

Systematic Review Protocol

Title: A comprehensive systematic review of the use of simulation in the continuing education and training of qualified Medical, Nursing and Midwifery Staff

Centre conducting review:

The Centre for Evidence-based Practice in Nursing and Midwifery at Thames Valley University

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Commencement date: January 2009-

Expected Completion date: June 2009

Background:

Simulation can be defined as a person, device or set of conditions made to resemble a real life situation.^{1,2} It is used in many high risk industries particularly when reality is dangerous, critical events are rare and errors are costly in human and/or financial terms. Examples of disciplines which use simulation include the aviation industry, the armed forces, nuclear power and offshore energy production industry.³ Simulation is increasingly being used in healthcare education to resemble clinical practice as closely as possible to provide opportunities to practise clinical skills and develop clinical judgement. A range of simulation technologies are available from low fidelity simulation; a cannulation arm, through mid-fidelity; Immediate Life Support (ILS) training moulages to high fidelity simulation; full immersion in real-time scenarios. Regardless of the level of sophistication, learners are required to respond to situations as they would in the real environment. They are active participants in the learning process as they must apply and integrate knowledge, develop skills and critical thinking.⁴ Debriefing and/or feedback on performance is immediately available and is integral to the learning process. Commonly, scenarios are recorded and debriefing is facilitated through the use of video playback of critical moments within the simulation.

The use of simulation is now considered an essential component of education programmes. Key drivers for this include:

- Changes in both medical and nursing education and training;
- The European Working Time directive which has limited junior doctors out of hours service limiting opportunities to gain clinical experience;
- Increased concern for patient safety;
- Changes in patient expectations and high profile patient incidents;
- Reports such as *National Confidential Enquiry into Patient Outcome and Death* (2005)⁵ which highlights failings in both the clinical and non-technical skills of healthcare professionals;
- NICE guidance *Acutely Ill patients in Hospital* (2008)⁶ requires staff have “competencies in monitoring, measurement, interpretation and prompt response to the acutely ill patient appropriate to the level of care they are providing”.
- Darzi report⁷ which advocates the use of simulation training in healthcare education.

Consequently, simulation is being increasingly used in both medical and nursing education. In nursing this is predominately focused on pre-registration learners. In the USA the National Institutes of Health has a new initiative called “Digital Biology: The Emerging Paradigm,” whose goal is to merge biomedical computation with biology and medicine over the next ten years.⁸ In the UK simulation has been used in anaesthetic training and is an integral part of the new Foundation Year programmes. Use of simulation in undergraduate education has been studied in depth but little is known about its use in post graduate education.⁹ Given that the National Confidential Enquiry into Patient Outcome and Death (2005) report⁵ noted, “*Training must be provided for junior doctors in the recognition of critical illness and the immediate management of fluid and oxygen therapy in these patients,*”

(Recommendation 5.4) it is timely to review where simulation could be used most effectively in continuing post graduate education.

There have always been concerns that learning in the clinical environment is unpredictable, unstructured and ad hoc.¹⁰ As Hewison and Wildman (1996) pointed out the clinical environment is not designed for the task of learning but for care delivery, which by necessity must take precedence.¹¹ The advantages put forward in support of simulation based training are that:

- it is learner centred as well as patient centred;
- it is possible to reproduce real-time interactive experiences with an appropriate level of challenge for the learners involved;
- learners are required to actively participate in clinical situations, within a safe and controlled environment;
- scenarios can be built around clearly defined learning outcomes that can be standardised allowing repetition, reliability and reproducibility;
- it can be incorporated into a structured learning package;
- it provides the flexibility to create a wide variety of clinical scenarios, from common conditions to the rare, unexpected or unusual;
- scenarios can be developed that are highly relevant to the clinical practice of the learners;
- it is ethically sound, allowing learners to make mistakes and discuss these openly;
- it allows the integration of clinical and non-clinical skills in education; the latter are often referred to as 'Human Factors' or 'Effective Behaviours' and include elements such as communication, teamwork, leadership, planning and prioritising workload, delegating effectively and knowing when to call for help;
- there may be an accelerated learning curve for psychomotor skills;
- it is helpful in preparing novices for practice and in remediation.

Whilst there are many benefits to simulation training there are several drawbacks to consider. Simulation involves expensive equipment and is resource intensive. Several members of staff are required to run even a simple simulation effectively and it is necessarily faculty intensive. Whilst adding to the clinical development of the learner, simulation still cannot replace clinical experience and lecturers/clinicians unused to a facilitative style of teaching may be resistant to engaging in the process. In addition some students find it difficult to take simulation seriously. These disadvantages are also set against the fact that there seems to be little empirical evidence that simulation improves patient outcome. Nevertheless studies from other disciplines, notably the airline industry have shown that the use of simulation to train pilots and to maintain their skills has had measurable benefits in terms of a reduction in pilot error related accidents.¹² There is need for similar evidence within nursing and healthcare although the complexities of real practice make this a major challenge.

Questions:

1) How effective is simulation training in terms of improving qualified doctors', nurses' and midwives self confidence in dealing with clinical situations?

2) How effective is simulation training at improving qualified doctors', nurses' and midwives practice in dealing with clinical situations?

Objectives:

The aim of this systematic review is to establish:

- Where and in which context is simulation an effective educational medium in post qualifying/continuing education?
- What is the benefit to learners of using simulation in respect of their knowledge, skills and confidence?
- What the implications are for future research in this area?

Criteria for considering studies for this review:

Types of studies:

This review will look for both quantitative and qualitative papers. In quantitative papers we will search for RCT, quasi controlled trials, observational studies and surveys, and we will consider all types of relevant qualitative papers that address this issue. The review will also include any relevant textual papers. Due to the lack of interpreter facilities only papers published English will be included.

Type of participants:

The review will focus on post qualification medical nursing and midwifery staff undertaking educational development programmes utilising simulation as defined below.

Types of interventions / phenomena of interest:

The intervention to be explored in this review is **simulation**. For the purposes of this review simulation is defined as:

A method of teaching and learning which involves the recreation of a patient centred scenario/event in a realistic context. The creation of this realistic context may utilise patient simulators and/or actors in a simulated healthcare environment. The aim is to provide a realistic setting in which doctors and nurses can rehearse, develop, apply and contextualise skills and knowledge. Structured feedback and reflection are essential components of the process.

This definition is derived from the work of several authors working in the field of simulation Gaba (1999)⁹, McGaghie (1999)² Alinier (2006)¹³ and the professional experience of the reviewers.

Types of outcome measures:

The outcome measures to be explored in this review are derived principally from a review of the literature previously carried out by one of the authors¹⁴. The studies to be examined will include some or all of the outcome measures below.

Knowledge

- Demonstration of the application of knowledge to the simulated clinical situation
- Demonstrable improvement in knowledge of the environment and equipment.

Behaviour –

- Demonstration of risk assessment
- Safe working practice in relation to the clinical environment
- Recognition of own limitations and knowing when to call for help
- Effective communication
- Team working and leadership skills

Self confidence

- Evidence from learners in relation to the educational experience
- Evidence of increased learner confidence following simulated practice.

Patient Outcome

- Evidence of improved patient outcome been assessed in relation to training

This review will exclude motor skills as an outcome measure

Search strategy for identification of studies

The search strategy aims to find both published and unpublished studies from 1998-2008. An initial limited search of MEDLINE and CINAHL will be undertaken followed by analysis of the text words contained in the title and abstract, and of the index terms used to describe article. A second search using all identified keywords and index terms will then be undertaken across all included databases. Thirdly, the reference list of all identified reports and articles will be searched for additional studies.

The strategy will adhere to a three stage approach to

- 1) Identify optimal search terms using CINAHL, MEDLINE
- 2) Identified key words and index terms will be searched using the following databases from 1998 - present:

Databases to be searched include:

- MEDLINE, CINAHL, EMBASE, ERIC

Databases to be searched for unpublished studies include:

- Dissertation Abstracts International, Proceedings First

Initial search terms will be:

simulation, nurses, doctors, midwives, education*, clinical, post-qualifying training

Methods of the review:

Assessment criteria:

Papers selected for retrieval will be assessed by two independent reviewers for methodological validity prior to inclusion in the review using the standardised critical appraisal instruments from the Joanna Briggs Institute. Quantitative papers will be assessed using RevMan 5 (Appendix I), qualitative papers using JBI-QARI (Appendix II) and textual data will be assessed using the JBI-NOTARI (Appendix III). Any disagreements that arise between the reviewers will be resolved through discussion with a third reviewer.

Data synthesis:

Quantitative data will, where possible be pooled in statistical meta-analysis using RevMan¹⁵. All results will be subject to double data entry. Odds ratio (for categorical data) and weighted mean differences (for continuous data) and their 95% confidence intervals will be calculated for analysis. Heterogeneity will be assessed using the standard Chi-square test. Where statistical pooling is not possible, the findings will be presented in narrative form.

Qualitative research findings will, where possible be pooled using the JBI-QARI (Appendix IV). This will involve the aggregation or synthesis of findings to generate a set of statements that represent that aggregation, through assembling the findings (Level 1 findings) rated according to their quality, and categorising these findings on the basis of similarity in meaning (Level 2 findings). These categories are then subjected to a meta-aggregation in order to produce a single comprehensive set of aggregated findings (Level 3) that can be used as a basis for evidence-based practice. Where textual pooling is not possible, the findings will be presented in narrative summary.

Textual papers will, where possible be pooled using the JBI-NOTARI (Appendix V). This will involve the aggregation or synthesis of conclusions to generate a set of statements that represent that aggregation, through assembling and categorising these conclusions on the basis of similarity in meaning. These categories are then subjected to a meta-aggregation in order to produce a single comprehensive set of synthesised findings that can be used as a basis for evidence-based practice. Where textual pooling is not possible the conclusions will be presented in narrative form.

Potential conflict of interest:

The simulation centre is in partnership with METI a commercial company who produce patient simulators and educational resources, the development of which the simulation team at TVU have collaborated with. The nature of this relationship is educational rather than financial.

References:

1. Issenberg S.B McGaghie W.C Petrusa E.R Gordon D.L Scalese R.J 2005 Features and uses of High fidelity medical simulations that lead to effective learning?: A BEME systematic review. *Medical Teacher* Vol27 (1) pp. 10-28.
2. McGaghie WC. Simulation in professional competence assessment: basic considerations. In Takien A, McGuire, McGaghie WC (Eds) *Innovative Simulations for Assessing Professional Competence*. 1999 Chicago: Department of Medical Education, University of Illinois.
3. Tekian, A., McGuire, C.G. & McGaghie, W.C. (Eds) (1999) *Innovative Simulations for Assessing Professional Competence* (Chicago, Department of Medical Education, University of Illinois at Chicago).
4. Good, M.L., Gravenstein, J.S., & Mahla, M.E., (1992). Can simulation accelerate the learning of basic anesthesia skills by beginning anesthesia residents? *Anesthesiology*, 77, A1133.
5. National Confidential Enquiry into Patient Outcome and Death. *An Acute problem?* 2005 London: NCEPOD.
6. National Institute for Clinical Excellence Guidance; CG50 *Acutely Ill Patients in Hospital*, London 2008 NICE
7. Darzi Lord A 2008 *High Quality Care for All: NHS next stage review final report* 2008 London, Department of Health
8. Huang C. Virtual labs: e-learning for tomorrow? *PLoS Biology*. 2004 June; 2(6): e157
9. Laschinger S, Pulling C, Medves J, Waytuck B, Harrison M. The use of simulation to enhance health profession student clinical practice. *JBI SR* in progress.
10. May et al. preparation for practice. Evaluation of nursing and midwifery education in Scotland 1992 programmes. *Final Report Scotland*: NBS.
11. Hewison A, Wildman S. The theory practice gap in nursing: a new dimension. *Journal of Advanced Nursing* 1996;24(4):754-761.
12. Travella S. Pilot training cuts corporations losses. *Business Insurance* 1983;17(3):306.
13. Alliner G Hunt B. Gordon R. Harwood C. 2006 "Effectiveness of intermediate –fidelity simulation training technology in undergraduate nursing education" *Journal of Advanced Nursing* 54 (3) 359-369.
14. Elliott S. A 2007 *Simulation as a teaching and learning strategy - A literature review* Unpublish Thames Valley University London sharon.elliott@tvu.ac.uk
15. The Cochrane Collaboration, RevMan 5 software, downloaded from <http://www.cochrane.org/RevMan> (January 2009).

Indicative Reading:

Kirkpatrick, D (1994). Evaluating training programs: The four levels. Berrett-Koehler: San Francisco

Gaba DM, The future vision of simulation in health care *Quality and Safety in Healthcare (BMJ supplement)* 2004: 13 i2-i10.

http://qshc.bmj.com/cgi/content/full/13/suppl_1/i2

Appendices

Appendix I

JBI Critical Appraisal Checklist for Experimental Studies

Reviewer _____ Date _____

Author _____ Year _____ Record Number _____

- | | Yes | No | Unclear |
|---|--------------------------|--------------------------|--------------------------|
| 1. Was the assignment to treatment groups truly random? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Were participants blinded to treatment allocation? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Was allocation to treatment groups concealed from the allocator? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Were the outcomes of people who withdrew described and included in the analysis? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Were those assessing outcomes blind to the treatment allocation? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Were the control and treatment groups comparable at entry? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Were groups treated identically other than for the named interventions? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Were outcomes measured in the same way for all groups? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Were outcomes measured in a reliable way? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Was appropriate statistical analysis used? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info.

Comments (Including reasons for exclusion)

JBI Critical Appraisal Checklist for Comparable Cohort/ Case Control

Reviewer _____ Date _____
Author _____ Year _____ Record Number _____

Yes No Unclear

1. Is sample representative of patients in the population as a whole?
2. Are the patients at a similar point in the course of their condition/illness?
3. Has bias been minimised in relation to selection of cases and of controls?
4. Are confounding factors identified and strategies to deal with them stated?
5. Are outcomes assessed using objective criteria?
6. Was follow up carried out over a sufficient time period?
7. Were the outcomes of people who withdrew described and included in the analysis?
8. Were outcomes measured in a reliable way?
9. Was appropriate statistical analysis used?

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

Appendix II

JBI QARI Critical Appraisal Checklist for Interpretive & Critical Research

Reviewer _____ Date _____

Author _____ Year _____

Record Number _____

- | | Yes | No | Unclear |
|--|--------------------------|--------------------------|---|
| 1. Is there congruity between the stated philosophical perspective and the research methodology? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Is there congruity between the research methodology and the research question or objectives? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Is there congruity between the research methodology and the methods used to collect data? | | <input type="checkbox"/> | <input type="checkbox"/> <input type="checkbox"/> |
| 4. Is there congruity between the research methodology and the representation and analysis of data? | | <input type="checkbox"/> | <input type="checkbox"/> <input type="checkbox"/> |
| 5. Is there congruity between the research methodology and the interpretation of results? | | <input type="checkbox"/> | <input type="checkbox"/> <input type="checkbox"/> |
| 6. Is there a statement locating the researcher culturally or theoretically? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Is the influence of the researcher on the research, and vice-versa, addressed? | | <input type="checkbox"/> | <input type="checkbox"/> <input type="checkbox"/> |
| 8. Are participants, and their voices, adequately represented? | | <input type="checkbox"/> | <input type="checkbox"/> <input type="checkbox"/> |
| 9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data? | | <input type="checkbox"/> | <input type="checkbox"/> <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info.

Comments (Including reasons for exclusion)

Appendix III

JBI Critical Appraisal Checklist for Narrative, Expert opinion & text

Reviewer _____ Date _____
Author _____ Year _____ Record Number _____

Yes No Unclear

1. Is the source of the opinion clearly identified?
2. Does the source of the opinion have standing in the field of expertise?
3. Are the interests of patients/clients the central focus of the opinion?
4. Is the opinion's basis in logic/experience clearly argued?
5. Is the argument developed analytical?
6. Is there reference to the extant literature/evidence and any incongruency with it logically defended?
7. Is the opinion supported by peers?

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

Appendix IV

QARI Data Extraction Form for Interpretive & Critical Research

Reviewer _____ Date _____

Author _____ Year _____

Journal _____ Record Number _____

Study Description

Methodology

Intervention

Setting

Geographical

Cultural

Data analysis

Authors Conclusions

Comments

Appendix V
JBI Data Extraction for Narrative, Expert opinion & text

Reviewer _____ Date _____
Author _____ Year _____ Record Number _____

Study Description

Type of Text: _____

Those Represented: _____

Stated Allegiance/
Position: _____

Setting: _____

Geographical: _____

Cultural: _____

Logic of Argument: _____

Authors Conclusion:

Reviewers Comments:

