation of the London Trauma System by Cole et al. [8] reported significant improvement in the quality of care for trauma patients and an increase in the number of patients surviving following the implementation of the trauma network system [9]. In the original NCEPOD study, 18% of patients died, compared to 7% in the new Evaluation of the London Trauma System (ELoTS) report [10].

* Corresponding author.
E-mail address: donna.barleycorn@sgul.kingston.ac.uk (D. Barleycorn).

https://doi.org/10.1016/j.ienj.2018.03.007
Received 13 September 2017; Received in revised form 7 January 2018; Accepted 25 March 2018

Although there have been quality improvements as a result of the introduction of MTCs, the improvement is less evident in the TUs where there is disparity in trauma care. To obviate these clinical variations, it was recommended that further trauma training and multidisciplinary education are required to provide consistent trauma care in TUs [10,6]

While patients with obvious severe injuries are taken to MTC, TUs will receive infrequent major trauma patients, due either to major trauma patient's self-presentation to trauma units, or because of the evolution of pathophysiology, patients may not initially trigger the trauma activation criteria or because MTCs are overwhelmed. This results, consequentially, in the paucity of experience and lack of skills to manage the complex trauma patient.

The challenge facing the trauma networks is, how can healthcare providers develop and retain trauma skills, particularly within the UK TU environment, where exposure to complex trauma is significantly less?

1.1. Simulation in healthcare

Human errors, the quality of non-technical skills (NTS) in trauma resuscitations and cognitive mistakes are recognised as significant threats to patient safety [11]. These NTS include situational awareness, decision-making, communication, leadership and management of stress, fatigue and disturbance [12].

The National Health Service [13] has identified teamwork, situational awareness and communication skills as significant factors in adverse clinical events. Bergs et al. [14] for instance, estimated that 50% of communication errors occur in trauma team resuscitations; this, coupled with inefficient documentation, leads to errors and compromises patient safety.

Several studies report that simulation has been shown to develop motor skills, team work and communication [15], although in Issenberg et al. [16] systematic review of 109 papers, the authors maintain there is generally a lack of empirical evidence to support this contention; moreover, the studies published are generally weak and widely varying results were reported. Overall, rigour and quality of the papers required improvement but Issenberg et al. concluded high fidelity simulation is educationally valuable and complements clinical education.

Nevertheless, simulation training is a recommended method to help prevent human errors in patient care and an aid in decision making [17,18,11]. It is an established method for education and training for emergency care practitioners and is utilised as a model for accrediting such providers [19,20].

Given the need to establish effective methods of treatment at TU level, the aim of this systematic review is to address the question- how effective is trauma simulation as an educational process for healthcare providers within trauma networks?

2. Method

2.1. Design

The question is addressed and analysed using the PICO (Population, Intervention, Comparison and Outcome) framework. A 'comparison' has been omitted within the PICO table, because this is not a diagnostic review nor a randomised controlled trial (RCT) review [21] Table 1. The Preferred Reporting Items for Systematic Reviews and meta-analysis (PRISMA) statement was followed for the conduct and reporting of this review [25].

2.2. Search strategy

The search strategy aimed to find published studies limited to the English language. The initial timescale of the search was set originally from 2000 to 2016, but since the advent of trauma networks in 2010 and the publication of the national trauma guidelines (NICE) [22], on secondary consideration, the studies from 2000 to 2009 were removed. The rationale for amending the search years is intended to reflect more accurately the analysis of simulation in the new trauma network environment and to take account of significant technological changes in simulation and changes in teaching, learning and evaluation techniques relating to simulation in the years since 2010. Therefore, pre-set inclusion criteria for the search included reports using simulation as a learning aid, those in English, health professionals as learners, adult only resuscitations and those within trauma settings. Exclusions encompassed paediatrics, non-trauma simulations and papers published before 2010. The databases searched included Medline, Embase and Cinahl citing all relevant literature. An example Embase Search as shown in Appendix one

Table 1
Terms applied to search.

Population	Intervention	Outcome
Adults	Trauma	Simulation
Nurse	Emergency/Trauma	Simulation (patient, human or trauma)
Clinician	Emergency /Trauma nursing	Education
	Trauma teams	Nursing education

The key search terms used included *human simulation, trauma simulation, trauma education, nursing education, trauma, adult, emergency nursing.* Each database was searched using these terms or MeSH with boolean operators and fitting permutations. The specific search strategies were created by a health services librarian with expertise in systematic review searching.

3. Results

3.1. Study selection

The search discovered a total of 92 hits initially from the databases Embase 26, Medline 22 and CINAHL 44 including 1 hand search in Google Scholar. The author independently screened the titles and abstracts found from the search, against the inclusion criteria [25].

The articles that were removed included studies pre-2010, irrelevant studies, conference only abstracts and repeated results. In total eleven papers were fully read to assess suitability and criteria for quality.

Features sought for selected studies for final inclusion (full text screening) to ensure consistency included those with pre- and post-intervention design, simulation in clinical and non-clinical settings for trauma team members. Four papers were subsequently excluded that did not meet the inclusion criteria as they were not empirical studies [26–28]. The screening and selection process followed the PRISMA Checklist Fig. 1 [25].

Finally, seven articles were chosen to critique in this systematic review. A systematic narrative synthesis is provided with information presented in Table 2, to summarise and explain the characteristics and findings of the final included studies [25].

The methodology study design utilised is the Scottish Intercollegiate Guidelines Network (SIGN) model [23], the cohort checklist was deemed most appropriate due the selected studies being observational cohort and/or retrospective studies [24].

A narrative commentary was undertaken as there were insufficient studies and significant heterogeneity for a meta-analysis.

3.2. Overall description of the selected studies

The common thread in these studies is that they are, broadly, observational evaluations of the beneficial effects of non-technical skills (NTS) development on trauma team performance, demonstrated in