Safety, Skills & Improvement
Clinical Skills

The Knowledge Network

CSMEN – Simulation Publications Update Bulletin May 2021

Reviews of Simulation-based Education

Welcome

Welcome to the Simulation Publications Update a service brought to you by CSMEN in partnership with NES Knowledge Services.

The focus for this Simulation bulletin is published reviews of aspects of simulation-based education. The reviews selected cover a wide variety of topics including use of VR and AR in nursing training and orthopaedic surgery. Different types of reviews have been undertaken including integrative, systematic as well as scoping reviews.

These articles may be of interest or relevance to your current role in NHS Scotland. The articles may also be of use in your research. These articles are from those journals we currently subscribe to. If there are any articles or journals that you would like us to add/consider please let us know.

Until now we have tried to provide approximately 30 links to articles on all aspects of simulation. We are now moving to shorter bulletins focusing on different aspects of simulation.

The articles identified those which used simulation for resuscitation training.

If you would like to suggest a focus topic or become a reviewer, please also let me know. Jean.ker@nhs.scot

The plan is to widen this service to focus on topic areas and to monitor its use and effectiveness so feedback would be much appreciated.

This bulletin has been developed by Jean Ker clinical lead CSMEN in partnership with Alan Gillies from NES Knowledge Services.

Access to Journals

Different journals have different processes for login so please follow the instructions for accessing the full text of the articles through the links provided.

On your behalf NES Knowledge Services subscribes to some journals direct and others via aggregators (i.e. journal collections or full text databases). We use something called a ‘link resolver’ to link you via the best route using your NHS Scotland OpenAthens password. Some journals can detect that you’re logging in from NHS premises, so won’t ask for the OpenAthens password, but if you’re accessing from home you may have to login. None of the links should require you to set up a separate login – where there are login boxes for personal accounts, look for an OpenAthens or ‘institutional login’ option as well, which will

accept your OpenAthens password.

Focus: Reviews of Simulation based Education

Evaluation of teamwork assessment tools for interprofessional simulation: A systematic literature review. Wooding E.L., et al, Journal of Interprofessional Care, Vol 34, 2, 162-172. 2020.

This is a useful systematic review for those who are using simulation based education to develop interprofessional teams as it collates the published evidence there is for the tools available which can objectively assess teamwork. It certainly highlights the need for more studies given the limitations of the data identified.

Background

The authors note that there are a number of teamwork measurement tools available but the validity evidence is variable both in relation to their use in different contexts and the duplication of effort in developing tools for use in interprofessional simulation training .

Methods

The paper shares the protocol used for the systematic review which was undertaken using a series of databases over a 10 year period as well as hand searching. More information on decisions made on databases inclusion would have been helpful. The authors selected those with 'education, interprofessional and medical foci' but no reasoning for this is provided in relation to the bias it may have produced. The review was reported according to the PRISMA statement and studies were evaluated according to Downing's validity framework.

Results

356 records were identified and 19 studies from 24 papers met the inclusion criteria.

In relation to sharing info on study characteristics this was inconsistent across all 19 studies in terms of participants and their prior experience. In terms pf team profiles 12 studies included nurses and 11 studies doctors with a variety of other professional groups represented but the extent of every groups' involvement was often not recorded. The most common content of the simulation scenarios was paediatric emergencies. 10 of the 19 studies utilised an assessment tool in its original state (included Objective Teamwork Assessment System, (OTAS), Anaethetists Non-Technical Skills behavioural scale (ANTS), Team Emergency Assessment Measure(TEAM) and the Kid SIMTeam performance scale). The quality of the teamwork rating process was again variable with six studies using interprofessional raters and four studies using doctors only. Others did not state the profession of the rater. Nine studies provided evidence of rater training. 11 studies assessed the psychometric properties of the tools used. Several did not refer to the psychometrics.

Discussion

It was difficult from this review to compare studies as they had different definitions of teamwork and were using a variety of tools which had not always been validated for new populations. The TEAM tool had the strongest validity evidence for assessing teams using interprofessional simulation. The authors do raise some legitimate concerns of the limitations of the review both in terms of the studies and their process.

Professor Jean Ker
Associate Postgraduate Dean, Clinical Skills (CS MEN)

Repeated simulation experience on self-confidence, critical thinking, and competence of nurses and nursing students-an integrative review, Al Gharibi, K.A. & Arulappan,Judie, SAGE Open Nursing. 2020.

This review investigated the outcome of repeated simulation experience nurses and nursing students. It concluded that repeated simulation enhances students' self-confidence, knowledge, competence, critical thinking, and satisfaction. The authors recommend integrating the use of low-fidelity simulators (LFS), mid-fidelity simulators (MFS), and high-fidelity simulators (HFS) with repeated simulation experiences.

Use of simulation practices in public or community health nursing: Findings from mixed-methods systematic review, Aslan, F., Scandinavian Journal of Caring Sciences, 2020.

The authors suggest that limited research exists on simulation for community or public health nursing education. This study therefore aimed to explore the methods that are being used to increase the knowledge and skills of nursing students who work for public health nursing and the evidence about the effectiveness of simulation practices in public or community health nursing. Eight studies were included in the mixed-methods systematic review (two qualitative, two mixed-methods and four quantitative studies). The students were satisfied with public health nursing simulation practices and had significant gains in active learning, collaboration, critical thinking, teamwork, evaluating family and individual together, and practical communication skills.

Umbrella review: Impact of registered nurses' continuing professional education informed by contemporary reviews of literature. Cant R. & Levett-Jones, T., Nurse Education in Practice, Vol 50. 2020.

This paper aimed to explore and classify studies of the impact and effectiveness of continuing professional education for registered nurses, using existing reviews of literature. Of 16 included reviews, 13 were of simulation-based education activities. Three reviews of experimental studies demonstrated strong positive evidence of education impact on nurses' learning. Objective evidence of transfer of knowledge and skills into practice included improved interprofessional team performance and less time taken to complete clinical tasks. Reports of practice improvements and intention to change practice provided further evidence of impact. A small number of individual studies measured impact on service delivery, reporting positive and neutral results. Further studies of translational impact are needed, specifically, of the impact on patient care.

The need for simulated patient method implementation in pharmaceutical education in Poland. Cerbin-Koczorowska M., et al, Indian Journal of Pharmaceutical Education and Research, Vol 54, 4, 875-880. 2020.

The aim of this review was to examines the simulated patient method (SP-method) and indicate potential areas of its implementation into the pharmacy curriculum, in the Polish context. The findings suggest that the SP-method allows students to accomplish many skill-based learning outcomes defined in the undergraduate pharmaceutical curriculum. Potential areas of implementation include: enhancing communication skills, patient counselling skills, patient education and pharmaceutical care, teamwork and interprofessional collaboration. The authors

conclude that pharmacy students, similarly to their colleagues studying medicine or nursing, should be given opportunities to learn using the SP-method.

A review of virtual-simulation for assessing healthcare students' clinical competency, Coyne, E., et al, Nurse Education Today, Vol 96. 2021.
The aim of this review was to explore the use of virtual simulation to assess clinical competence in health education. A thematic analysis identified four themes: pedagogy differences across disciplines, debriefing to enhance learning, preparing healthcare professionals in a safe and cost-effective environment, and managing challenges of virtual simulation. The review suggests that virtual simulation is a feasible strategy to assess students' clinical competency and support their learning in both medical and nursing programs, however simulation should be authentic and incorporate reflection.

Review of the use of simulators in learning revascularization techniques. EL Andari, et al, General Thoracic and Cardiovascular Surgery. 2021.
This review aimed to summarise research conducted on the use of simulation-based teaching (SBT) for trainees learning percutaneous coronary intervention (PCI), coronary artery bypass grafting (CABG), and off-pump CABG (OPCAB). SBT has been pursued as a potential adjunct to fill the gaps left by the traditional apprentice model. The review found that while simulations have been demonstrated to be successful in teaching both experienced and inexperienced learners complex techniques, it is unlikely that training will ever solely rely on simulations. The authors suggest that the most efficient method of training learners for revascularization in the future will likely involve a combination of hands-on learning and SBT.

Using simulation to facilitate transition to the nurse educator role: An integrative review. Fitzwater, J., et al, Nurse Educator, 2020.
The purpose of this review was to examine what is known about using simulation to facilitate transition to the nurse educator role. It concluded that simulation learning has the potential to support the nurse educator in role transition and development.

Virtual simulation in nursing education: A systematic review spanning 1996 to 2018. Foronda C.L., et al, Simulation in Healthcare : Journal of the Society for Simulation in Healthcare, Vol 15, 1, 46-54. 2020.
The objective of this systematic review was to identify how virtual simulation impacts nursing student learning outcomes. 80 studies were reviewed. Most research (n = 69, 86%) supported virtual simulation as an effective pedagogy to support learning outcomes while highlighting gaps and areas of bias. The authors conclude that future studies should use more robust research designs, prioritize curricular integration of virtual simulation, and determine best practices in virtual simulation methodology.

Multi-professional simulation-based team training in obstetric emergencies for improving patient outcomes and trainees' performance. Fransen, A.F., et al, Cochrane Database of Systematic Reviews, 011545. 2020.
This Cochrane review aimed to assess the effects of simulation-based obstetric team training on patient outcomes, performance of obstetric care teams in practice and educational settings, and trainees' experience. It included eight RCTs, six of which were cluster-randomised trials, involving more than 1000 training participants and more than 200,000 pregnancies/births. It concluded that simulation-based obstetric team training may help to improve team performance of obstetric

teams, and it might contribute to improvement of specific maternal and perinatal outcomes, compared with no training. However, high-certainty evidence is lacking due to serious risk of bias and imprecision, and the effect cannot be generalised for all outcomes. Future studies investigating simulation-based obstetric team training compared to training courses with a different instructional design should carefully consider how and when to measure outcomes. Particular attention should be paid to effect measurement at the level of patient outcome, taking into consideration the low incidence of adverse maternal and perinatal events.

Clinical simulation for nursing competence development in cardiopulmonary resuscitation: Systematic review, Garcia Nascimento, J.,da Silva, et al, Revista Latino-Americana De Enfermagem, Vol 28, 2020.

This review aimed to identify the effectiveness of clinical simulation for competence development regarding cardiopulmonary resuscitation in comparison with different teaching and learning strategies used in the education of nursing students. Five studies with good methodological quality were included. All had statistically significant results to develop competence through clinical simulation, when compared to other methods.

Augmented reality and mixed reality for healthcare education beyond surgery: An integrative review. Gerup, J., et al, International Journal of Medical Education. 2020.

This study aimed to review and synthesize the current research and state of augmented reality (AR), mixed reality (MR) and the applications developed for healthcare education beyond surgery. Twenty-six studies were included. Six involved established applications the rest being prototypes. The most frequently studied subjects were related to anatomy and anaesthesia (n=13). All studies showed several healthcare educational benefits of AR and MR, significantly outperforming traditional learning approaches in 11 studies examining various outcomes. Studies had a low-to-medium quality overall.

Use of high-fidelity simulation technology in disasters: An integrative literature review, Gunshin, M., et al, Acute Medicine & Surgery, e596. 2020.

This integrative literature review of 21 studies assessed the role of high-fidelity simulation (HFS) technology in disasters. Nearly 60% covered only disaster preparedness phase. The four most frequently mentioned technologies were immersive virtual reality simulation, computerized virtual reality simulation, full-scale simulation, and augmented reality wearable smart glasses simulation. Nearly 50% of the studies used technology for purposes other than disaster simulation education, including telemedicine (14.3%), risk planning (14.3%), high-risk map generation for preparedness purposes (9.5%), or rehabilitation medicine (4.8%). The review concluded that HFS has the potential to provide an authentic training environment, secure response, valuable risk planning, and smooth resilient opportunities for disasters.

The role of manikins in nursing students' learning: A systematic review and thematic metasynthesis. Handeland J.A., et al, Nurse Education Today, 104661. 2020.

This review aimed to summarise and synthesise findings from qualitative primary research studies of nursing students' experiences from educational activities using manikins, to gain a deeper understanding of the role these manikins play in the students' learning. Twenty-eight articles from twenty-seven studies were included. The review identified three themes: Seeing the manikin as a doll or a patient, Experiencing yourself as a nurse caring for a patient, and Being a team member. When it is perceived as a patient, a manikin can give students a realistic experience of what it means to behave like nurses. This realism lets students practice and acquire relational,

communicative, and collaborative nursing skills. The authors suggest that educators should create learning methods that amplify the students' experience of manikins as patients and themselves as nurses by using patient scenarios that personalise the manikin and situate the students in a specific situation. This way, even skill trainers or low-fidelity manikins may appear as 'real patients' for the students.

Use of artificial intelligence and virtual reality within clinical simulation for nursing pain education: A scoping review, Harmon, J., et al, Nurse Education Today, 104700. 2021.
This review examined studies of virtual reality or artificial intelligence interventions for education on pain care provision in nursing. Four published studies were included. All used mixed methods and used artificial intelligence within clinical simulations as an intervention. No studies using virtual reality for pain education met the inclusion criteria. The authors conclude that there is a paucity of research on the use of virtual reality or artificial intelligence in pain education for nurses. Current studies are preliminary in nature and/or pilot studies.

Deliberate practice in simulation-based surgical skills training: A scoping review. Higgins, M., et al, Journal of Surgical Education, 2020.
In recent years there has been a shift from traditional Halstedian methods toward more simulation-based medical education (SBME) for developing surgical skills. This review explored the effectiveness of deliberate practice as an instructional design for developing surgical skills through SBME interventions. 17 articles met the inclusion criteria. Deliberate practice-informed SBME interventions appeared effective for developing surgical skills among trainee surgeons, however the reliability of these conclusions was limited by the modest quality of the research studies and the design elements of deliberate practice were inconsistently applied. There was little evidence that deliberate practice led to skills retention beyond 30 days, although participant numbers were low and the quality of studies was modest.

Applicability of augmented reality in orthopedic surgery - A systematic review. Jud, L., et al, BMC Musculoskeletal Disorders, 103. 2020.
While Augmented Reality is increasingly used in several medical specialties, its potential benefit in orthopedic surgery is not yet clear. The purpose of this article is to provide a systematic review of the current state of knowledge and the applicability of AR in orthopedic surgery. 31 studies and reports were included and classified into the following categories: Instrument / Implant Placement, Osteotomies, Tumor Surgery, Trauma, and Surgical Training and Education. The article includes a discussion by the authors on the requirements for seamless integration of Augmented Reality in future surgical practice.

Ochsner obstetrics and gynecology simulation program: A review of the literature and description of a multidisciplinary simulation program targeting management of obstetric emergencies. Lawson W., et al, Ochsner Journal, Vol 20, 4, 394-399. 2020.
This article reviews the current literature regarding simulation training for obstetric emergencies and describes the implementation of a multidisciplinary obstetric simulation program. The review found that many studies focused on provider education but few studies detailed the direct impact on patients. It reviewed simulation reports that demonstrated improved clinical outcomes after obstetric emergencies. These studies formed the basis of the Ochsner Obstetrics and Gynecology Simulation Program in New Orleans, including: a half-day course at the simulation training center, in-situ simulation on clinical care floors, and just-in-time training in the classroom. The article

presents detailed examples of simulation scenarios to assist others in creating a robust simulation program to ensure staff and providers are well trained to respond to obstetric emergencies.

Effect of simulation-based team training in airway management: A systematic review, Nielsen, R.P., et al, Anaesthesia, 2021.
This review examined the effect of simulation-based team training on patient outcomes, healthcare professionals' clinical performance and preparedness for airway management. Twenty-two studies were included. Four reported patient-centred outcomes (Kirkpatrick level 4), and three reported outcomes related to healthcare professionals' clinical performance (Kirkpatrick level 3). The results were ambiguous and the studies had significant methodological limitations. Most studies reporting knowledge or skills outcomes demonstrated in a test setting (Kirkpatrick level 2) were in favour of simulation-based team training, but were prone to bias. The authors concluded that the current evidence is weak and recommended that future research should be based on randomised study designs and patient-centred outcomes.

Use of endovascular simulator in training of neurosurgery residents - A review and single institution experience. Patchana, T., et al, Cureus, Vol 12, 12, e11931. 2020.
Simulators for surgical procedures and interventions have undergone significant technological advancement in the past decade and are becoming more commonplace in medical training. This article reports on a systematic PubMed search for studies related to neurointerventional radiology training via simulation, and reports on one institution's experiences.

Improving patient- and family-centered communication in pediatrics: A review of simulation-based learning. Peterson, E., et al, Pediatric Annals, e32-e38. 2021.
This article reviews the available literature on simulation-based learning to improve patient- and family- centered communication in the discipline of pediatrics. It examines the various methods, theories, and frameworks on which simulation-based learning for communication skills are built with the goal of assisting pediatric providers in using this educational technique.

The integration of immersive virtual reality simulation in interprofessional education: A scoping review, Qiao, J., et al, Nurse Education Today, 104773. 2021.
This review aimed to explore the effectiveness of immersive virtual reality simulation (IVRS) in interprofessional education (IPE) and the experience of students from various disciplines in a virtual clinical environment. 12 articles were included. The experiences of students participating in IVRS centered on enhanced cooperation and communication across their disciplines. They obtained a more accurate picture of the patient and developed an interdisciplinary care plan. After the IPE session, they had greater appreciation of the importance of a team approach and shared learning. Students acknowledged the usability of virtual worlds (VWs) and appreciated the immersive learning experience that was offered.

Contemporary integrative review in simulation-based learning in nursing. Rajaguru, V. & Park, J., International Journal of Environmental Research & Public Health, 2021.
The aim of this review was to synthesize research findings regarding the effects of simulation-based learning among nursing students. Fifteen articles were included. Effects of simulation-based learning methods were derived under four themes: knowledge and skills; attitude; self (learning, efficacy, determination, competency, confidence, utilization, satisfaction, assessment); and 'com' (competency, communication, and confidence) and P (perceptions and performance).

How does virtual reality simulation compare to simulated practice in the acquisition of clinical psychomotor skills for pre-registration student nurses? A systematic review. Rourke, S., International Journal of Nursing Studies, Vol 102, 103466. 2020.
This review aimed to systematically review the published evidence to answer the question 'How does virtual reality simulation compare to simulated practice in the acquisition of clinical psychomotor skills for pre-registration student nurses?' Nine studies were included in the review. All studies employed a quasi-experimental design but were of mixed methodological quality. Virtual reality groups performed favourably in comparison to simulation groups in posttest knowledge scores, cognitive gain, skill performance scores and skill success rate. There was divergence of results in relation to time taken to complete the skill. Whilst the results are generally favourable for virtual reality, variation in devices, data collection tools and outcome measurements mean that caution must be used in their interpretation.

Use of virtual reality-based training in different fields of rehabilitation: A systematic review and meta-analysis. Rutkowski, S., et al, Journal of Rehabilitation Medicine, jrm00121. 2020.
This review analysed the effectiveness of VR-based interventions within several fields of rehabilitation, and whether the outcomes of VR-based interventions, in terms of upper or lower limb function, gait and balance, differ with respect to the VR system used. 20 articles were included, with neurological, orthopaedic, geriatric or paediatric patients, and 17 studies were included in a meta-analysis. The review concluded that use of specialized VR and gaming VR can be advantageous for treatment of the upper extremity, but not for hand dexterity and gait. Specialized VR can improve balance in neurological patients.

Skill acquisition of safe medication administration through realistic simulation: An integrative review. Santana, B.d.S., et al, Revista Brasileira De Enfermagem, e20190880. 2020.
This review aimed to investigate evidence on the contribution of realistic high, medium or low fidelity simulation to the acquisition of knowledge, skills and attitudes in safe medication administration by nursing students. The authors concluded that using low and high fidelity simulators, standardized patients and virtual simulation can promote acquisition of essential skills for patient safety.

The effect of multiple exposures in scenario-based simulation: A mixed study systematic review. Svellingen, A.H., et al, Nursing Open, 380-394. 2021.
This review examined the use and effects of multiple simulations in nursing education. 27 studies were included. In the studies, students participated in multiple simulation sessions, over weeks to years, which included 1-4 scenarios in various nursing contexts. Simulations were used to prepare for, or partly replace, students' clinical practice. The authors concluded that multiple scenario-based simulation is a positive intervention that can be implemented in various courses during every academic year to promote nursing students' learning.

Evaluation of teamwork assessment tools for interprofessional simulation: A systematic literature review. Wooding E.L., et al, Journal of Interprofessional Care, Vol 34, 2, 162-172. 2020.
This review aimed to assess the validity of teamwork tools used in simulation-based interprofessional training for healthcare workers and students. 24 studies were included. Three tools demonstrated good validity evidence underpinning their use – TEAM (Team Emergency Assessment Measure), TPOT (Team Performance Observation Tool) and GATOP/AOTP ((Global) Assessment of Obstetrical Team Performance). However, three studies did not explore tool psychometrics at all, and the quality of reporting amongst these studies on design and participant

demographics was variable. The authors concluded that further research to generate reporting guidelines and validate existing tools for new populations would be beneficial.

Effectiveness of virtual reality training in improving knowledge among nursing students: A systematic review, meta-analysis and meta-regression. Woon A.P.N., et al, Nurse Education Today, 104655. 2020.

This review aimed to (1) evaluate the effectiveness of virtual reality (VR) training in improving knowledge among nursing students and (2) identify the essential features of training. 14 RCTs were included. Meta-analysis demonstrated a significant improvement in knowledge, with a small-to-medium effect in the VR group compared to the control group. Subgroup analyses highlighted that VR training was more efficacious in delivering procedural knowledge to undergraduate nursing students when conducted in multiple, self-guided, short sessions within 30 min and by using low–moderate level of immersion. The authors concluded that VR may be a viable teaching strategy to improve knowledge acquisition, but it is presently suitable for supplementing conventional teaching methods.