Simulation in Nursing Education: An Evidence Base for the Future

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Foreword

In the rapidly evolving landscape of healthcare education, higher education institutions (HEIs) are seeking new and innovative approaches to keep pace with technological advancements, overcome placement capacity challenges and meet the growing workforce demands. The COVID-19 pandemic demonstrated the resilience and adaptability of the HEI sector, as institutions quickly embraced opportunities to innovate including new uses of simulation to replicate clinical placements. It's vital that we keep up this momentum and build on the lessons learnt from the pandemic to drive further advancement.

Simulation can play a transformative role in revolutionising nursing education through diversifying and strengthening learning experiences, expanding placement opportunities beyond the traditional clinical setting and fostering a new generation of skills. This report offers an evidence-base to show how simulated practice learning can shape the future of nursing education in the UK. It explores organisational readiness, the opportunities and challenges facing HEIs in adopting and delivering SPL and student and supervisor experiences. The findings of this report have particular relevance against the backdrop of the NMC's recently updated Standards for Pre-Registration Nursing Programmes and the ambitious targets of NHS England's Long Term Workforce Plan.

Having been first elected as lead of the Council of Deans of Health Education Impact Group in 2016, I have been able to see how innovation has transformed the sector over the years. I look forward to seeing how this report will inform discourse and decision making around the role of simulation in the future of healthcare education. I would like to thank my colleagues at Anglia Ruskin University who have worked tirelessly to compile this comprehensive report, and to the Council of Deans of Health for their support.

Professor Nigel Harrison Council of Deans of Health Pedagogy & Innovation Chair, Pro Vice Chancellor and Dean of the Faculty of Health, Education, Medicine and Social Care, Anglia Ruskin University

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Methods

- Phase one – A systematic review of primary studies and regulatory and national standards.
- Phase two – A cross-sectional survey to explore organisational readiness for simulation-based education (SBE) and opportunities and challenges of SBE in pre-registration nursing courses in the UK.
- Phase three – A case study involving two self-reporting student surveys and a focus group with academic staff acting as practice supervisors.
- Phase four - Focus groups with Council of Deans of Health (CoDH) members who have NMC approval for SPL to capture their experiences in the delivery of SPL in pre-registration nursing programmes.

Findings and Conclusion

This report provides an evidence base demonstrating how simulated learning can transform practice learning in nursing education and meet the NMC (2018) future nurse standards of proficiency for registered nurses. The findings emphasise the significant contribution of simulated practice learning (SPL) in the delivery of pre-registration nursing programmes. The systematic review indicated that, on average, SBE is more effective than traditional clinical education in improving nurse assessment outcomes.

The cross-section survey of higher education institutions (HEIs) with pre-registration nursing programmes highlighted their commitment to SBE with the recognition that infrastructure, commitment by faculty leadership, access to facilities, resources and funding were critical for ensuring success and sustainability. SPL was acknowledged as an effective method that complements learning in clinical placements and enables attainment of the future nurse standards of proficiency for registered nurses.

This research highlighted the difficulties HEIs face when delivering SPL. There was a strong desire for clarity and a benchmarking tool to ensure consistency in the approach of HEIs. In addition, the planning, design and delivery of simulation was viewed as an advanced skill for academic staff and thus they require sufficient training. There is a need to develop the evidence base of SPL and measure the impact and benefit on student learning and achievement of proficiencies. Creating a standardised tool to evaluate the outcomes of SPL would provide a benchmark for all HEIs to use. It would also be useful for the NMC to monitor the impact of the new definition of SPL.

This research has been undertaken after several HEIs have already incorporated SPL into their programmes. In line with ambitions in the NHS England Long Term Workforce Plan, there is now an opportunity to expand the number of HEIs integrating SPL into their pre-registration nursing programmes. The findings provide an important bedrock of evidence for future decisions such as regulatory and financial support for simulated learning. Relevant stakeholders may take a range of positions on this subject, but this evidence base will further inform the conversations ahead.

Suggested next steps

Future work could include greater collaboration across the sector to share best practice and to co-produce the design, development, and delivery of scenarios for SPL. It would also be helpful to offer clarity around terminology and guidance around SBE and SPL, as well as clarity on funding models and availability of tariffs to support the sustainability of SBE and SPL. HEIs self-assessed capacity and readiness for SBE could be featured within NMC programme approvals. It is also recommended that further research should be conducted to explore HEI motives for not choosing to seek NMC approval to adopt up to 600 hours of SPL, staff preparedness for SBE, and clinical practitioners' perceptions of SBE and SPL.

Introduction

For centuries, simulation has been used across a diversity of disciplines including healthcare and aeronautics, revolutionising education, and training by offering immersive and hands-on learning experiences that bridge theory and practice. Simulation in healthcare aims to mimic clinical environments and aspects of clinical care to improve healthcare provider performance, healthcare processes, and patient outcomes. The use of simulation-based education (SBE) aids the development of clinical knowledge, skills, and practice, whilst simulated practice learning (SPL) contributes to the management of clinical placement capacity. Simulation activities allow a healthcare student to experience a range of conditions, scenarios, environments, and patients that in-person placements may not. Unlike clinical practice, where the needs of the patient are the main priority, SPL is centred around the needs of the learner and can be tailored to meet required learning outcomes. Crucially, they allow students to make mistakes, reflect, learn, and transfer knowledge into their clinical placements, so they can be better prepared professionals and provide higher quality care for patients.

During the Covid-19 pandemic, the Nursing and Midwifery Council (NMC) (2021) introduced the Emergency Standard for Nursing Education (RN6D) which allowed for up to 600 hours of the required 2300 clinical placement hours to be replaced by SPL. Initially implemented to respond to decreased placement capacity during a national emergency, these standards were later permanently adopted by the NMC (2023) and can now be used by approved education institutions.

The NMC (2023) Standards for Pre-registration Nursing Programmes require nursing students to complete 2300 hours of learning in practice settings. The literature suggests that a post-Brexit review should be undertaken of the number of hours students undertake in practice learning, with a move towards a focus on attaining standards of proficiency rather than hours of learning. Practice learning hours required in nursing courses vary across the world (Garrow et al., 2022). The NMC has previously consulted on this through commissioning Harlow Consulting (2021) to compile an independent benchmarking report, and the 2300 hours currently remain a requirement in the UK. By comparison, the practice learning component in other healthcare courses varies, for instance, the Chartered Society of Physiotherapy in the UK stipulate that physiotherapy students need to spend 1000 hours in settings that enhance their knowledge and skills, amounting to approximately one third of the course time.

Innovations made during the Covid-19 pandemic, alongside the opportunities afforded by Brexit to better tailor nursing regulation to the UK's needs, underpin the importance of this report. This study provides an evidence base for future decisions on how far simulation could enhance nursing education in the UK. This comes shortly after the publication of NHS England's (2023) Long Term Workforce Plan that explicitly seeks to embrace technology, calls for further regulatory change in nursing and asks universities to utilise the updated standards on SPL already introduced by the NMC.

Definitions

At the start of this research project in October 2022, simulation was defined by the NMC (2019) as "an artificial representation of a real-world practice scenario that supports student development and assessment through experiential learning with the opportunity for repetition, feedback, evaluation and reflection". In April 2023, the NMC revised their definition as "an educational method which uses a variety of modalities to support students in developing their knowledge, behaviours and skills, with the opportunity for repetition, feedback, evaluation and reflection to achieve their programme outcomes and be confirmed as capable of safe and effective practice" (NMC, 2023).

SBE or simulation-based experience are interchangeably used in literature and defined in the Healthcare Simulation Standards as "a broad array of structured activities that represent actual or potential situations in education, practice, and research (International Nursing Association for Clinical Simulation and Learning (INACSL, 2021)). These activities allow participants to develop or enhance knowledge, skills, and/or attitudes, and provide an opportunity to analyse and respond to realistic situations in a simulated environment" (INACSL, 2021). SBE is used in this research project as it was the most commonly used term in the healthcare simulation literature at the time this research project was undertaken. It is also used by NHSE (former Health Education England) (HEE, 2018, 2020, 2021) in their frameworks, vision, and toolkits for simulation.

SPL is a term initially mentioned by the NMC (2007) and again in their publication of the Emergency Standard for Nurse Education (NMC, 2021). The definition was recently revised by NMC (2023) stating that "simulated practice learning can replicate, support, and complement practice learning scenarios through a wide variety of methodologies". These methodologies can include the use of actors and role play to portray clinical scenarios; the use of immersive rooms, which can depict any situation from a hospital environment to a motorway emergency; as well as the use of virtual reality to carry out simulated clinical assessments" (NMC, 2023). The NMC stipulated that SPL must:

- Meet the Standards for Pre-registration Nursing Programmes for practice learning.
- Meet the Standards for Student Supervision and Assessment (SSSA).
- Ensure that those supervising SPL should be appropriately prepared to do so.
- Demonstrate achievement of the learning outcomes that would have been experienced in a practice setting.
- Be used to enhance practice learning.
- Provide opportunities to explore diverse areas of practice and experience situations less frequently encountered in the practice setting.

For the purpose of this research project, SBE will be used to describe the learning activities as described by INACSL (2021) and SPL will be used to describe simulation activities delivered by approved AEIs that specifically meet the NMC requirements for SPL, as described above, for the maximum of 600 of the 2,300 hours.

Overview of the Simulation Research Project

Aims

The purpose of this research project was to investigate how simulated learning can transform practice learning by comparing existing learning approaches with emerging simulated and technology-enhanced learning approaches. The project also maps the ability of simulation to meet the NMC (2018) Future Nurse Standards of Proficiency for Registered Nurses.

Methods

Phase one – A systematic review of primary simulation studies and review of regulatory and national standards.

Phase two – A cross-sectional survey to explore organisational readiness for SBE and opportunities and challenges of SBE in pre-registration nursing courses in the UK.

Phase three – Two self-reporting student surveys and a focus group with academic staff acting as practice supervisors.

Phase four – Focus groups with CoDH members who have NMC approval for SPL to capture their experiences in the delivery of SPL in pre-registration nursing programmes.

The School Research Ethics Panel for Allied Health, Nursing and Midwifery and Medicine at Anglia Ruskin University reviewed and approved this study (approval number ETH2223-2620, 2223-0867, 2223-6347).

Phase one – Systematic review of primary studies and review of regulatory and national standards

1. A systematic review of primary studies in nursing where SBE used to develop competence is compared to practice-based learning (person-based teaching).
2. A review of regulatory standards from anywhere in the world that includes use of simulation for the education of nurses at undergraduate and postgraduate level.
3. A review of international literature on national standards used for SBE and related approaches in engineering, aviation, and robotics, that are applicable to nursing.

The evidence collected from the systematic review was used to map against the Future Nurse Standards of Proficiency for Registered Nurses, to see where there is evidence available for the outcomes listed and whether SBE has any impact on competency measures.

Phase two – Cross-sectional survey

Council of Deans of Health (CoDH) members, which include representatives from higher-education institutions that deliver pre-registration nursing courses in the UK, were invited to undertake a survey exploring their organisational readiness for SBE and the opportunities and challenges involved.

Phase three – Case study

A case study approach was used for an in-depth evaluation of the use of SPL with second year mental health (n=22) and child (n=26) pre-registration nursing students from Anglia Ruskin University who engaged in a two-week SPL between January and May 2023. The nursing students engaged in a range of scenarios observed by practice supervisors to achieve skills outlined in Annexe A and/or procedures in Annexe B of the NMC Future Nurse: Standards of Proficiency for Registered Nurses.

The nursing students were surveyed and asked to evaluate the SPL. Feedback provided focused on experience of the SPL; student supervision; student assessment; development of skills; support, facilities, and equipment; engagement and satisfaction, transferability to other settings, and effective delivery. The themes/questions were agreed by the expert reference group.

A focus group was conducted with academic staff (n=4) who acted as practice supervisors facilitating the SPL.

Phase four – Focus Group

CoDH member representatives of higher-education institutions, who had received NMC approval to include SPL in the delivery of practice learning through the RN6D standard, were invited to engage in focus groups. The aim was to capture their experience of the approval process; learning from set up and delivery, and hints and tips for overcoming barriers.

Strategic Assurance Group

Survey and focus group questions were circulated to the Council of Deans of Health Innovation and Pedagogy Strategic Policy Group and Regulation Strategic Policy Group for review, discussion, and feedback.

Phase one: Systematic review

Professor Catherine Meads and Dr Louise Prothero

Systematic Review

The question that the systematic review answers is whether SBE can be used to replace some of the 2300 hours of practice-based learning pre-registration nurses undertake in a range of clinical practice settings, and which elements from the NMC (2018) Future Nurse Standards of Proficiency for Registered Nurses can be delivered by SBE.

Background to systematic review

There are a very large numbers of published studies of SBE, and there is a specialist journal entitled Clinical Simulation in Nursing. However, many of the studies take a single group of students, teach them using SBE and then assess their proficiency, competency, or skills. Modifications to this case series study design include assessing them before and after the teaching and assessing at follow up to assess retention of learning.

Alternatively, a two (or three or four group) study design can be employed, where the intervention group(s) receive the SBE, and the comparator groups receive the previously used teaching methods (classroom-based, low-fidelity simulation, clinic-based, hospital-based etc). These two groups are then compared for a wide variety of quantitative outcomes including self-assessed competency, anxiety, and other mental health outcomes, OSCE results, objectively assessed competency, exam results, or qualitative outcomes or a combination. Self-assessed outcomes may not be accurate (Garner, 2020; Alastalo, 2022).

There are relatively large number of studies with concurrent intervention and comparator groups, comparing SBE to classroom teaching on the same topic, but much fewer comparing SBE to real patient-based training on the same topic. Fewer still have recorded objectively assessed quantitative outcomes of competency, examination results and objective structured clinical exam (OSCE) results or with other relevant outcomes. These are the study designs required to prove that SBE can be used to educate nurses instead of, or to complement, patient-based education on the same topic in their clinical placements.

A review of systematic reviews and meta-analyses in simulation teaching in the published literature, including the Clinical Simulation in Nursing Journal, revealed a considerable number (approximately 300-400) systematic reviews. None of them fully answered the question as to whether SBE can be used to educate nurses instead of patient-based training in their clinical placements. The nearest were an early systematic review of simulation in preparation or substitution for clinical placement (Larue et al., 2015), a realist meta-narrative review of simulation to replace clinical hours in nursing (Roberts et al., 2019) and a review of hospital-based simulation in nursing education (Rutherford-Hemming, 2017). Larue et al. (2015), in particular, discussed the issue of throughput of nurses in clinical education and the possibility of using simulation to replace some of the clinical hours, and found that substituting clinical placement with simulation did not seem to have a significant impact on clinical competency, critical thinking, knowledge acquisition, and self-confidence, but the systematic review was not written to the PRISMA Guidelines (first published in 2009) and it is a little unclear as to how the conclusions were derived from included studies. Therefore, we conducted an up-to-date systematic review on the evidence to demonstrate whether SBE in any form can be used to train nurses instead of patient-based training of the same topics in their clinical placements, using objectively measured outcomes.

Methods

The protocol for this systematic review was registered on the PROSPERO database (registration number: CRD42022363205).

Eligibility criteria

Design of studies

Empirical comparative studies with a concurrent comparator including randomised controlled trials (RCTs), cluster RCTs, cross-over RCTs, cohort, or case-control studies were included. Studies must have been fully published in a peer review journal. Conference abstracts and fully published studies with a historical control (for example, students were assessed before and after an episode of SBE) were excluded.

Population and setting

Studies including participants who were nursing students at undergraduate level were included. Studies including mixed participant groups (for example, nursing students at undergraduate level and medical students) were excluded. The setting could be any educational or health-related establishment, which could include hospitals or primary care providers, or universities or education colleges anywhere in the world.

Intervention

The use of SBE to teach clinical skills was included. Simulation could include very basic equipment such as injecting into potatoes to develop skills in administering injections, or use specialist equipment such as mannequins for resuscitation, or could be very technological advanced such as using virtual reality. SBE is the process where students practice a procedure or routine in a simulated learning environment (SLE) before treating actual patients. These environments use different scenarios and equipment and can vary in realism.

Comparator

The same set of skills and abilities being taught using clinical practice-based or patient-based teaching was included. Studies without a comparator were excluded.

Outcomes

Primary outcomes included:

1. Any relevant clinical outcomes (for example, mortality, wound infection, length of hospital stay).
2. Patient-based care being given appropriately.
3. Examination success, OSCE success, assignment success, externally verified proficiency or competency, teacher verified proficiency or competency.
4. Patient acceptability of nursing care given.
5. Staff resource time for teaching of the students.

Secondary outcomes included staff resources required for the education and training. Studies were only included if they reported one or more of the primary outcomes. Effect measures could be given in a variety of ways, such as exam pass rate percentages, mean scores on competency assessment or patient ratings of nursing care.

Study design, time frame and language

Any comparative studies were included. The publication date was limited to the year 2000 onwards. There were no language restrictions.

Information sources and search strategy

The following databases were systematically searched in December 2022: MEDLINE (OVID), Embase (OVID), Maternity and Childcare (OVID). CINAHL (EBSCO), PsycINFO (EBSCO) Central (Cochrane Library), Scopus, Science Citation Index (Web of Science) ERIC (EBSCO), and Assia (ProQuest).

Included studies in 17 systematic reviews found through searching Google were checked for eligibility because some nursing journals are not indexed in any of the databases we searched, for example, the Journal of Nursing Education and Practice, hence the need to search for includable studies via other means. The journal Clinical Simulation in Nursing was searched for systematic reviews and meta-analyses published from 2000 onwards. These were then sifted for eligible studies for this systematic review.

The search strategy was based on synonyms of 'simulation', 'assessment', 'teaching', 'nurse', 'undergraduate', 'trial' and 'patient'. Searches combined free text words and MeSH terms which were exploded to gain maximum capture. The search strategy, originally for Ovid MEDLINE, was adapted for use with the other databases. The search strategy was limited to studies published from January 2000.

Selection process

Following the database searches, retrieved citations (titles and abstracts) were exported to Endnote Web and screened to identify potentially relevant studies. Of these citations, 60% were assessed independently for inclusion by two people, with any disagreements resolved through discussion. The remaining 40% of citations were assessed by one person, as by that point good agreement had been reached. One list of eligible citations was made and full texts were obtained. Where it was not clear if a citation were includable or not, the full text was also obtained. Full texts were assessed for inclusion by two people, with any disagreements resolved through discussion.

Data collection process

Data were extracted by two people and checked by each other. Material extracted included study design, patient characteristics, clinical area of teaching, type of simulation, type of patient-based teaching, control condition, type of outcomes measured, and numerical results. Data were extracted onto tables in a Word document.

Meta-analysis

Studies were categorised into groups according to intervention and comparator (SBE vs clinical teaching, SBE plus clinical teaching vs clinical teaching only, more vs less SBE in course). In each category, meta-analyses were attempted if there were more than four studies presenting continuous outcomes or presenting categorical outcomes. As the continuous outcomes were for a variety of different outcome measures, standardised mean differences (SMD) were used. This is a measure of effect size, which has the advantage that it does not depend on the units of measurement used in the included studies. However, the SMD is reported in units of standard deviation rather than a measurement scale so is more difficult to interpret. As a rule of thumb, a large effect size is 0.8, medium 0.5 and small effect 0.2.

Meta-analysis was conducted in the Revman 5.4 package. For each study, if more than one outcome was reported, a single most appropriate outcome was chosen (such as nursing proficiency, final exam results, OSCE results, knowledge test results) before the meta-analysis was conducted. The actual

outcome chosen for each study is reported in the meta-analysis section of the results. Normally a higher score is a better result. Where the lower score is a better result (such as for number of errors) the results are reversed in the meta-analysis. Heterogeneity was assessed using the I^2 statistic.

Funnel plots were constructed where there were ten or more studies in a meta-analysis, in order to look for publication bias (because small studies with non-significant results tend not to be published).

Results of the systematic review

From 7,870 citations from databases, 3,966 citations were sifted after duplicates had been removed (See Appendix 1). We investigated 132 full text pdfs and included 34 studies (from 35 papers). Although we also looked at systematic reviews of simulation studies, no extra texts came through this route. Of the additional foreign language papers found, eight South Korean papers were excluded by a speaker of the Korean language, one in Turkish (Tuzer and Yilmazer, 2020) by a Turkish speaker and two of the three Chinese papers were also excluded by a Mandarin speaker. There is one paper written in Mandarin (Cao, 2015) and one in Korean (Lee, 2014) that might be includable but have not currently been included in the systematic review. It is unlikely that the results of these two papers would alter the conclusions of the systematic review but are mentioned here for completeness. Excluded studies where the full text was obtained and the reasons for exclusion are in Appendix 2. Most studies were excluded because they had the wrong control group, often because it was classroom-based teaching, but also no teaching at all or another form of simulation for example, high- versus low-fidelity simulation.

We included 34 studies (see Appendix 3 for their characteristics). The studies mostly came from the USA (n=18), but also South Korea (n=5), Saudi Arabia (n=2), Canada (n=2) and one each from the UK, Norway, Ghana, Iran, Jordan, Oman, and Turkey. Study designs included 14 RCTs, two randomised crossover trials, four cohort studies and 14 case control studies.

Studies varied in size from 30 students (Guerrero, 2021) to 847 students (Hayden, 2014). All the studies included undergraduate nursing students on a variety of courses such as fundamentals of nursing, medical, surgical, mental health, women's health, maternity nursing, family planning, critical care, and paediatric nursing. The courses were described as associate degrees, Baccalaureate Nursing, Bachelor of Nursing, Diploma of Nursing, Licensed Vocational Nursing, Prelicensure Nursing and undergraduate nursing degrees. The settings were a combination of hospital, clinical, nursing home and nursing school venues.

The specific teaching used varied from very short courses such as how to insert contraceptive implants (Dery, 2019) to the full length of the nursing course (Curl, 2016; Guerrero, 2021; Guerrero, 2022; Hayden, 2014; White, 2021). There were three main types of comparisons:

- SBE only vs clinical only – 26 studies.
- SBE plus clinical vs clinical only – 6 studies.
- More SBE vs less SBE in course – 2 studies.

The SBE only vs clinical only studies tended to investigate a relatively short aspect of the nursing course for example, Thomas et al. (2022) where volunteers for the simulation elective had high-fidelity mannequin-based scenarios or standard patient teaching on wound care, medication administration, urinary catheter insertion and cardiopulmonary resuscitation whereas the comparator group non-volunteers had their traditional clinical teaching. Two of these studies were comparing students who had attended the nursing course before the Covid-19 pandemic with those attending during the pandemic, when teaching had to move to SBE only (Banj-Ogunnowo, 2022; Roberts, 2022).

A study with an example of SBE plus clinical practice vs clinical practice only was Alinier (2006), in which students were randomised to SBE using SimMan and various scenarios plus clinical course or clinical course as usual.

An example of a comparison of more SBE versus less SBE during the course was in a study by Hayden et al. (2014) in which entire courses that had simulation for 50% of the course were compared to those with 25% of the course and 10% of the course.

Types of SBE included high-, medium-, or low-fidelity simulation, virtual reality, computer programmes, avatars, mannequins, standardised patients (paid professional actors or trained patients) or simulated scenarios and were not specifically described in some of the studies in which whole courses were compared. Where described the intensity of SBE was compared to clinical education in a 1:2 ratio, so that students would be given for example, one hour of SBE for two hours of clinical education. Debriefing was mentioned in most of the studies but not well-described. Ten studies either had no mention of debriefing or did not do it (Banjo-Ogunnowo, 2022; Centrella-Nigro, 2016; Dery, 2019; Harris, 2011; Hayden, 2014; Luctkar-Flude, 2012; Mancini, 2019; White, 2021; Woda, 2019; Yu, 2017) and in one study it was unclear (Meyer, 2011).

Much less information was available about exactly what the comparator groups received. For the most part it was described as, clinical course as usual, classroom plus standard clinical education on wards or clinical experience of the same topic. For three of the studies, the comparator group was the group of students who had yet to take part in the simulation training (Craig, 2021; Meyer, 2011; Schlairet, 2010). In Meyer (2011) only the two-week scores were SBE vs clinical teaching as all students in the study rotated through the simulation teaching in two-week blocks.

All of the studies included one or more independent assessments of nursing ability, such as exams, OSCEs, knowledge tests, externally rated performance scores and clinical placement grades. Numerical results from all studies are presented in Appendix 4. Most results are presented as continuous outcomes (means with or without standard deviations, medians, and ranges) but several presented categorical outcomes, usually pass rate percentages (Guerrero, 2021; Hayden, 2014; Mancini,2019; Olaussen, 2022; Soccio, 2017; Thomas, 2022). Almost all of the numerical results focused on nursing ability and teaching success.

Two studies also reported dropout rates for more vs less SBE (Hayden, 2014) or SBE plus clinical teaching vs clinical teaching only (Olaussen, 2022). They both showed a higher rate of student dropout with more SBE, but Olaussen et al. (2022) did not explore reasons for drop-out rates. Hayden et al. (2014) suggested that some of the dropouts might be because of people failing exams, but there was no statistically significant difference in failure rates between the three groups. They also found that there were higher numbers of withdrawals because people no longer wished to take part in the study in the 50% group (n=31), and the 25% group (n=21) when compared to the 10% group (n=7).

Regarding education of staff delivering SBE, 23 of the 34 included studies gave no details at all. Of these, some studies may have had a single simulation trainer who was also the author of the paper, but this was not clear. In the remaining 11 studies, only two explained how the staff delivering the simulation were trained. Meyer (2011) described how simulation-trained teaching assistants educated to master's degree level were paired with inexperienced facilitators, whereas Raman (2019) described how all simulation facilitators were educated by a simulation expert certified by the Society for simulation in healthcare (SSIH).

Meta-analysis using SMD in Revman 5.4.

Three main comparisons were used:

1. SBE only vs clinical education only

For the meta-analysis, a single outcome was chosen to be used for each study. Some of the studies only reported one outcome, but where more than one outcome was available, the outcome chosen was based on nursing proficiency and clinical ability rather than knowledge only, and final overall results rather than interim or subscale scores were used. The following studies were eligible for this comparison, plus the outcome for each study chosen to be used in the meta-analysis:

- Ataee (2019) – OSCE total score.
- Banjo-Ogunnowo (2022) – Raw HESI exit exam results.
- Centrella-Nigro (2016) – Basic knowledge assessment.
- Dery (2019) – Mean number of errors committed (reversed).
- Hansen (2017) - Total score.
- Harris (2011) – Clinical grades.
- Hwang (2020) - Nursing performance.
- Luctkar-Flude (2012) - Respiratory assessment performance scores.
- Mancini (2019) – NCLEX scores.
- Meyer (2011) - Twi-week performance scores.
- Raman (2019) - Creighton Competency Evaluation Instrument – competency.
- Reid (2020) - Lasater Clinical Judgment Rubric.
- Roberts (2022) - NCLEX exit exam scores.
- Seo (2021) - Clinical competency.
- Son (2020) - Critical thinking.
- Tawalbeh (2020) – Knowledge.
- Thomas (2022) – Assessment Technologies Institute (ATI) comprehensive predictor scores.
- White (2021) - Benchmark exam scores for maternal-newborn course.
- Witt (2018) - Final examination scores.
- Yu (2017) - Overall SBAR communication scores.
- Yu (2021) - High-risk neonatal infection control knowledge.

Not appropriate for meta-analysis

The following studies were not considered eligible for meta-analysis (reasons for each study given in brackets):

- Hall (2015) – Proficiency - (percentages only).
- Schlairet (2010) - Knowledge test – (size of groups not given).
- Sears (2010) – Medication errors – (numbers of errors only).
- Soccio (2017) - ATI test passes - (categorical not continuous outcome).
- Terzioğlu (2016) - Psychomotor skill (medians and ranges given only).

2. SBE plus clinical education vs clinical education only

The following studies were eligible for this comparison:

- Alinier (2006) – OSCE results.
- Craig (2021) – Medication Safety Knowledge Assessment Scores at week 4.
- Curl (2016) - Exit Exam Standard Score.
- Guerrero (2021) – Final internship grades.

- Guerrero (2022) – Final OSCE results.
- Olaussen (2022) - Knowledge test.

3. More SBE vs less SBE in course

As only two studies were eligible for this comparison, no meta-analysis was conducted.

- Hayden (2014).
- Woda (2019).

As comparisons 1 and 2 had more than four eligible studies each, meta-analysis was conducted for these two comparisons and are presented below.

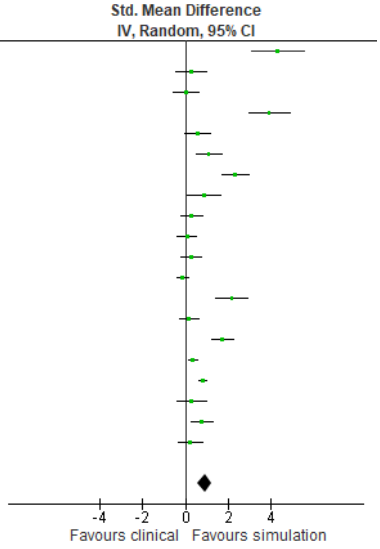
1. SBE only vs clinical education only meta-analysis result

There were 20 studies included in the meta-analysis (Figure 1). The SMD was 0.91 (95% CI 0.58 to 1.24). This means that, on average, SBE is more effective than clinical education in improving the mix of outcomes measured. The effect size is 0.91 so this could be considered a large effect size. The heterogeneity (I^2) is large at 91% meaning that there is much variation between studies. However, it is noticeable from the Forest plot that none of the 20 studies favoured clinical education over SBE. Examination of the funnel plot (see Appendix 5) suggests that small studies with negative or no difference in outcomes may be missing. If these were present, they would have the effect of reducing the effect size.

Figure 1. Forest plot of simulation vs no simulation/clinical education only

	Simulation			Clinical				Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Ataee 2019	34.1	4.1	19	16.6	3.8	18	3.3%	4.33 [3.10, 5.55]
Banjo-Ogunnowo 2022	896.8	148.5	18	859.1	105.7	14	4.7%	0.28 [-0.42, 0.98]
Centrella-Nigro 2016	68.2	3.5	21	67.1	66	22	5.0%	0.02 [-0.58, 0.62]
Dery 2019	2.48	0.16	25	1.93	0.11	25	3.9%	3.94 [2.97, 4.92]
Hansen 2017	21.73	3.1	22	20.01	2.8	26	5.1%	0.58 [-0.01, 1.16]
Harris 2011	3.7	0.1	16	3.4	0.3	55	5.0%	1.10 [0.51, 1.69]
Hwang 2020	2.5	0.2	34	1.9	0.3	32	4.9%	2.34 [1.71, 2.97]
Luctkar-Flude 2012	32.9	4.2	14	28.9	4.5	14	4.5%	0.89 [0.11, 1.67]
Meyer 2011	24.3	3.8	28	23.1	4	29	5.2%	0.30 [-0.22, 0.83]
Raman 2019	19.81	2.28	40	19.59	3.19	34	5.4%	0.08 [-0.38, 0.54]
Reid 2020	31.96	5.44	27	30.29	6.72	35	5.3%	0.27 [-0.24, 0.77]
Roberts 2022	944.3	116.5	112	956.9	99.4	112	5.8%	-0.12 [-0.38, 0.15]
Seo 2021	31.9	4.5	25	18.9	7.2	20	4.6%	2.18 [1.43, 2.94]
Son 2020	106.3	10.5	47	104.6	11.4	31	5.4%	0.15 [-0.30, 0.61]
Tawalbeh 2020	29.8	4.3	38	23.8	2.2	38	5.2%	1.74 [1.21, 2.27]
Thomas 2022	74.6	5.5	102	72.2	6.9	293	5.8%	0.36 [0.14, 0.59]
White 2021	76.3	8	358	70.2	6.9	282	5.9%	0.81 [0.65, 0.97]
Witt 2018	87.9	7.6	17	85.8	5.7	15	4.7%	0.30 [-0.40, 1.00]
Yu 2017	17.3	3.3	31	14.7	3.4	31	5.2%	0.77 [0.25, 1.28]
Yu 2021	22.8	2.3	25	22.1	3.3	25	5.1%	0.24 [-0.31, 0.80]
Total (95% CI)			**1019**			**1151**	**100.0%**	**0.91 [0.58, 1.24]**

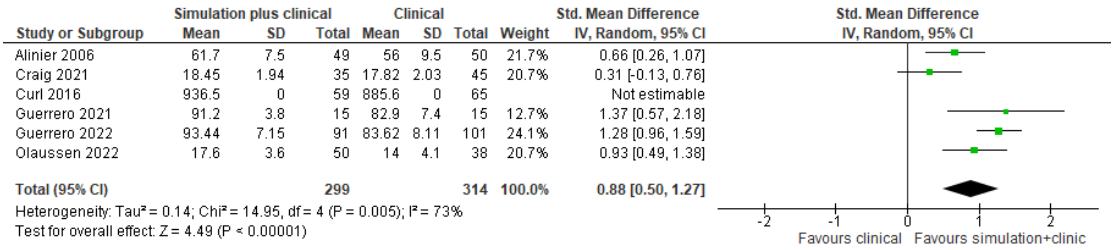
Heterogeneity: Tau² = 0.48; Chi² = 204.93, df = 19 (P < 0.00001); I² = 91%
Test for overall effect: Z = 5.41 (P < 0.00001)



SBE plus clinical education vs clinical education only meta-analysis result

There were six studies eligible for this meta-analysis (see Figure 2), but one study (Curl 2016) did not report standard deviations so could not contribute to the numerical result of the meta-analysis. The SMD of the five remaining studies was 0.88 (95% CI 0.50 to 1.27). This means that, on average, SBE plus clinical education is more effective than clinical education alone in improving the mix of outcomes measured and has a similar effect size to the previous meta-analysis. The heterogeneity (I^2) is large at 73% meaning that there is much variation between studies. However, it is noticeable from the Forest plot that none of the five studies favoured clinical education over SBE. There were insufficient studies to generate a meaningful funnel plot.

Figure 2. Forest plot of simulation plus clinical education vs clinical education only



Discussion of systematic review

Summary of results

There were 34 included studies, providing evidence on whether SBE could be used to substitute some clinical education hours for nursing students. Meta-analysis results suggested improved educational assessments with more SBE, with effect sizes of around 0.8-0.9, but two studies suggested higher drop-out rates with more simulation. There was no evidence on patient-based outcomes or resource implications. There were only two included studies evaluating more vs less SBE during the nursing curriculum (Hayden, 2014; Woda, 2019), but one of these was a very large study (Hayden, 2014). This measured a number of educational assessment outcomes and showed that there was little difference in attainment overall between 50% simulation, 25% simulation and 10% simulation.

Some of the included evidence was from natural experiments caused by the Covid-19 pandemic. Because of all the other difficulties that were happening to people during as opposed to before the pandemic, the two groups may not be that comparable. However, despite this, the cohorts during the pandemic did just as well as those before the pandemic. Debriefing is another important aspect to teaching and learning, but most of the included studies were relatively vague on the nature and extent of debriefing used.

Strengths and limitations

A major strength of this systematic review is the strong focus on a precise clinical question. A difficulty has been the large number of publications evaluating SBE in nursing education in general, which has meant sifting through large numbers of publications to find the specific evidence required. The search terms used in the different databases had to be a trade-off between sensitivity and specificity, so that the systematic review could be completed during the time of the research project. Inevitably there may be evidence not found, but given the numbers of included studies, it would be unlikely that any missing evidence would considerably alter the findings. Another strength has been the use of already published systematic reviews to find includable studies. It was useful to note that some of the studies found in the database searches had already been found through the systematic reviews.

There is an assumption in the way this systematic review has been conducted in that all SBE is equivalent. However, it is acknowledged that this is far from true. In the literature the term simulation can mean different things to different people. It can involve using real people, such as standardised patients, or mannequins in beds and simulated wards, or virtual reality and other computerised scenarios. There was insufficient information from included studies to establish whether there were consistent differences in educational assessments comparing real life simulation to virtual reality. Some of the included studies used both. The meta-analyses also assumes that different outcome measures are equivalent, which is probably not the case. However, to mitigate this

partially SMDs were used as the meta-analysis metric. The fact that none of the included studies showed worse outcomes for SBE gives confidence in the findings despite the different outcomes used.

This systematic review could only include studies where the same topic could be taught by SBE and through clinical or patient-based teaching in hospitals and other similar environments. Unusual events that nurses' need to know about, such as catastrophes, natural disasters, and terrorist attacks, are rare, so it likely that they could only be taught through SBE. Therefore, they are not covered by this systematic review. On the other hand, real people tend to be much more unpredictable than scenarios used in simulations, so may give students false confidence in the range of experiences they are likely to experience in real practice. To add authenticity to scenarios the signs and symptoms demonstrated by mannequins can be altered such as in a scenario of a deteriorating patient, requiring the nursing student to recognise, record and act on the change in condition.

As this is a rapid review, quality assessment of included studies has not been formally assessed. If there had been more time, it could have helped to establish which studies' findings were more believable than others, due to the study having been more rigorously conducted and reported. In an effectiveness question there is a well-established hierarchy of evidence from the various study designs, starting at RCTs and randomised cross-over studies, then cohort studies then case control studies. This information has been presented in Appendix 3, to give the reader some information on the study design and so the strength of the evidence.

Implications for policymakers

From 2007, the NMC permitted 300 of the 2,300 clinical practice hours (13%) to be replaced by SPL (Larue et al., 2015), and the current position is that up to 600 hours can be replaced by SPL (NMC, 2023). One question is whether this 26% can be increased any more without loss of clinical ability and achievement of proficiency or competence in nursing students. The main implication for policymakers is that substituting more hours in clinical practice with SPL is likely to make little difference or may improve nursing student success rates in educational assessments. This is in accordance with a recent UK Delphi study that suggested that between 11% and 30% of clinical placement time could be replaced with SPL (Bridge, 2022).

Another question is whether increasing SBE may slightly increase student nurse attrition. The two studies that reported drop-out rates (Hayden, 2014; Olaussen, 2022) showed higher dropout rates with more SBE. Hayden et al. (2014) showed that more students declined to take part in the study, particularly in the 50% group and to a lesser extent in the 25% group, not because there was any difference in failure rates but because more students no longer wished to take part in the study. The reasons why they no longer wished to take part was not explored.

Implications for research

The original protocol for the study listed any relevant clinical outcomes, such as mortality, wound infection, length of hospital stays, and patient acceptability of nursing care given as important primary outcomes. None of the included studies reported these patient-based outcomes, yet the main driver for the 2,300 hours clinical practice requirement is to ensure adequate proficiency, competence, and patient-based skills in nursing graduates. The next simulation vs clinical teaching evaluations should measure clinical and patient-based outcomes rather than educational outcomes.

The original protocol for the study also listed staff resource time for teaching of the students as an important primary outcome, but none of the included studies reported this either. There needs to be an assessment as to whether the staff in nursing schools in higher education spend more time teaching students through simulation compared to the equivalent hours in a clinical practice setting, and some estimate of the costs of each option.

There is a need to determine whether there is a higher student dropout rate with more simulation or not, why this might be happening, and whether alterations to the way simulation teaching is delivered might prevent higher dropout rates.

Conclusions from systematic review

The evidence from 34 included studies suggests that SBE in general can replace some of the hours of learning on the same topic in clinical practice, and the effect might improve success in student nurse evaluations, but it might slightly increase the number of nursing students dropping out of their courses. There was no evidence regarding resource implications of increasing use of SBE.

Mapping of the systematic review studies to the UK Future Nurse Standard

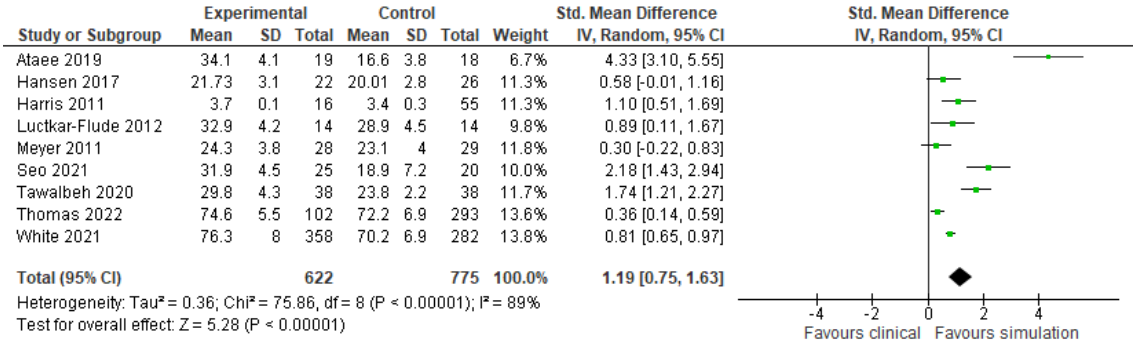
Appendix 6 shows an attempt to map the topic of SBE used in included studies in the systematic review to individual proficiencies within the Future Nurse Standards. It is acknowledged that, as these are relatively short journal articles, precise teaching content was not always clear. Also, some of the included studies evaluated whole courses rather than individual education. However, the proficiencies that were clearly covered during education included:

- Outcome 2.5 - Promote and improve mental, physical, behavioural, and other health related outcomes by understanding and explaining the principles, practice, and evidence-base for health screening programmes (one study).
- Outcome 3.5 - Demonstrate the ability to accurately process all information gathered during the assessment process to identify needs for individualised nursing care and develop person-centred evidence-based plans for nursing interventions with agreed goals (one study).
- Outcome 3.9 - Recognise and assess people at risk of harm and the situations that may put them at risk, ensuring prompt action is taken to safeguard those who are vulnerable (one study).
- Outcome 4.4 - Demonstrate the knowledge and skills required to support people with commonly encountered mental health, behavioural, cognitive, and learning challenges (two studies).
- Outcome 4.5 - Demonstrate the knowledge and skills required to support people with commonly encountered physical health conditions, their medication usage, and treatments (13 studies).
- Annexe A: Communication and relationship management skills (three studies).
- Annexe A Part 1. Underpinning communication skills for assessing, planning, providing, and managing best practice, evidence-based nursing care (one study).
- Annexe A. 4.1.2 - Clear instructions and check understanding when delegating care responsibilities to others (one study).
- Annexe B Part 2, 11 - Procedural competencies required for best practice, evidence-based medicines administration and optimisation (one study).
- Annexe B 11.4 - Undertake accurate drug calculations for a range of medications (one study).
- Annexe B Part 2, 11.7 - Administer injections using intramuscular, subcutaneous intradermal and intravenous routes and manage injection equipment (one study).

Some of the studies assessed the same outcomes as delivered in the taught simulation component. In addition, outcome 7.1 (understand and apply the principles of partnership, collaboration, and interagency working across all relevant sectors) was assessed in one study.

As teaching mapping to outcome 4.5 was taught in 13 studies, of which 9 were in SBE versus clinical education, a Forest plot was constructed from the results from these 9 studies (see Figure 3). This shows that SBE was more successful than clinical education to improve outcomes measured in the studies (SMD 1.19 (95%CI 0.75-1.63).

Figure 3. Forest plot of simulation vs clinical education for studies exploring simulation that maps to Future Nurse Standard outcome 4.5



Review of regulatory standards for simulation teaching in nursing

Background to regulatory standards review

This part of the research project comprises the identification and review of regulatory standards on SBE relevant to the development of proficiencies, skills, and competencies in nursing.

An important aspect of regulatory standards or guidelines for teaching is whether they are based on evidence, or on the opinions of educationalists. The potential for standards to enhance teaching of nurses is dependent on their quality, and their uptake and adoption in nursing. High quality evidence-driven standards have the potential to improve student learning and so improve patient care. Standards also have the potential to improve allocation of finite health resources in terms of staff time and reduce waste (Woolf et al., 1999). Recommendations based on opinions are unreliable as they can be based on judgements, misconceptions, and personal recollections. The involvement of a panel should help to prevent the influence of individual bias.

In some areas of teaching, the need to teach a large group may outweigh individual students' learning needs. Blanket recommendations, rather than a series of options or recommendations for shared decision making, flipped classroom options or other ways to include student voices can ignore student needs (Woolf et al., 1999). More consistent teaching patterns through the use of standards and reduced variation in teaching practice may come at the expense of reducing individualised teaching for those who need it most. Some students may not relate well to SBE, and without good data collection on the impact of standards on student outcomes, these students may fail or drop out of the course unnecessarily.

Another impact is the resource implications of the adoption of SBE. This involves teaching of staff about how to use SBE appropriately, and the pedagogy itself may involve more staff teaching time than otherwise. Teaching through SBE and/or SPL uses university staff whereas clinical learning settings uses clinically based staff, which has considerable ramifications for resource allocation. Some SBE modes involve very expensive simulation mannequins and equipment, and the university or other education establishment must be sure that purchasing this provides good value for money. Professional bodies and regulators who apply these standards should acknowledge the resource implications of imposing their standards. University staff need to be updated regularly to remain contemporary and familiar with policies and procedures. Lecturer practitioners and skills tutors employed part-time in a practice setting provides a solution.

Methods

1. An internet search using google was made to find relevant regulatory standards for SBE in healthcare. Experts on the team provided links to SBE standards commonly used in the UK.
2. The included studies in the systematic review were examined to see if they developed their SBE based on any regulatory standards for education in healthcare.
3. An assessment was made on whether, for one of the most used UK standards for SBE, the recommendations made were based on evidence showing that they would enhance student achievement.

Results of regulatory standards review

1. Appendix 7 shows available standards for SBE available around the world specifically for nursing and midwifery, and Appendix 8 shows available standards for SBE available around the world for healthcare professionals more generally. There are a relatively large number of regulatory standards for SBE in healthcare. However, those commonly used in the UK are INACSL and ASpiH. The Jeffries Simulation Framework is different to the others, as it is a framework rather than standards/guidelines. There is no downloadable PDF for Jeffries, so the book reference has been included.

2. Of the 34 included studies in the systematic review, 21 made no mention in the journal article of any regulatory standards for SBE in healthcare that they might have used. However, this does not necessarily mean that they did not use a standard. A limited word count may have restricted their ability to include details of the regulatory standards for simulation teach in healthcare that they used. The most commonly used standard was INACSL (seven papers), and then the Jeffries Framework (four papers). The remaining two papers referred to issues around regulatory standards for simulation teaching in healthcare:

   "This powerful learning approach termed simulation has been guided more by preferences, anecdotes, and available equipment, rather than by evidence and objective guidelines. Often, simulation instruction is conducted with little faculty preparation operating under the assumption that nurse educators would intuitively know how to use this powerful learning technology. This has led to large variability in the use of simulation in prelicensure RN programmes" (Mancini et al., 2019).

   And regarding evidence-based regulatory standards for simulation teaching in healthcare:

   "The NCSBN has challenged state boards of nursing to develop specific guidelines regarding the use of simulation in prelicensure nursing programs. However, there is insufficient research on which to develop evidence-based practices to create new models of clinical education delivery that incorporate simulation as a component" (Hansen et al., 2017).

   Six years on from this observation, evidence is emerging that could be used to inform standards.

3. The current INACSL standards were chosen to assess whether their recommendations made were based on evidence. Table 1 shows that some of the parts of the standards are based on evidence, but most aspects are currently based on opinion.

Table 1. Review of evidence base within INACSL Healthcare Simulation Standards of Best Practice

Standard title	Number of reviews, primary studies cited	Total number of references	% evidence base content (in descending order)
Pre-briefing	9	32	28.1%
The Debriefing Process	12	63	19.0%
Simulation Design	12	70	17.1%
Facilitation	4	29	13.8%
Objectives and Outcomes	5	39	12.8%
Evaluation	2	19	10.5%

Discussion of regulatory standards review

Twelve guidelines for SBE were found that were relevant to the education of nurses. The large number available is noted. Some nursing SBE guidelines are based on previous medical or other health-related guidelines. The INACSL standards seem to be used most commonly for nursing simulation teaching, compared to the other standards found and are fairly extensive. However, many of their recommendations are not evidence-based. It is unclear how similar or different each of the guidelines are to each other, and further research comparing each guideline to each other would be needed to establish similarities and differences. It is unclear at this stage whether any of the guidelines are fully evidence-based.

In order to improve the standards of guidelines, an Appraisal of Guidelines for Research and Evaluation (AGREE) Instrument has been developed. The AGREE II tool evaluates the process of practice guideline development and the quality of reporting, and can be used to evaluate any guideline, including those intended for educational purposes.

The next step in guideline development should be to assess the current guidelines using the AGREE II tool, and then develop the most appropriate ones into evidence-based guidelines.

Review of international literature on national standards on use of SBE in other disciplines

Background – a brief history of SBE

Early SBE used single part models, such as a French midwife Madame du Coudray in 1600, who used a mannequin made from leather to describe the stages of childbirth. Mechanical dummies and models of limbs were used in the 1700-1800s to learn bandaging, as mentioned in Lee's handbook in 1874. Mrs Chase was a life-sized mannequin developed in 1911, for the purpose of nursing education. With static single part models, simulation can teach practical physical skills, such as learning how to perform injections into the correct anatomical part.

In the 1960s, a model called Rescusci Anni was developed for teaching cardiopulmonary resuscitation. In the early 1960s, new developments were made in advancing design of simulators to enhance the fidelity and functionality of the mannequin by using electronic and electromechanical devices to mimic the sounds produced by the cardiovascular system. These give more realistic experience when learning more complex physical skills.

With the advent of the computer, major developments became possible regarding simulation, enabling screen simulation in two-D and later three-D. This enabled the aeronautics industry for example, to develop flight simulators, which gradually became more and more advanced, with more mechanical and electronic features. These simulators could train pilots in the physical skills needed to fly an aeroplane. By the 1980s, these flight simulators were even available in funfairs.

The flight simulation training for pilots then became more focused on human factors, teamwork, communication skills, situational awareness, and crew management, as these were the specific skills needed by flight crew in the cockpit. Gaba and DeAnda (1988) recognised and integrated these Crew Resource Management (CRM) techniques into training of anaesthetists in a simulated operating theatre. This focused on crisis management, risk elimination and understanding of human behaviour during the realism of the simulation. These full situational simulations were then developed for other healthcare professionals in other clinical areas. In 1989, virtual reality emerged from a group of NASA researchers using a three-D representation of body muscles, which led to the era of using virtual reality in surgery. The Laerdal Virtual IV system for learning intravenous catheterization was the first application in nursing (Phillips, 1993).

The use of role-plays and games as part of the nursing education appeared in the nursing literature in the 1970s and the computer-assisted instructions merged in the early 1980s. These then combined with the situational simulations to develop more realistic immersion in the clinical area being taught about. Since the start of the new millennium there has been an increasing focus on patient safety and reducing clinical errors, and The Department of Health (2001) recommended that integrating education about human factors was incorporated into both undergraduate and postgraduate education, including "enhancing the role of simulation laboratories to expose staff to risk situations with no actual patients involved".

Simulation education can come in a variety of forms, see Table 2.

Table 2. Description of different types of simulation

	Appearance	**Interaction with learner**	**Educational context**
Human part trainer	Realistic, but of single body part	Realistic but limited response	Repetitive practice of isolated skill
Full body (High-fidelity human patient simulator)	Realistic body with physiological modelling	Allow examination (for example, pulse), realistic interaction	Practice whole scenarios
Screen simulator	2D image of patient, equipment, staff	Realistic response, input via keyboard, mouse	Cognitive exploration in a variety of situations
Virtual reality	3D image of patient, equipment, staff	Realistic response, input via a variety of methods	Practice variety of clinical skills
Real people	Real people acting	Verbal and non-verbal interaction	Practice a variety of clinical skills
Hybrid simulation	Any combination of the above	Verbal, non-verbal communication and interaction	Realistic practice
Simulated environment	An entire clinical environment	Full interaction with patient and team	Realistic practice and team training

Adapted from Edgar, Forrest, and McKimm (2013).

SBE is a growth area for bespoke training and is available in a wide range of job areas including aviation, automotive industry, energy industry, financial services, hospitality and leisure and retail in addition to health services. However, the skills and abilities that SBE focuses on in these disciplines varies considerably, depending on the needs and functions of the role environment being simulated. It should be noted that best practice in one discipline may not be useful in another.

Methods

A preliminary search via the internet was made for any international or national standards on use of simulated learning in disciplines other than healthcare. However, once it was realised that would not necessarily be applicable to the education of nurses, extensive searches were not conducted.

Results

Two example standards were found in aviation and in engineering (see Table 3).

Table 3. Example regulatory standards on use of SBE and related approaches in engineering and aviation

Organisation	Title	Countries	Area	Publication date	Number of pages
NAFEMS	Engineering Simulation Quality Management Standard (ESQMS) ESQMS is supported by a companion Guidelines book.	Global	Engineering	2020 2021 (issue 2)	41 163
Civil Aviation Authority	Guidance for use of Web based training, Distance Learning, Simulation and Virtual Reality.	UK	Aviation	2020	21

Discussion

Although there is a considerable amount of SBE being undertaken across the world in a variety of disciplines, few standards were found on how to develop appropriate SBE and apply it appropriately in the discipline involved. Moreover, none of the standards were based on evidence, in that there was no justification that applying each aspect of the standard was going to enhance student education. This may not be needed in some disciplines, such as aeronautics, given the safety of pilots and crew taught through simulation will far outweigh the safety levels when learning to fly an actual aeroplane. However, little was found that would enhance best-practice in SBE that has not already been found in the review of regulatory standards for simulation teaching in healthcare reported above.

Phase two: Council of Deans of Health Members Survey

Dr Naim Abdulmohdi

Introduction

This phase of the Simulation Research Project includes a CoDH member survey to:

- Explore the organisational readiness for SBE.
- Explore opportunities and challenges of SBE in the pre-registration nursing courses in the UK.

Methods

Aim

To explore challenges, opportunities, and organisational readiness for SBE in pre-registration nursing education in the UK.

Design

This study adopted quantitative and qualitative methods, using a self-report and cross-sectional survey design for data collection.

Sampling and recruitment

A convenience sampling technique was used to recruit study participants. The potential study population included CoDH members who deliver pre-registration nursing courses in the UK. The sampling frame of eligible members from which the final study participant sample was drawn consisted of 87 participants. This provided all universities who offered pre-registration nursing with the opportunity to contribute to the survey.

Data collection

After obtaining ethical approval, CoDH members across the 4 nations of the UK were invited through the CoDH bulletin and an email sent by the CoDH administration team inviting the named member for the university as listed on the Councils data base to participate in the study. The first two sections of the survey provided participants with a participant information sheet (PIS), a consent form and the researcher's contact details. Each participant needed to read the first two sections and sign the consent form before progressing to the survey questions. After the initial invitation, participants received six further email reminders to complete the survey between December 2022 and February 2023.

Instruments

Data were collected using a self-report questionnaire through a five-part online secure survey via Joint Information Systems Committee (JISC). Part one collected information about institutions' pre-registration courses such as the number of cohorts per year, number of students in each cohort, number of approved SPL hours, and their interest in SPL. The second part included questions relating to academic confidence in using different simulation modalities. This part had six items in which participants were asked to select the level of confidence in staff using different simulation modalities,

with each statement using a five-point Likert-type scale ranging from one (not at all confident) to five (extremely confident). It produced an overall confidence level on a scale of 5-30. The third part included six questions related to the institution's use of different simulation modalities in pre-registration nursing courses. The participants were asked to select the frequency of using these different simulation modalities by their staff, with each statement using a five-point Likert-type scale ranging from one (never) to five (always). It produced an overall frequency level on a scale of 5-30.

The fourth part of the questionnaire included the Simulation Culture Organisational Readiness Survey (SCORS) (Foisy-Doll and Leighton, 2017). SCORS items asked participants to rate their degree of agreement with a given item using a five-point Likert-type scale ranging from one (not at all) to five (very much). It has 36 items including nine items on Defined Need and Support for Change, 11 items on Readiness for Culture Change, 12 items on Time, Personnel, and Resource Readiness, and four items on Sustainable Education Development to Embed Culture. It provides an overall measure of organisational culture and readiness for SBE, with a range of 36-180. The organisational culture and readiness score was interpreted based on the table below (see Table 4). This scale has an established validity and reliability (Foisy-Doll and Leighton, 2017) and have been used in nursing research (Almotairy et al., 2023).

Table 4. SCORS interpretation score

Interpretation	Overall SCORS	Defined Need and Support for Change	Readiness for Culture Change	Time, Personnel, and Resource Readiness	Sustainable Education Development to Embed Culture
None	0-36	0-9	0-11	0-12	0-4
A little	37-72	10-18	12-22	13-24	5-8
Somewhat	73-108	19-27	23-33	25-36	9-12
Moderately	109-144	28-36	34-44	37-48	13-16
Very much	145-180	37-45	45-55	49-60	17-20

The score for each item in the scale above three denotes an acceptable mean cut off point within the five-point scale, based on the SCORS manual.

Finally, the fifth part of the questionnaire included open-ended questions about the challenges and opportunities of SBE and examples from each institutions' experience with impact on pre-registration nursing education.

The survey questions were reviewed by CoDH's Innovation and Pedagogy Strategic Policy Group and Regulation Strategic Policy Group. On occasion, some of the questions were revised following their feedback. The survey was pilot tested with three academic staff who have extensive experiences in simulation from the Faculty of Health, Medicine and Social Care at ARU to ensure clarity of its content.

Ethical considerations

Participation in this study was voluntary. All participants were given a participant information sheet and informed consent prior to completing the survey. The School Research Ethics Panel for Allied Health, Nursing and Midwifery and Medicine at Anglia Ruskin University reviewed and approved this study (approval number ETH2223-2620).

Data analysis

Version 28 of the Statistical Package for Social Sciences (SPSS) software was used to analyse the data. The data were quantified using means, frequencies, and standard deviations (SDs). Initially, datasets were analysed using histograms and Shapiro-Wilk's tests to assess the approximate normality required for parametric tests. The data sets did not meet the assumptions for parametric analysis and therefore, non-parametric statistical tests were conducted. Spearman's correlation coefficients were used to evaluate the correlations between the demographical variables and key study variables (see Results section). Analysis of variance was conducted using one-way ANOVA to explore the impact of demographical factors on organisational readiness to SBE. The statistical significance was set for an alpha level at $p<0.05$.

The content of the open-ended questions of the survey were analysed using thematic analysis guided by the steps outlined by Braun and Clake (2021). Transcripts were extracted from the online survey platform and imported to NVivo 12 software for analysis. To ensure internal validity and enhance the reliability of our findings, the analysis was independently carried out by two researchers (NA and MA). Subsequently, collaborative discussions were held to reach a consensus on the emerging themes The focus of the analysis was on the challenges, opportunities, and impact of SBE on pre-registration nursing education in UK schools of nursing. Each anonymised response was allocated a participant number from 1 to 60 to reference the quotations used. For example, the tenth response was allocated participant ten (P10).

Results

Responses were received from 60 participants from the 87 CoDH members invited to complete the survey (69% response rate). Table 5 demonstrates that there was relatively even participation from all regions of the UK. Most of the participants reported that they are using SPL (89.2%; N=54), with 201-400 hours being the most common time range reported. Participants reported that they mainly have one to two cohorts of pre-registration nursing courses per year (66.7%; N=40), with more than 500 students per year (61.7%; N=37). Table 5 also shows that more than half of the participants are interested in seeking NMC approval for SPL (51.7%; N=31). 45% said they already have approval from the NMC for their SPL and under 10 percent mentioned that they are not interested without rationale.

Table 5. Sample characteristics

Variables	N (total N=60)	(%)
Region		
Yorkshire and the Humber	8	13.3%
South-East England	8	13.3%
London	7	11.7%
Scotland	6	10%
Wales	5	10%
North-East England	5	8.3%
West Midlands England	5	8.3%
East of England	5	8.3%
South Midlands England	5	8.3%
East Midlands England	3	5%
North-West England	3	5%
Number of hours of SPL		
<200 hours	14	23.3%
201-400 hours	26	43.3%
401-600 hours	14	23.3%
Not applicable	4	6.7%
Others	2	3.3%
Number of cohorts per year		
1	21	35%
2	19	31.7%
3	7	11.7%
4	1	1.7%
>4	12	20%
Number of students in pre-registration nursing		
<200	6	10%
200-299	6	10%
300-399	3	5%
400-500	8	13.5%
>500	37	61.7%
Interest in seeking NMC approval for SPL		
Yes	31	51.7%
No	16	26.7%
Other	13	21.7%

Quantitative results

Confidence in and use of simulation modalities

Confidence and use of SBE modalities are shown in Table 6. The reliability scores of both confidence and use were very good in this study, with a Cronbach's alpha of 0.86 and 0.85 respectively. The overall mean score of confidence in the use of simulation modalities was 18.70 (SD =5.12) which is a moderate level of overall confidence (see Table 6). High level of confidence (Mean ≥ 4.0) was noted in the use of low-fidelity simulation and medium levels of confidence (Mean = 3.0-4.0) noted in the use of the human-patient simulation and SPL. Table 6 below also shows low levels of confidence (Mean ≤ 3) in using medium to high-fidelity simulation, desktop simulation, virtual reality, and augmented reality. The overall mean score of uses of simulation modalities in this study sample was 19.35 (SD = 4.28) which is a moderate level of overall use. High levels of uses (Mean >4.0) were found for low-fidelity simulation. There were moderate levels (Mean 3.0-4.0) of uses of medium- to high-fidelity

simulation, human-patient simulation and SPL. Table 6 shows a low level of use (mean <3.0) of visualisation, virtual reality and augmented reality, and desktop simulation. It is indicative that the higher the level of technology required in the simulation modality, the lower the confidence and use of that modality.

Table 6. Simulation modalities: use and confidence

	Confidence			**Use**		
Simulation Modality	**Mean** (SD)	**Minimum**	**Maximum**	**Mean** (SD)	**Minimum**	**Maximum**
Low-fidelity simulation *(for example, part-based manikin such as cannulation arms, resuscitation models)*	4.0 (1.0)	1	5	4.2 (0.80)	1	5
Medium- to high-fidelity simulation *(Full body manikin for example, SimMan3G)*	2.97 (1.07)	1	5	3.62 (0.83)	1	5
Human patient simulation *(for example, service users, actors)*	3.45 (1.11)	1	5	3.17 (1.1)	1	5
Visualization, virtual reality, or augmented reality *(for example, 2D, 3D anatomical simulation, Oculus Quest, HoloLens)*	2.22 (1.01)	1	5	2.42 (0.99)	1	5
Desktop simulation or virtual world	2.67 (1.22)	1	5	2.48 (1.17)	1	5
SPL *(Clinical experience that meet NMC requirements for SPL (audit, SSSA))*	3.45 (1.27)	1	5	3.47 (1.11)	1	5
Overall	18.70 (5.12)	6	29	19.35 (4.28)	9	27

SCORS numerical results

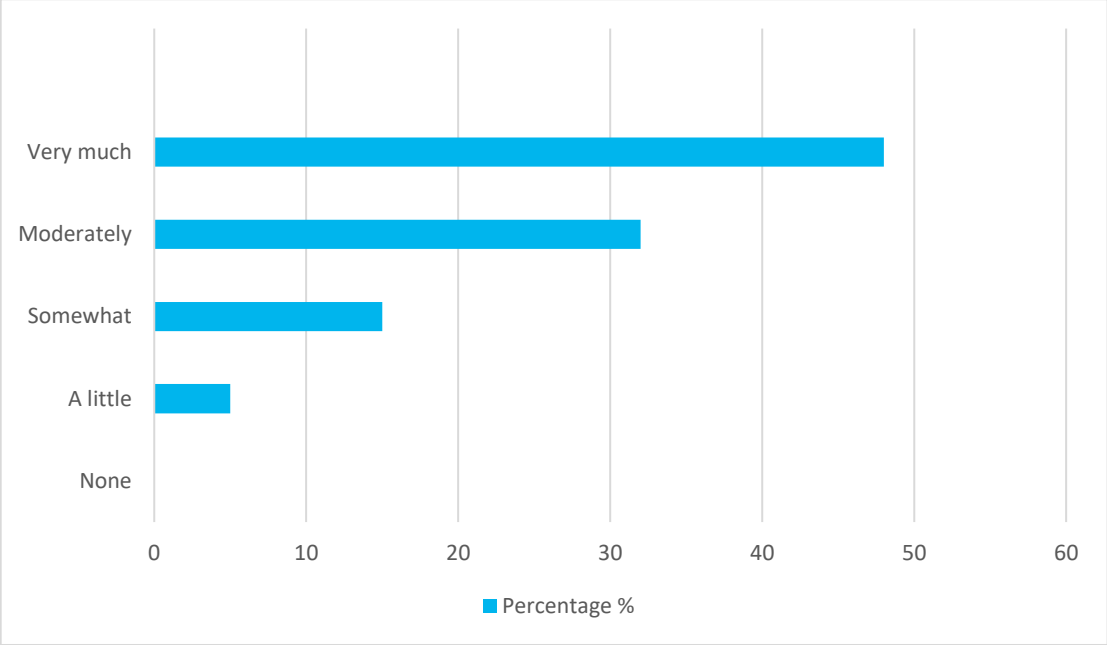
The reliability score of SCORS was excellent in this study, with a Cronbach's alpha of 0.97. The mean SCORS in this sample was 137 (SD = 28.79). This a moderate level of organisational readiness to SBE. Appendix 9 shows the mean (SD) minimum and maximum scores for all parts of the questionnaire, and the results are colour-coded to show which results have a mean score of 4+ (green), 3.5-3.99 (clear), 3.00-3.49 (amber) and below 3.0 (red). Table 7 shows that all subscales indicated moderate levels of organisational readiness to SBE.

Table 7. SCORS numerical results overall and for subscales

	Mean (SD)	Minimum	Maximum
Overall SCORS	137 (28.79)	61	179
Defined Need and Support for Change	31.2 (7.68)	14	40
Readiness for Culture Change	39.25 (8.69)	19	52
Time, Personnel, and Resource Readiness	43.55 (10.2)	18	60
Sustainable Education Development to Embed Culture	14.98 (3.41)	5	20

Figure 4 below shows that 48% of the organisations had a high level of readiness for SBE, 32% were moderately ready and 20% were low level of readiness for SBE.

Figure 4. SCORS Distribution



Looking at Appendix 9, two sections had most of the areas that needed attention for further development to increase organisational readiness to SBE: Readiness for Culture Change and Time, Personnel, and Resource Readiness sections. Three items from those sections came under the acceptable levels of readiness (mean SCORS score less than 3) which included the following:

Readiness for Culture Change section items

1. The availability of credentialed simulation practitioners who mentor/coach others, including other simulation practitioners.
2. Staff/faculty proficiency in the use of technology.

Time, Personnel, and Resource Readiness sections items

3. Availability of administrative and support staff.

Appendix 9 also shows which mean SCORS scores per item were just above the acceptable cut-off point of 3 and requiring attention. These included staff skills, involvement of librarians in the evidence

to support SBE, leader support culture of change and sustain SBE program integration, the availability of fiscal resources to fund equipment, development of physical space and release time to lead on integrating SBE in the curricula, and the leadership influence on SBE as part of the Sustainability of Practices.

Statistical analysis of results

Bivariate analysis revealed significant positive correlations between the overall level of confidence and both SCORS score (r_s = 0.0.593, p <0.001) and the overall use of simulation modalities (r_s =0.741, p<0.001) (see Table 8.). Thus, the higher the level of overall confidence in simulation modalities was associated with increased overall utilisation and higher levels of perceived organisational readiness for SBE. In addition, positive correlations were also found between the number of students and both the SCORS (r_s = 0.368, p <0.004) and the overall level of confidence (r_s = 0.401, p < 0.001). Therefore, higher numbers of students in nursing courses were associated with higher levels of perceived confidence in simulation modalities and organisational readiness for SBE. No other significant correlations were identified. Analysis of variance was conducted using One-way ANOVA to explore the impact of institutional factors on SCORS. The results found that the number of students was the only significant factor associated with statistically significant difference in SCORS mean score (F (5, 54) = 3.67, p = 0.007). The difference in the mean score between the groups has a small size effect (eta square = 0.25). This indicates that the higher the number of students in nursing courses positively affect the organisational readiness to SBE.

Table 8. Significant Spearman's Rho correlation coefficients between variables

Variable	1. Overall confidence	2. Overall use	3. SCORS score
1. Overall confidence			
2. Overall use	0.741✳✳✳		
3. SCORS score	0.593✳✳✳	0.449✳✳✳	
4. Number of students	0.401✳✳✳	0.251	0.368✳✳
✳✳ = p value ≤ 0.01 ✳✳✳= p value ≤0.001			

Qualitative results

Sixty participants (69%) responded to the survey's open-ended questions. The content of the response analyses delineated themes that described the challenges, opportunities, and impact of SBE on pre-registration nurse education in UK schools of nursing. Each anonymised response was allocated a participant number from 1 to 60 to reference the quotations used. For example, the tenth response was allocated participant ten (P10).

Opportunities and benefits of SBE

One hundred and forty-one statements were coded as opportunities and benefits of SBE, and 120 statements were coded as challenges and barriers for SBE. In addition, 40 statements were coded as examples of impact of SBE in nurse education.

Enhancing students learning experience

SBE offered opportunities to enhance students' learning in a variety of ways. This was described in the way SBE offered real-life scenarios, authentic learning settings, the variety of simulation modalities offering a range of learning activities, and opportunities to develop professional identity, decision

making and leadership skills. It was described as offering consistent, responsive, and inclusive education.

Examples of quotations:

- *P19: "...responsive education to changing dynamics in healthcare".*
- *P25: "Offer our students the best possible exposure to real life situations and scenarios, enhancing their learning experience".*
- *P5: "Represent diverse patients, students and staff through manikins has made the curriculum more inclusive and received a lot of positive feedback".*
- *P50: "Learning opportunities for our students to practise in safe, realistic environments, with a wide range of patient simulators and part task trainers from low to hi (high) fidelity depending on the complexity of the scenario. With the use of standardised patients, we are able to use trained actors, in conjunction with the delivery of SBE".*
- P59: "Offers consistent experiences for students. More consistent assessment".

Increase placement capacity

SBE was found to increase placement capacity and reduce pressure on clinical staff. It was found to offer learning experiences rarely encountered in practice and allowed the achievement of proficiencies unable to be achieved in clinical practice.

Examples of quotations:

- *P16: "Without simulation our students would have struggled to complete all the proficiencies required by the NMC to achieve sign off in their online practice assessment learning (OPAL) portfolios".*
- *P27: "...effective preparation of all pre-registration nursing students at a time when practice-based learning experiences to meet all NMC proficiencies and competencies, including in communication skills, cannot be guaranteed".*
- *P35: "SBE [simulation-based education] is ideally placed to allow students to achieve proficiencies not encountered in clinical practice".*
- *P51: "Students have opportunity to learn, practise and repeat skills for which they may have limited exposure in practice areas".*
- *P20: "Expanding placement capacity, Preparation for practice, Annexe B skills, End of life care, LD [learning disability] simulations, Physical health placements for Mental health students".*
- *P27: "...reduce pressure on placement capacity".*
- *P47: "...takes some pressure off clinical areas".*

Offer a safe learning environment

SBE was described as a safe environment for both learners and patients. It was found to provide a controlled environment to learn, practice, make mistakes and learn from those mistakes. The second most frequent described benefit of SBE was that it was found to be of minimal risk to learners, patients, and others.

Examples of quotations:

- *P14: "...practising in a safe environment".*
- *P16: "...practice without risk to patients or themselves".*
- *P17: "...learn new skills in a safe and support environment".*
- *P3: "...provides them with the opportunity to practise skills in a safe environment".*
- *P51: "...able to practise in safe environment without risk to others, contemporaneous feedback and debriefing enables reflection and self-learning".*
- *P37: "Simulation-based education provides opportunities for students to gain experiential learning in a 'safe' and controlled environment".*
- *P45: "Creates a safe space for errors and an opportunity to learn from it".*

- *P5: "Safe way to make mistakes and learn".*

Developing students' knowledge, competency and confidence

The participants described how SBE offered great benefits in developing students' knowledge, skills, competencies, and proficiencies. There was a great emphasis on how it helped students develop their confidence.

Examples of quotations:

- *P11: "Desktop/online virtual simulation for example, enhances student nurse knowledge, confidence, and competence for safe practice for example, early recognition and response to the deteriorating patient".*
- *P16: "All students can gain an evidence-based baseline knowledge, skills, and confidence through SBE [simulation-based education]. Impact and effectiveness of Safe Medicate on pre-registration nursing student preparation for safe medication calculations and administration in practice".*
- *P23: "Greatly increase skills, competence, and confidence of students".*
- *P14: "SBE assists student to meet the NMC standards/proficiencies".*
- *P24: "It has increased their [students] confidence and knowledge that can be transferred to practice".*
- *P44: "Readiness to practice amongst our pre-reg students compliments and prepares for physical placement".*
- *P49: "Moving through a psychomotor, cognitive and afferent programme of skills acquisition through to holistic clinical decision-making and management can only be achieved safely within simulation".*
- *P5: "Students can learn about team working, communication, critical thinking, decision making and reflection".*

Good preparation for clinical practice

The participants described that SBE offered good preparation for practice, enhanced students' readiness to practice, developed students' abilities and consolidated learning after clinical placement. It enhanced the application of theory to practice.

Examples of quotations:

- *P15: "...develop proficiency and confidence before practice placements".*
- *P16: "Enhance the preparation of our nursing students for safe, effective person-centred nursing practice... gain an evidence-based, baseline knowledge, skills and confidence through SBE [simulation-based education] that they can build on when opportunity presents itself in practice".*
- *P5: "Builds students confidence before going to practice".*
- *P17: "Opportunity to prepare for and supplement their practice placement learning...to contextualise these skills. It also allows them to reflect upon and discuss learning experiences and incidents from practice".*
- *P37: "Students view simulated based education as the most important part of the curriculum in preparing them for readiness for clinical practice".*
- *P36: "Practice Learning Partners are of the same view, as students are more confident and able to 'hit the ground running' when they commence clinical placement".*
- *P24: "Increases confidence and readiness to practice amongst our pre-reg students".*

Facilitated interprofessional learning (IPL)

A few participants found SBE provided opportunities for IPL and supported the development of communication and multidisciplinary team (MDT) working skills.

Examples of quotations:

- *P14: "...increased opportunity for multi professional learning...collaborate with other universities on IPE".*
- *P29: "SBE [simulation-based education] provides students with the opportunity to learn and be assessed in a safe environment with an IPE culture".*
- *P47: "Offer interprofessional opportunities MDT working".*
- *P51: "Students able to come in and practice skills as self-directed or supported by sim team... opportunities for IPE, support for completion of mandatory training".*
- *P54: "SBE is used to integrate the professional IPL being a key part of what we do".*

Enhance student satisfaction

Participants also described how SBE, and the active participation were enhancing student satisfaction and experience.

Examples of quotations:

- *P15: "Students state they enjoy practical interactive learning activities".*
- *P22: "SBE that is undertaken is well evaluated".*
- *P30: "...improved student experience".*
- *P48: "...helping student satisfaction, job satisfaction, teaching and learning development".*
- *P1: "SBE is central to our curriculum and the part that students enjoy the most and get the greatest benefit from".*

Challenges and barriers of SBE

Resource constraints

The most prevalent barrier to SBE was found to be the lack of resources (68 codes), including staffing, facilities, funding, and time. Participants described the availability of facilities as a major barrier, in particular the availability of physical space. They highlighted the need for adequate physical space, advanced technologies, and funding to support high-quality simulations. The increasing number of students posed sustainability challenges, and limited availability of facilities hindered the effective implementation of SBE.

Examples of quotations:

- *P3: "Simulation-based education requires adequate resources in terms of faculty, technical support and physical resources in order to provide simulation experience of quality".*
- *P18: "Develop high-quality simulation is very costly in terms of physical resources and staff".*
- *P53: "It is difficult to fit all small groups into the timetables to allow for the SBE to be delivered".*
- *P41: "Existing facilities shared with other programmes and require development to accommodate growth of nursing programme".*
- *P37: "We have a very large faculty that is expanding on a yearly basis, this comes with capacity issues and not having enough simulation suites to sometimes deliver as much high-fidelity SBE as we would like".*
- *P22: "...very resource-intensive (with the level of intensiveness rising in parallel with the level of fidelity and sophistication of the simulation)".*
- *P9: "Currently limited number of academics/practitioners leading the way for this in our institution".*
- *P43: "Lack of personnel both technical and academic".*
- *P46: "Not having enough time to invest in teaching and learning".*
- *P22: "Time to develop and embed new simulation activities in programmes, courses, modules".*
- *P35: "...adequate time and resources for faculty training".*
- *P14: "...time resources and high demand on staffing".*
- *P21: "The need for sizeable capital investment in estate".*

- *P51: "Funding remains our biggest challenge as there appears to be no funding in 2022 for HEE funding bidding opportunities".*
- *P6: "Funding challenges - ongoing licence costs, equipment maintenance etc., Tariff funding variable annually and not seen by the university as a secure source of income to invest against".*
- *P18: "High staff costs for use of practice supervisors and assessors are challenging - HEE placement tariff funding has been requested to cover costs".*

Staff knowledge, skills, and motivation

Another significant challenge was related to staff capacity and skills. The participants described staff engagement, technical skills, knowledge, and experience with simulation as factors affecting the integration of SBE in nurse education. Some staff members showed reluctance due to lack of experience, confidence, or recent clinical practice, whilst others were hesitant to engage in SBE.

Examples of quotations:

- *P39: "Staff reluctance due to lack of experience and technical skills".*
- *P26: "Getting academic staff onboard with the idea of developing new ways of teaching when they feel overwhelmed with their current workload".*
- *P12: "Lack of recent clinical experience thus making them [academic staff] hesitant to engage in teaching simulation".*
- *P57: "Faculty of the schools. They are reluctant to get involved or see it as harder work than standing and delivering a lecture".*
- *P19: "The staff knowledge of how to effectively utilise the technologies needs to widen to include staff outside of the simulation team. The main barrier is the higher tech modalities in simulation where the simulation team take the lead to provide support to academics".*

Leadership awareness and recognition of the value of SBE

Lack of understanding and appreciation of SBE at a senior leadership level within HEIs was identified as a barrier. While senior leaders acknowledged the importance of SBE in the curriculum, they often lacked a realistic view of the operational challenges involved. The need for cultural change and integration of various simulation modalities was also emphasised.

Examples of quotations:

- *P36: "Lack of understanding across the university at a senior level and appreciate of the developing pedagogy and resources required".*
- *P32: "Senior leaders are positive about including this in the curriculums, they do not have a realistic view or understanding of how difficult it can be to deliver SBE from an operational perspective".*
- *P13: "Cultural change from a predominantly skills-based university to 1 with a full range of fidelity in mannequins, immersive spaces, AR [augmented reality]/VR [virtual reality] and XR [extended reality] opportunities which have all produced a massive challenge to integrate".*

SBE is perceived as complementary and filling the gap

Simulation was perceived as an add-on rather than a fundamental component of the curriculum. It was seen as filling gaps in traditional nursing programs rather than being considered a crucial approach to nursing education.

Examples of quotations:

- *P51: "Simulation is an add-on rather than a cornerstone of the curriculum".*
- *P27: "Fill gaps in the traditional nursing programme, rather than as an approach to nursing education in its own right".*
- *P42: "Acknowledgement and securing organisational/leadership commitment and buy-in to SBE. This is no longer a nice thing to do but must be seen as essential in pre-registration health professional programmes - not just nursing".*

Lack of support and commitment for SBE

Difficulties in obtaining support and commitment for SBE were highlighted. NHS pressures, university procedures, and a lack of strategic vision were identified as barriers. Additionally, the absence of clear requirements for SBE from the Nursing and Midwifery Council (NMC) and restrictive regulations hindered innovation and experimentation.

Examples of quotations:

- *P23: "Difficulty getting practice involved due to NHS pressures".*
- *P16: "University procedures are blocking and slow change towards SBE, which does not fit into a simple University process".*
- *P53: "Previous simulation leads were not empowered".*
- *P10: "Current skills lab technicians follow facilitators ideas - seen as assistants rather than innovation leads or opportunity designers".*
- *P11: "Traditional universities don't recognise the staff student ratios needed to deliver SBE".*
- *P17: "No strategy has been disseminated and circulated to be able to operationalise the organisations plan".*
- *P34: "HEI culture of faculty walls - lack of institutional awareness of how to decipher separatist funding cross-faculty potential.... Vision and opportunities for a simulation strategy to create meaningful learning through simulation is held and pushed from the bottom-up".*

Clarity on requirements for SBE

Several participants discussed feeling muddled about the implications of the NMC's requirements, when deciding how to develop SBE within their nursing programmes.

Examples of quotations:

- *P22: "NMC regulation isn't always very clear around SBE".*
- *P10: "The NMC is quite restrictive on how many hours can be used for simulation".*
- *P56: "Driver is replacing NMC hours - so quantity over quality is the focus".*
- *P9: "We are constantly innovating with SBE and developing new modalities and activities, but we are arguably delivering more than is necessary for the sake of NMC practice hours".*

Example of SBE impact on nurse education

The most frequently identified positive impact of simulation was on student satisfaction, confidence, readiness to practice, and their knowledge and team working skills.

Students' satisfaction

Participants described that SBE had a positive impact on student satisfaction. Students often reported that they enjoyed SBE and that it helped them to learn better. SBE provided a safe and realistic environment in which students could practice their skills and learn from their mistakes.

Examples of quotations:

- *P2: "SBE is always well evaluated by pre-registration students, and they often ask for more".*
- *P28: "Learners have reported via NSS that they learn best through simulation but want more of it".*
- *P25: "Students satisfaction surveys show high level of positives for sim. Student attendance and engagement is high. Sim facilities and opportunities aid recruitment".*
- *P1: "Students provide consistently high levels of positive evaluations".*
- *P13: "Simulation evaluations are overwhelmingly positive by students. They enjoy it. They want more of it and more time in sessions".*

Improve student confidence

SBE was also found to potentially help improve student confidence. When students were able to practice their skills in a safe environment, they were more likely to feel confident when they were faced with the same situation in the clinical setting.

Examples of quotations:

- *P10: "Opportunity to learn and grow confidence in a safe supportive environment rather than leaving it to chance or practising for the first time on a patient under supervision of a PA".*
- *P19: "More confident with the 'know how' and 'show how'. More confident in working as a team and understand the importance of collaborative teamwork and leadership".*
- *P36: "SBE helps to build students' confidence and provides them with the opportunity to practice skills in a safe environment".*
- *P23: "Simulation allows those with less confidence, and widest variety of learning styles to really practice their skills and develop proficiency".*

Increased students' readiness to practice

When students practiced their skills and learnt how to manage complex situations in a safe environment, they were more likely to be prepared for the challenges of the clinical setting. It enhanced students' clinical readiness to practice.

Examples of quotations:

- *P53: "Improve students' readiness for practice".*
- *P22: "Build knowledge and confidence for recognising and responding to early signs of patient deterioration in readiness for qualified nursing practice".*
- *P7: "Improved confidence, improved readiness for placement integration of learning".*
- *P34: "Trusts have fed back that SBE is integral to students' preparation for practice, as clinical staff do not have time, or resources to teach students in clinical placements".*
- *P20: "Feedback from a patient group that our students were more prepared for practice".*

Enhance knowledge, skill, and interprofessional working

Participants also described how SBE could help students enhance their knowledge, and skills, and ability with interprofessional working.

Examples of quotations:

- *P15: "Developing multi-professional team working skills and communication".*
- *P39: "It also facilitates interprofessional education".*
- *P21: "Interprofessional learning opportunity".*
- *P41: "Increase in knowledge and skills".*
- *P6: "Staff in practice report the skills and knowledge of students has much improved".*

Phase three: Case study

Dr Siân Shaw and Dr Mary Edmonds

Introduction

This part of the Simulation Research Project used a case study approach to explore:

- A two-week field-specific SPL for a group of second year pre-registration mental health nursing students.
- A two-week field specific SPL for a group of second year pre-registration children's nursing students.
- The experiences of mental health academic staff acting as practice supervisors.

Methods

Aim

The purpose of the case study was to investigate the experiences of nursing students undertaking a SPL and the experiences of academic staff acting as a practice supervisor.

Design

This study adopted quantitative and qualitative methods, using two self-reporting surveys and a focus group for data collection.

Sampling and recruitment for student surveys and focus groups

Student surveys

A convenience sampling technique was used to recruit the nursing students, from the Chelmsford campus at Anglia Ruskin University. The sampling frame of eligible students, from which the final study participant sample was drawn, consisted of 151 participants.

Group 1: 93 second year, pre-registration mental health nursing students.

- Group 1a mental health students: 23 January 2023 to 3 February 2023.
- Group 1b mental health students: 6 February 2023 to 17 February 2023.

Group 2: 58 second year BSc (Hons) pre-registration child nursing students.

- Group 2a child students: 24 April to 19 May 2023.
- Group 2b child students: 8 May to 19 May 2023.

After obtaining ethical approval, nursing students were invited via email to participate in the study. The purpose of the study was posted on their Canvas site (learning management system) for the module. This was followed up with a face-to-face explanation. After the initial invitation, participants received two further email reminders to complete the survey. A gift voucher incentive was then introduced to increase recruitment.

Focus groups

A convenience sampling technique was used to recruit mental health academic staff who acted as practice supervisors on the mental health SPL.

Data collection for survey and focus group

Student surveys

After obtaining ethical approval, two surveys were sent to the students during the last week of the SPL including:

1. A student self-assessment of competence against the NMC (2018) Part 2 and 3 Standards of Proficiency for Registered Nurses.

2. A student evaluation of the experience of the SPL including supervision, assessment, skills development, support, facilities and equipment, engagement and satisfaction, transferability to other settings, and effective delivery.

The student surveys were conducted using online JISC surveys.

Instruments

1. The student self-assessment of competence against the NMC (2018) Part 2 and 3 standards of proficiency consisted of three sections. The first section gathered demographic information, such as the students' field of nursing, age, and experiences. In the second section, information was collected regarding the achievement of 33 NMC proficiencies listed in Part 2 or 3 of the Practice Assessment Document (PAD). Finally, the third section specifically focused on six proficiencies (number four, and numbers 12-16) that can only be achieved in Part 3 of the Practice Assessment Document (PAD). The proficiencies in Part 2 and 3 were scored either achieved or not achieved.

2. The student evaluation of the SPL survey contained five sections. In the first section, participants provided demographic details including their field of nursing, age, and prior experiences. Additionally, their learning needs and the availability of technology resources were assessed. Moving on to the second section, students rated the impact of SPL using a Likert-type scale with six points ranging from strongly disagree to strongly agree. This section consisted of ten statements focusing on the influence of SPL on students' overall experience, as well as three statements related to its impact on skills development, attitudes, and collaboration with multidisciplinary teams and service users.

3. The third section comprised 11 statements, also measured on the same Likert-type scale. These statements aimed to evaluate the effect of SPL on students' acquisition of new skills such as documentation, communication, engagement, confidence, and use of technology.

4. Section four concentrated on the quality of the placement area, with three statements requiring participants to rate it on a scale of 1 to 10. Feedback regarding the support and facilitation provided by practice supervisors for learning was included along with recommendations students would give to their peers about the placement.

5. The fifth section contained open-ended questions. Students were encouraged to share their perceptions of the benefits and challenges associated with SPL, as well as the knowledge and skills they had acquired. Furthermore, participants were given the opportunity to provide suggestions for future improvements.

Focus groups

After obtaining ethical approval, five academic staff who had acted as a practice supervisor on the mental health SPL were invited via email to participate. An email was sent by one of the researchers. Participants were provided participant information sheet, a consent form, and the researcher’s contact details. The consent form needed to be signed before progressing to participation in the scheduled focus group.

A set of questions (Table 9.) were developed and reviewed by CoDH’s Regulation Strategic Policy Group and Innovation and Pedagogy Strategic Policy Group. Data were collected in February 2023.

The focus group was conducted with four participants by two researchers (Dr Mary Edmonds and Dr Siân Shaw). It was recorded online via Microsoft Teams and took 70 minutes.

Table 9. Focus group questions for practice supervisors

1. Tell me about the preparation/support you had before you undertook your role as practice supervisor (PS).
2. How did you feel about simulated practice learning before being a practice supervisor?
3. Do you think that the content was relevant and appropriate?
4. What was it like being a practice supervisor?
5. What type of practice activities did you participate in?
6. How did you manage the different types of practice activities?
7. What were the challenges?
8. What made a difference to your experiences?
9. Tell me about the support you had during the SPL.
10. Is there anything else, you think would be useful to share?

SPL experiences

Mental health nursing SPL

The two-week SPL formed part of a five-week placement experience, which included five days of clinical skills in ARU skills laboratories and two weeks in a mental health placement in clinical practice. The SPL and skills lab days were mapped to achieve nine proficiencies from Part 2 and 3 of the NMC (2018) Future Nurse Standards of Proficiency for Registered Nurses listed in Appendix 10. These nine proficiencies were identified as those which mental health students struggled to achieve in clinical practice.

Service user involvement was central to the SPL. Case scenarios were developed and led with service users and academic staff. This enabled students to:

- Reflect on each service user's unique story.
- Practice how to undertake an assessment and plan care for each service user.
- Practice how to work with service users who have a personality and relational difficulties using a structured clinical management approach (assessment to discharge).
- Participate in history taking, motivational interviewing and therapeutic engagement.
- Reflect and evaluate how they manage the impact of the Mental Health Act (1983) on the individual from the perspective of a registered mental health nurse.
- Practice how they would act as an advocate for clients.

Students were observed by the practice supervisors in how they engaged with, and reacted to, the people they met. Evidence of how students were working towards achieving proficiencies was uploaded into the electronic PAD by the practice supervisors.

On campus skills days, the students participated in role-play. One role-play focused on a frail patient with dementia using GERonTOlogic (GERT) suits. The weighted GERT suit consists of separate elements which offer the opportunity to experience the impairments of older persons. By wearing the suit, the user can experience very similar impairments of the sensory-motor skills of old age. The age-related impairments that the GERT suit simulates are:

- Opacity of the eye lens.
- Narrowing of the visual field.
- High-frequency hearing loss.
- Head mobility restrictions.
- Joint stiffness.
- Loss of strength.

- Reduced grip.
- Increased mental load and increasing movement uncertainty.

Four students wore the GERT suits while other students supported the 'patients' with a range of activities for example, putting on clothes, going for a walk in the garden, and preparing food. A third group of students observed the activities and, through debrief sessions, provided feedback on the interactions, considering elements including the therapeutic engagement.

Child nursing SPL

The two-week SPL formed part of a five-week placement experience which included five days of clinical skills in ARU skills laboratories and two weeks in a child placement in clinical practice. The SPL and skill lab days were mapped to achieve ten proficiencies from Parts two and three of the NMC (2018) Future Nurse Standards of Proficiency for Registered Nurses listed in Appendix 11. These ten proficiencies were identified as those which child nursing students struggled to achieve in clinical practice.

Experts from clinical/professional practice worked with students to practice, reflect, and evaluate how to providing care in different environments with different service users:

- A senior nurse/practice education facilitator from the accident and emergency department of a placement provider.
- An assistant headteacher and safeguarding lead at a local school to work with the students to address safeguarding issues.

In week one, the students followed the journey of Amy – a six-month-old baby girl with bronchiolitis. The content was interprofessional, interactive, and engaging. The SPL activities were aligned to develop their skills, knowledge and understanding. These included practising assessments, nutritional scores, observations, medication administration, and care planning.

Day 1: Orientation to the placement environment.
Day 2: Pre-hospital admission – GP/primary care.
Day 3: Paediatric emergency department.
Day 4: Preparing for transfer and admission to the children's ward.
Day 5: Transfer to paediatric intensive care unit.

In week two, the students followed the journey of Tom, a 14-year-old boy who presented with his parents to the emergency department of his local hospital with his first prolonged tonic−clonic seizure. Tom also experienced some mental health issues. An animated handover was created by ARU's learning technologists to introduce the students to Tom.

Day 1: Mental health risk assessment.
Day 2: Emergency care.
Day 3: Management of seizure on ward.
Day 4: Mental health support.
Day 5: Discharge and safeguarding.

The skill sessions were:
- Airway and breathing.
- Circulation and disability.
- Pre and post operative surgical care.
- Venepuncture and cannulation.
- IV and blood transfusions.
- Neonatal life support.
- In hospital life support and retrieval.

Ethical considerations

Participation in this study was voluntary. All participants were given a participant information sheet and supplied informed consent prior to completing the survey. The School Research Ethics Panel for Allied Health, Nursing and Midwifery and Medicine at ARU reviewed and approved this study (approval number ETH2223-0867).

Data analysis

The quantitative data from the student surveys were analysed using descriptive statistics (for example, frequencies) through Microsoft Excel. A sample of student quotes from the open-ended questions were selected to represent the emerging themes.

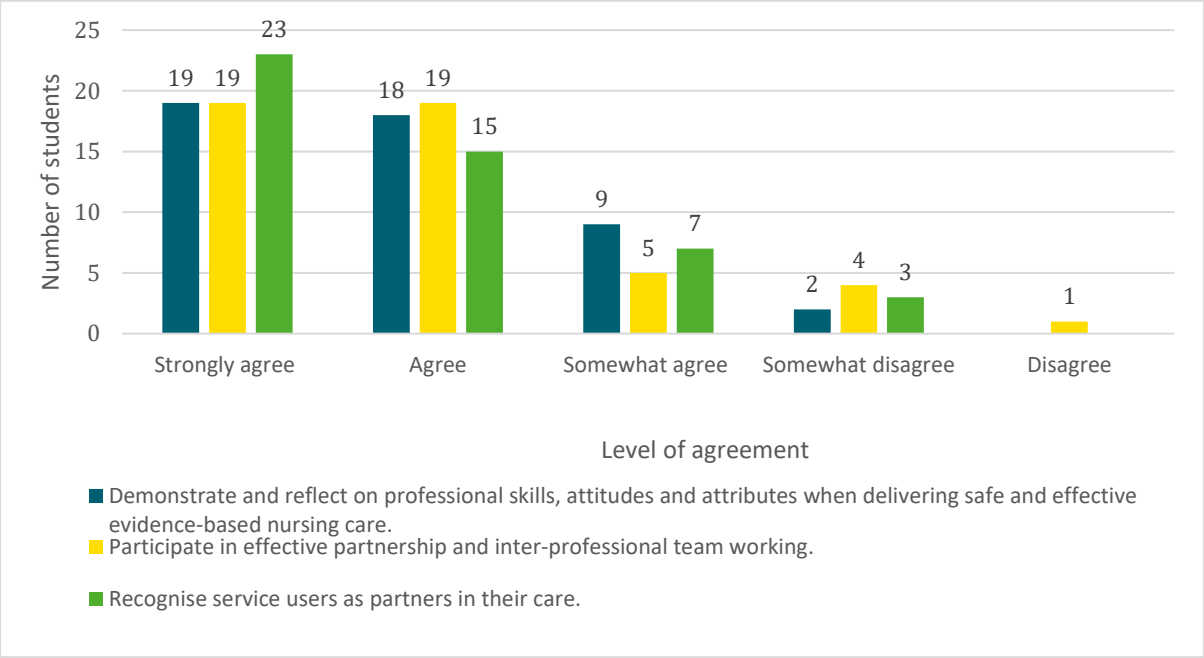
The qualitative data from the focus group were imported into ATLAS.ti version 23 software to facilitate qualitative analysis. Guided by the steps outlined by Braun and Clarke (2021), a thematic analysis was conducted. To ensure internal validity and enhance the reliability of our findings, the analysis was independently carried out by two researchers (Dr Mary Edmonds and Dr Siân Shaw). Collaborative discussions were held to reach a consensus on the emerging themes.

Quantitative results from student surveys

From a total of 151 students, 22 mental health and 26 child nursing students completed the student survey. This equated to 24% of the mental health group and 45% of the child group invited to participate.

Most students agreed or strongly agreed that the SPL was engaging, they had increased in confidence and developed a range of skills which would be beneficial for their future roles and registered nurses (Figure 5 and Figure 6).

Figure 5. Student self-assessment of skill development

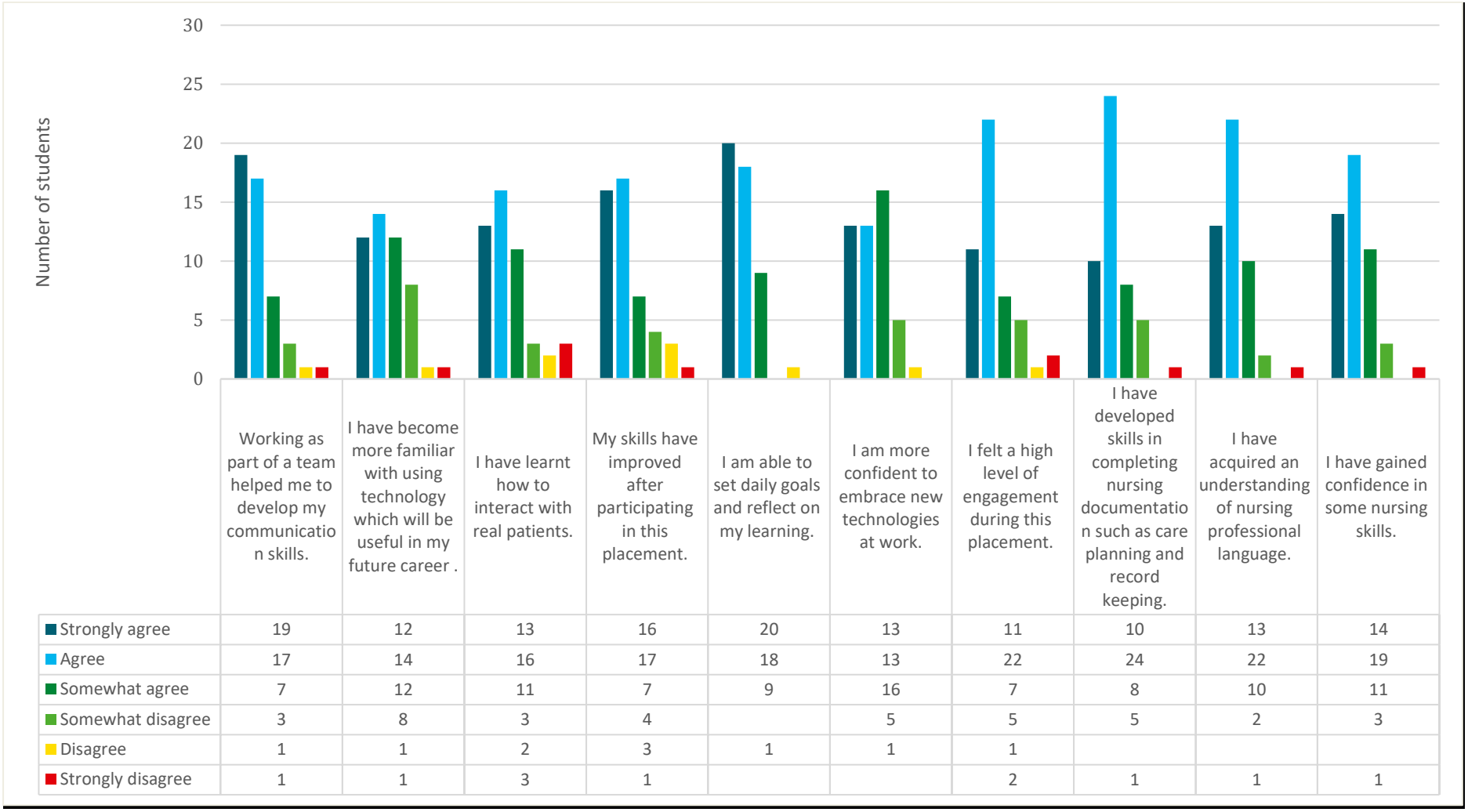


The NMC Future Nurse Standards of Proficiency for Registered Nurses from Part 2 and 3 are listed in Appendix 12 and 13. The shaded proficiencies were those specifically targeted within the learning outcomes for the SPL. Of those shaded blue, more than 80% of the students achieved the targeted proficiencies, and of those shaded amber fewer than 80% of the students achieved the targeted proficiencies.

Different targeted proficiencies were selected for the fields. The data from students' self-assessment shows that the mental health students were more successful than the child nursing students in achieving the targeted proficiencies in the SPL. Over 86% of the mental health nursing students achieved six of the nine targeted proficiencies. The mental health students were also more successful at achieving non-targeted proficiencies with 85% or more achieving four of the proficiencies which were not targeted.

The data for the self-assessment for the child nursing students shows only two of the ten targeted proficiencies were achieved by more than 80% of the students. Non-targeted proficiencies had a higher attainment rate. The child nursing students had missing responses for some of the proficiencies, whereas the mental health nursing students responded to all the proficiencies.

Figure 6. Skills developed during SPL



	Working as part of a team helped me to develop my communication skills.	I have become more familiar with using technology which will be useful in my future career .	I have learnt how to interact with real patients.	My skills have improved after participating in this placement.	I am able to set daily goals and reflect on my learning.	I am more confident to embrace new technologies at work.	I felt a high level of engagement during this placement.	I have developed skills in completing nursing documentation such as care planning and record keeping.	I have acquired an understanding of nursing professional language.	I have gained confidence in some nursing skills.
Strongly agree	19	12	13	16	20	13	11	10	13	14
Agree	17	14	16	17	18	13	22	24	22	19
Somewhat agree	7	12	11	7	9	16	7	8	10	11
Somewhat disagree	3	8	3	4		5	5	5	2	3
Disagree	1	1	2	3	1	1	1			
Strongly disagree	1	1	3	1			2	1	1	1

Qualitative results from student surveys

Three themes emerged from the student surveys: benefits for students, challenges for students, and transferable skills. The themes are summarised below. Each anonymised response was allocated a participant number to reflect that they were either a mental health (MH) or child (CH) nursing student.

Benefits for students

Students agreed the SPL was a valuable, authentic experience in enabling them to develop communication and problem-solving skills. They gained confidence in their interactions and therapeutic relationships with services users and use of technology.

In the quotations below mental health student nurses are identified by MH and child field student nurses by CH. Each anonymised response was allocated a unique participant number to identify different student responses.

Examples of quotations:

- *MH S:5 "I have built relationships with clients, learned about their unique needs, and developed a better understanding of how to help them achieve their goals. Finally, I have also gained confidence in my ability to provide a safe and supportive environment for therapeutic conversations".*
- *MH S:14 "One of the primary benefits of doing this placement is gaining practical experience in a real-world setting".*
- *CH S:47 "Working in teams, real-life scenarios without the pressure of the clinical setting".*
- *CH S:43 "Work through opportunities that you might not see on the wards, such as intubation and transfer".*

Challenges for students

Some students experienced difficulties doing the SPL.

Examples of quotations:

- *MH S:6 "The SPL was full on, it was intense".*
- *MH S:15 "I had difficulties with technical issues and poor internet connectivity".*

Transferable skills

There was an appreciation and recognition of the SPL and how this learning would benefit students as they progressed through different caring situations. Most students were able to identify transferrable skills they could take from the SPL into clinical practice.

Examples of quotations:

- *MH S:5 "The skills and knowledge I acquired from my placement will be invaluable for future placements. I developed excellent communication and interpersonal skills, which can be applied to any work environment. I also developed an understanding of the working world and how different departments interact with one another. I was able to use the knowledge I gained from my placement to better understand the workflow and procedures, which will help me when I enter a new workplace. Additionally, I learned the importance of being organised and efficient, which will help me to succeed in any future placements".*

- *MH S:21 "The GERT [GERonTologic simulator] suit [aging suit] I found beneficial as this was hands on and gave students an insight into neurological disorders. This has made me more aware when caring for older patients or those with hearing and sight loss".*
- *CH S:28 "Knowing different medications needed, knowing how to carry out a care plan and risk assessment. Knowing how to administer from ED [Emergency Department] to the ward".*
- *CH S:36 "I will feel more confident supporting mental health patients and know how to care for patients suffering from seizures".*
- *MH S:9 "Using VERA [validation, emotion, reassure and activity] tools/techniques to promote therapeutic and collaborative working. Also, to have a wider knowledge of the importance of being trauma informed. It helped me in knowing how to communicate with my colleagues and the multidisciplinary team".*
- *CH S:32 "I feel really confident with bronchiolitis and seizures. I also feel I developed good skills to use when discussing mental health with a patient".*
- *CH S:35 "I now feel confident to work in a team. I feel my communication skills continue to build".*

Qualitative results from focus group

The focus group consisted of four practice supervisors (NMC registered nurses and academics from the Nursing Faculty at Anglia Ruskin University who were different from the students' academic assessors) who supported students on the mental health SPL. This was conducted in February 2023. Three themes emerged from the practice supervisor focus group: responsibility of getting it right, addressing gaps in knowledge and experience, and the challenges of being a practice supervisor. The themes are summarised below. Each anonymised response was allocated a participant number to reflect they were a different practice supervisor (PS).

Responsibility of getting it right

The creation of the SPL was a collaborative endeavour involving a team of academic staff with specialist knowledge and experience in mental health nursing. The academic staff focused on creating content in their area of expertise. The mental health nursing team spent a lot of time at the start of the SPL thinking about which skills the students needed and how these could be achieved.

- *PS 4: "As a mental health team, we thought about what should go in there [SPL]. Then colleagues said what they would quite like to do, what they were interested in doing".*
- *PS 1: "There was a lot of involvement in prep for the materials from the team. Colleagues sometimes working in pairs. Everybody shared their own knowledge, we wanted to give the most updated information to students".*

Addressing gaps in knowledge and experience

The academic staff were concerned about the level of knowledge and skills of their students during and following the Covid-19 pandemic. The SPL offered an opportunity to reignite students' learning.

- *PS 1: "Post-pandemic mental health services have been really badly affected. They shut down a lot of the community mental health services during the pandemic and the learning opportunities for students have been constrained. This felt like a really great opportunity to expose them to things that would be interesting, and they would have hopefully a bit of joy about mental health-related materials again".*
- *PS 2: "The whole mental health focus was really important. And it felt quite special, it was just specialised for them, like a specialist virtual placement. If it goes forward and happens again, I'd be really up for that. I think what we did was really good for mental health practice, to be really intense".*

The academic staff identified gaps in areas of knowledge or skills important for future mental health nurses. This included practising how to apply attachment theory when assessing patients. Activities were planned to

practice using talking therapies with specific disorders such as schizophrenia, bipolar, and dementia. The SPL provided valuable additional time for these activities so students would be ready for their next placement.

- *PS 4: "The service user went from the fact that she might have just been lonely, to being bipolar or having schizophrenia. And it feels like perhaps within the remit of what we deliver there isn't enough focus on that. So, that gave us a bit more of a chance to do that. These are things that mental health nurses need to know. And although we don't diagnose, we certainly have a huge contribution to diagnosis. And if it fluctuates from "she's just lonely to she has schizophrenia", we're not getting something right".*
- *PS 3: "And that last physical day that we had when we were asking them to intervene with distressed patients and we're playing the patients their communication skills, some of them are excellent, some of them were a bit worrying. I was turning chairs over because I was a patient, a person with dementia and I was hallucinating all most, and people were charging in and 'no, don't do that!' Wrestling the chair off me and I was like, 'Whoa, don't be doing that out in practice'".*

The challenges of being a practice supervisor

The practice supervisors wanted to do their best but were worried about not being able to deliver what they aspired to.

- *PS 1: "I think that as practice supervisors, this is part of what motivated us to want to do a good job with this, because we are so conscious that it doesn't work well in practice. We wanted to improve the students' understanding of how to do this. … We want to deliver a good and quality experience for our students. We want them to go back into practice and work there for a long time on the front line enjoying what they do".*

One reason for this struggle was the intensity of the SPL and managing their academic workload.

- *PS 2: "I think for the students it's difficult as well because we had a lot of interactive activities throughout the day".*

- *PS 3: "Because of the constant engagement it's been really intense. We have also had marking. Then we had moderating. I've spent quite a lot of time just trying to catch up".*

Despite the challenges for the practice supervisors there was enthusiasm to be involved in the next SPL.

- *PS 3: "I will be jumping at the chance because it's vital at this moment with the standards for the future nurses and how things have changed. We really need to be pushing that time for mental health nursing students. I feel both excited and daunted because I know how much work is involved".*

Phase four: Focus Groups

Dr Naim Abdulmohdi, Dr Mary Edmonds, Dr Siân Shaw

Introduction

During the Covid-19 pandemic, the Nursing and Midwifery Council (NMC) (2021) introduced the Emergency Standard for Nursing Education (RN6D) which allowed for up to 600 hours of the required 2300 clinical placement hours to be replaced by SPL .This part of the Simulation Research Project includes a focus group with Council of Deans of Health (CoDH) members who have NMC approval for RN6D. This captures their experiences in the delivery of RN6D in pre-registration nursing programmes.

Methods

Aim

- To explore the experience of the NMC approval process for SPL in the delivery of practice learning in pre-registration nurse education in the UK.
- To understand how approved education institution (AEIs) have set up for delivery and to share hints and tips for overcoming barriers.

Design

This study adopted a qualitative methodology, using focus groups for data collection.

Sampling and recruitment

A convenience sampling technique was used to recruit study participants. The study population was CoDH members who deliver pre-registration nursing courses in the UK and have received approval from the NMC to include SPL. The final study sample was drawn from a small population of 16 eligible CoDH members, located across England and Scotland. Seventeen HEIs across the UK were approved by NMC to deliver SPL at the point of recruitment between April-May 2023. These HEIs were concentrated in England and Scotland, with one HEI excluded from the sample as they were not a CoDH member.

Data collection

After obtaining ethical approval, CoDH members across the UK were invited to participate in this study through CoDH weekly bulletins and an email sent by the CoDH administration team inviting members from approved education institutions. Participants were provided with a link to the Survey Online system including a Participant Information Sheet, a consent form and the researcher's contact details. Each participant needed to read the first two sections and sign the consent form before progressing to participation in one of the scheduled focus groups. After the initial invitation, participants receive five further email reminders between April and May 2023 to register their interest to participate in this study.

Focus groups

Data were collected using focus groups. A set of questions (Table 10) were developed and reviewed by CoDH's Regulation and Innovation and Pedagogy Strategic Policy Groups and a Senior Nursing Advisor for NMC. The focus groups were conducted online through Microsoft Teams and took between 50-75 minutes. Each focus group was conducted by two researchers (Dr Mary Edmonds and Dr Naim Abdulmohdi) and was video recorded. Audio files were then extracted from each video and transcribed. Due to the limited availability of participants to match in two focus groups, five small focus groups were conducted with two or three participants per group.

Table 10. Focus group questions for HEIs approved for SPL

1. Tell us about your motivations for applying for NMC approval for your simulation programme.
2. Tell us about your experience of going through the NMC approval process for simulated practice learning.
3. How and when do you use simulated practice learning?
4. Tell us about positive experiences you have had with simulated practice learning.
5. Tell us about challenges you have had with simulated practice learning.
6. What resources (for example, infrastructure/technologies/staffing/training) do you have in place to support simulated practice learning?
7. Who or what influences your decision to purchase a particular type of equipment or software for use in simulated practice learning scenarios?
8. How have you integrated assessment into your simulated practice learning activities?
9. What evidence have you obtained that simulated practice learning has successfully transferred to clinical practice?
10. How do you evaluate the student experience of your simulated practice learning activities?

Ethical considerations

Participation in this study was voluntary. All participants were given a participant information sheet and supplied informed consent prior to participating. The School Research Ethics Panel for Allied Health, Nursing and Midwifery and Medicine at Anglia Ruskin University reviewed and approved this study (approval number ETH2223-6347).

Data analysis

The transcripts were imported into ATLAS.ti version 23 software to facilitate qualitative analysis. Guided by the steps outlined by Braun and Clarke (2021), a thematic analysis was conducted. To ensure internal validity and enhance the reliability of our findings, the analysis was independently carried out by three researchers (Dr Siân Shaw, Dr Mary Edmonds, and Dr Naim Abdulmohdi). Subsequently, collaborative discussions were held to reach a consensus on the emerging themes. It is important to note that the analysis primarily focused on exploring institutions' experiences with the NMC approval process for simulated learning, design, and the delivery of SPL in pre-registration nurse education.

Qualitative results

12 participants (75%) participated in five focus groups. The focus group analyses delineated themes that described the institutions' experiences with approval process, design, and delivery of SPL in pre-registration nurse education.

Five major themes were identified:

- Motivation for NMC approval of SPL.

- Universities' experience with the NMC approval process: navigating uncertainty and evolving understanding.
- Integrating and advancing SPL through innovation and collaboration.
- Sustainability of SPL.
- Challenges in measuring the impact of SPL.

The focus group members were allocated unique alphabetical identifiers which are used within the qualitative analysis below.

Motivation for NMC approval of SPL

There were several driving factors in universities applying for NMC accreditation to deliver SPL (RN6D). The most prominent driver was a shortage of placement areas and the need to increase placement capacity. The Covid-19 pandemic exacerbated this shortage. A significant increase in student nurse recruitment to courses also intensified the need to find more placement opportunities. Universities took advantage of the NMC emergency standards developed during the Covid-19 pandemic.

- *D: "Our motivation was born out of really our experience in the pandemic, where placements became very, very difficult to secure. We had to pivot a huge amount using the emergency standards, to move some students into simulated placement. We have grown very quickly over a short space of time. So, we've gone from 30 students in 2019 to 500 students this year, across various programmes, campuses. And to grow a nursing programme to that sort of scale, you need swift growth in placements. In the backdrop of a pandemic, that was very challenging. So, the additional simulated placements allowed us to compensate for the tight placement. And that was in a backdrop of doing a lot of placement expansion".*

- *A: "One of the issues identified is around capacity. So obviously with the emergency standards, but then also looking forward to the future and how it could future-proof us, as well as our nursing programme. We had discussions and looked at how we could manage the programme to support the peaks and troughs".*

- *B: "We've done simulation for a long time, and we've done some really exciting, innovative stuff. But when the pandemic came, that started to stall because you couldn't really do any of it in lockdown. Then it changed to a need. With simulated placements, it was an opportunity to keep students on track and stop them getting behind if we could offer simulation when they couldn't go out on placement and so on. We're a really large provider. During the pandemic we did lose lots of placements temporarily, so simulation was a massive help".*

In some of the trailblazer universities, simulation existed as part of the validated curriculum prior to the pandemic so they expanded on what had already been developed.

- J: "We were already delivering what we classed as clinical learning, but this turned into simulated practice learning on the back of Covid. So, we were quite fortunate to have that up and running at the point that Covid hit, which I think was phenomenal".

As SPL has developed, universities are seeing SPL as an opportunity to enhance learning experiences. A key focus was on proficiencies and skills that were sometimes difficult for students to achieve in clinical practice.

- *B: "But then over time it became more than just a way to keep people on track and a way to generate more placements. It became more about student experience, and sort of offering something innovative and forward thinking. It was a way for students to practice their skills in a safe environment and to have the opportunity to practice skills that they weren't sometimes getting access to. For example, [for] mental health students, a lot of the skills in the current*

standards are quite adult focused. You wouldn't necessarily get the opportunity to do a blood transfusion or insert an NG tube in a mental health setting. So, it meant we could help our students get exposure to things that they weren't necessarily accessing in practice".

Funding for simulation resources facilitated the proliferation of SPL.

- *H: "We'd also secured funding for some digital simulation equipment, so we got some immersive rooms and VR headsets and things. That gave us that extra infrastructure to further develop what we were doing, so those were some of our motivations around it".*

Some universities had a particular interest in simulation and wanted to be early innovators. They were interested in simulation pedagogy and sought to understand any benefits of simulation and how SPL linked to innovations in healthcare service delivery.

- *C: "Since the pandemic is over, it's not over, but it's quieting down. It's given me the opportunity to really look at what it is that we deliver as simulation. What does it mean for teaching and learning with the students? And how do we prepare students to replicate what's there. New ways of delivering, and services are evolving".*

- *F: "I think we were particularly interested and excited to be, to be one of the early implementers, because we feel experienced with simulation. We've been doing quite a lot anyway, but also it gave more scope to do more exciting things".*

Universities' experience with the NMC approval process: navigating uncertainty and evolving understanding

The approval process was straightforward and the NMC viewed as supportive in the process.

- *F: "It was more an opportunity to talk about what we're doing, because you can write that on a form, can't you? But you can't get the flavour over of the types of things that you're doing, and the types of feedback you're getting from the students. So, it was just nice to be able to do that and have that positive dialogue around and we talked a lot around creative methods in our meeting. It was a pleasant discussion around what we're up to, and an ability for us to showcase a bit more about what we're about, as a university".*

Understanding the regulatory requirements caused the most uncertainty. Changes in definitions and terminology meant it was sometimes difficult to pinpoint what was required and permitted. Approved HEIs with RN6D standards felt a huge responsibility in leading the way for those who were not using SPL. There seemed to be huge learning curve for all.

- *B: "I thought the actual process, the application wasn't too challenging. It was hard work, but it wasn't challenging. Speaking to other universities in the NMC focus group, we've got a little community of practice. I think what we and most people found complicated was understanding what's acceptable, what constitutes a simulated placement and what doesn't. So, what turns simulation into a simulated placement? And everybody is doing something so different. There was anxiety around are we doing the right thing? Will this be allowed? Will this count for the hours?".*
- *D: "It was a bit like the wild west during the pandemic, in terms of what people were doing? ….. I still feel there are some huge, huge grey areas around what is and what isn't acceptable. And I do think that that's a bit of a minefield".*
- *M: "I had a realisation early on that this was a journey we were all on, the NMC as well. I think, once I realised that and discussed that with people, it became a lot more relaxed. Yes, we need to achieve certain things, but this isn't about being very prescriptive. It's about how can we do it best and learn from each other".*
- *P: "I feel like they're using us as a test bed, they want to know what our experiences are to help other people in the future. They call us the trailblazers. They're learning from our mistakes. And I*

very much feel like it's okay to make mistakes and it's okay to include negative points in the reports. That whole process has been more of a fact-finding mission, but we are the testers, the initial early adopters, but the actual support from the NMC has been really apparent".

The journey to understanding what constituted SPL had generated uncertainty and anxiety. It was evident this was a rapid and shifting dialogue, continuously evolving.

- *J: "The dialogue has changed over the years. You evolve and you go with it, whereas some people don't like that uncertainty around the definitions. There has been a lot of pushbacks about what's acceptable and what's not, and what's a high standard and what's not, and that's the ambiguity around it. The ever-moving definition makes people uncomfortable. So, it's been a learning process for them [NMC], and I feel like they've really listened to us and changed their perception of simulation-based education as a result of the whole process".*

The terminology used to describe SPL has changed and become more regulated over time to reflect that used in clinical placement. This makes it clear to students that they are considered for a placement rather than undertaking a theory module at university.

- *K: "When we've been putting in our quarterly reports, we've been asked to change our language and utilise simulated practice learning".*
- *P: "We've been responsive in the way we had to change terminology for example, we would always refer to simulation facilitators and now they're assessors. Enabling the student learners, to understand that they are on placement and to make that very clear in the terminology that we use as opposed to it being you're in university doing simulation. They have to understand the difference between being in simulation for the theory hours and being on simulation for simulated practice learning. And the distinctions that we've made using terminology leaflets to welcome the students 'to your placement' and referring to it as a placement rather than 'You're just in simulation.'"*
- *M: "Initially, I think, there was a lot of confusion, a lot of stress: "What do they mean? What does 'simulated practice learning' mean?" Even to this day the number of discussions I'm sure we've all had about what that means, and everyone has got a slightly different interpretation, although it's becoming much, much clearer, which is great".*
- *N: "I was at the webinar this week from the NMC, and it's much clearer now in the standards".*

A clear differentiation was identified between skills learning through simulation and SPL in terms of what was counted as practice learning hours. It was necessary to ensure that the design, delivery, and assessment reflected clinical practice. This was needed to demonstrate compliance with the NMC (2018) Standards for Student Supervision and Assessment. This was critical to maintain public and regulator confidence in the skills and knowledge of graduating nurses. This presented its own set of challenges.

- *E: "We have basically ringfenced just the ones that are practice hours. The ones that are sat within the practice assessment document, where there is a timesheet, where there is the academic assessor, practice assessor model in place for the hours that we're capturing…. Everyone has been doing simulation littered through their programmes for years. But I suppose it's which ones you're counting as your practice hours, is probably the key discriminator".*
- *K: "I think the challenge for us wasn't so much the delivery because we've been delivering it. It was the compliance and the governance, so how do we maintain compliance with the Standards for Student Supervision and Assessment if we're going to use it from a summative assessment perspective? How do we reassure the regulator that we are providing robust systems that ensure that the public are protected, and we instil public confidence within the standards, the code, and don't undermine the integrity of practice-based learning".*

Integrating and advancing SPL through innovation and collaboration

The expansion of SPL requires attention to the design, development, and delivery of the experience. It was evident from the focus groups that creativity and innovation underpinned the construction of a range of different models of simulation. This section outlines how universities have undertaken this process.

Co-creation of SPL

Co-creation of SPL and engaging one or more practice partners, students or service users was considered beneficial in improving engagement and making the experience authentic and relevant, thereby enhancing learning and improving the assessment process and subsequently improving student satisfaction. Involving practice partners in the process helped them overcome initial hesitancy and accept SPL and develop better understanding of practice assessment.

- *H: "Particularly with our practice partners, there was that hesitation around, "Well, it's not practice, so how do we know that what you're doing equates to what we need it to?" But I think, by involving them in that process, they are also now 100% on board with us and can see the benefits of having simulated practice and being part of that learning and facilitation with our students. So, I think part of the benefits we've seen is definitely more partnership working, and stronger relationships with our partners around that".*

Engaging others within SPL challenged students' perceptions and enabled students to understand the importance of individualised patient care.

- *K: "We have student simulation writing groups, so we're getting our students to write the scenarios, along with our practice partners, so that we are addressing some of their needs and some of the issues that have been raised by practice about what our learners are coming out with. But [also] vice versa: what learners would have preferred to have had, ahead of going to a placement or during the placement. We're hoping that should help us to improve our student experience within the practice learning setting, because they're coming back to explore some of the things that they're seeing in practice, within a simulated practice learning setting".*
- *C: "We've got the service users that we work with, and we were able to do the digital stuff, but we're also able to do the everyday stuff, that is important. Our service users have obviously got genuine conditions. It was realistic, and they've used services for a long time. And the evaluation from the students, was impactful because the students said they learnt so much because they are service users".*
- *H: "We have experts by experience involved. They play different roles. So, the students would have a caseload of patients, and be interacting with different patients, and we are working with them, and writing in their portfolio what they're learning".*

Positionality of SPL within the pre-registration nursing curriculum

The universities used SPL in all years of the pre-registration nursing curriculum and in adult, child, and mental health fields. In some universities there was a greater emphasis on SPL in the first year, with decreasing hours in the second and third years. Using SPL at the start of the first year is seen as a way of transitioning students from theory/the university into the practice environment.

- *G: "The majority of our simulated practice learning hours are in the first year, the first placements for students. We do a bit of a trilogy of short placements at the start, a creative health placement, which is an assessed simulated placement. We class both of those as simulation, and then a clinically based placement. There are about 300 hours during the first year classed as simulated assessed learning. It reduces in second and third year. The third year tends to be more focused around achieving some of those more difficult-to-achieve skills in the competencies and the proficiencies, so we heavily weight it towards Level four".*

- *H: "It's a six-week placement, and we run that for our first-year students' first placement or second placement. We've purposely done that because it helps the students, particularly when we've got students that are new to healthcare, to get that lovely introduction into what practice learning looks like and what it is. It just helps to consolidate that first-year theory in preparation for when they do go out into practice. For the ones that have it as their second placement, it helps to consolidate what they've seen in practice, because it gives them that opportunity to question, perhaps, where there are those gaps. For year two and year three, it is focuses on Annexe B which is a real challenge, particularly for mental health, for them to achieve all those proficiencies".*
- *L: "We tend to be using it in our second part students, and they tend to be mental health students on a physical health placement. This is what we identified as quite a pinch point across the programmes and across provision in the university".*
- *J: "In the third year they do all their advanced proficiencies in simulated practice learning, so it's where they can't get to do the annexe proficiencies".*

Innovations in SPL

There has been considerable and rapid innovation in the design and delivery of SPL. The modalities used are diverse and cover a range of digital contributions from requiring little, if any technological input, to high technological input.

- *E: "We are quite progressed with our VR, we've got 130 headsets, we're very well furnished, with VR. We use it across our second years predominantly in VR. We're using single licences for year ones, to condition the students. In effect, we can create anything we want in that particular space. There are even smell diffusers in there, so we can choose different smells to enhance the space".*

Other universities who invested in virtual reality (VR) were unsure of the benefits, in terms of whether it currently delivers what is needed. There was discussion about the need to develop UK-centric scenarios designed specifically for the nursing profession.

- *D: "We had the opportunity to invest in VR and to develop some expertise around that. When there is a VR component to a simulated practice learning week, it is often the top of the list of the things that they've [students] enjoyed. So, the students really do see that as a powerful tool".*

Several of the participants raised concerns about the practicality of using VR technology at universities with large student nurse cohorts and the costs involved. Not everyone has received funding to develop their estate or purchase resources.

- *G: "Somebody in the NMC was talking about VR helmets. And I said, "Our cohorts are 600, I don't know how this is even going to look. We don't get any funding. We're not getting any compensation for absorbing this, we're having to absorb all this workload and all this money, and we have no money to do this. Sometimes I think it's a little unrealistic. We have no support with this at all".*

One participant described how a dedicated team from a collaboration of universities created a mobile simulation van that toured hospital sites, focusing on the proficiencies and skills students found hard to achieve in clinical placement.

- *F: "Because of the red-flag skills, those more difficult proficiencies to gain, we've used our practice learning simulation to be on tour, really. We're a university that's geographically spread across four sites that aren't close to each other, so that can be challenging. We've got simulation on all four sites as a standard, but we've also got a team who can arrive, if you like, and really focus on those particular tricky skills".*

Another focus group participant described an innovative, award winning *Creative Health placement* focusing on social care which required no technology and benefitted the local community.

- *G: "I am really proud of our 'creative health placement' and, the benefit it's having, for our students, but also the local community. It's using a lot of social prescribing because, as curriculums, we're not… The curriculums can often focus on health, and less on social care, so, as a university, we're passionate to make sure that we're supporting our social care partners, both in workforce transition but also within our communities. So, the Creative Health placement works directly with our local neighbourhoods, across all our sites. Those Creative Health simulated placements are the epitome now of transformative learning. I think we have some students who start them, going, "What on earth is this? What are you talking about? I'm going to work with a dancer," or, "You're going to make me sing in a choir and go and perform …. They come in wanting acute care. Nursing is all about acute care, making people better, and saving lives. Then we say, "Go and have four weeks and find out what's in your neighbourhood, and work with Gypsy, Roma Traveller communities and mental health communities".*

Another approach described was using in-depth holistic case studies in which students became immersed.

- *A: "The learners follow a patient case study right through from admission through to discharge and then consider where they discharge to within that local community. They're divided into groups and are given a different case study. There's a medical, surgical, emergency, and a community type scenario that they go through in groups, and we take them through the group work. We use near life videos, we use escape rooms, we use simulated whole care episode skills stations as well as specific skill stations as well. You could just see at the end that the learners got it. You could see what they were going to take away into practice after that experience to improve patient care as well".*

Structured models for SPL

An alternative approach to SPL was the use of a structured design model. One such model used was Peer-enhanced e-Placement (PEEP) developed by Dr Lisa Taylor, Professor of Occupational Therapy at the School of Health Sciences, University of East Anglia and underpinned by the Five Stages of Learning model (Salmon, 2011).

- *H: "For us, having PEEP has been a really great way of introducing simulated practice learning to not only our students but also to our academics and our partners, because it's a nice, structured model. It's clear what we're doing. It just helps people to have that experience of, "This really is simulated practice," because it was something new that we introduced, people were not always clear on what it is, and how does it look".*

Another structured model described within the focus groups was an adapted version of Staffordshire's five-stage approach (Brown, 2019).

- *M: "We built up the learning and the simulated practice learning, so it's all contextualised. The students start off with all being given patient identities at the beginning of their training, and people to consider and follow throughout in their simulated practice learning and being an advocate for that person as well in different scenarios. Then, we give some background. They may have some prep before the simulation, pre-reading for the scenario.*

  Then stage two moves on to more simpler tasks that you might do. Stage three and four become much more multidisciplinary, more people involved, more contextualised. The environment might be the same as it would be for example, in a community setting or a hospital ward, wherever it is.

  So, we don't throw them into it, because from the evidence we've read and what we know about simulation is that, even though they go straight into these things in practice, it's a bit overwhelming, all the information. They don't really take it all in. From a resource perspective, for

us, there's no point in chucking them all into that straightaway and putting huge resources in if they're not actually absorbing it".

Going beyond

Simulation was described as not replacing practice learning but enhancing it. Participants described a fast-paced journey, where it will be a while before people know where the destination is. Some thought it would never be found as exciting new places to travel toward are constantly discovered.

- *M: "That's the thing for me, when people talk about simulation replacing clinical practice, I'm like, "It's not…", it is enhancing it. It's doing the things that you can't do, sometimes, in clinical practice. …. There are other elements that it can do. Some of the new technology that you can do is just… It goes beyond, a little bit. Because I don't think we know where simulation is going yet. It's moving quickly and it could go anywhere. We need to be adaptable to that".*

Sustainability of SPL

Within all the focus groups, sustainability of SPL was a dominant theme. Key concerns centred on funding sources, academic expertise with the necessary skill sets and infrastructure. It was recognised that, in order to build capacity and capability for SPL, ongoing financial investment was crucial. The implications for SPL on staff (for instance, academic, administrator, technologist) and facilities were intensive.

- *L: "We run a four week and then it's a week break and then another four week and then a week break and then another four weeks and the strain is apparent as you go through them especially as it gets towards the end… In the second year, they have a week before they go out on their first placement and then they have a block of six weeks in February. That six-weeker is absolutely brutal for staff and for students".*
- *D: "If you look at a week of simulation, that's 40 hours, that's a module. So, in terms of workload, you're saying to two staff, for a group of 30 students, you're running another module and again, if you multiply that to three weeks, you're asking someone to plan and deliver three modules, on top of their day job".*
- *E: "Then there's the sheer workload that comes alongside a placement delivery. It's five days a week, full days. We have to account for all the hours, because obviously they're getting the hours as placement time on their timesheet. They've got to be there for the whole day, it has got to be structured properly, like a working day".*

If students did not engage with the SPL, they were required to make up the time in other placements. This could be potentially challenging, particularly if it involved large numbers of nursing students. This also raised the question as to why nursing students were not engaging with SPL.

- *K: "In the six-week block we ran, 60% didn't engage, so 60% of those 350 students have got six weeks of placement to make up over the remaining two years. We said, "we're not putting on additional simulated placement learning for you if you didn't turn up," because we'd put all that preparation in place".*

Some of the participants felt they did not have the required expertise to deliver SPL effectively. There was a sense of frustration when senior management did not appear to understand their needs.

- *D: "We don't have a lead for simulation and we don't have any ASPiH-registered technicians either. Both are an aspiration that we're working hard on. It's trying to get the university to understand what the resourcing around that is".*

Administration processes and ensuring assessments met the NMC (2018) Standards of Student Supervision and Assessment requirements often took a substantial amount of academic time.

- *A: "It's very resource heavy. It takes a lot of organisation to ensure that the students are rotating through the different parts of it. I think the professionalism is sometime a bit of an issue. Managing learners who are late and then questioning "why have I got to sign in?" I think one of the issues as well is acting as a practice supervisor and being able to provide that amount of feedback for that number of learners, we're looking at between 100-200 learners on each iteration, going through there and managing that".*

Staff preparedness for SPL

There was an acknowledgement that existing and new academic staff needed to have continuing professional development (CPD) to acquire the necessary skills to deliver high quality SPL.

- *P: "Upskilling the staff, any new staff coming in, is challenging but once they're in there, they enjoy it, but it is quite daunting for some people who are maybe more a traditional academic or a traditional lecturer".*
- *M: "We developed a Master's in Interprofessional Healthcare Simulation. Some of the staff are really getting into simulation and excited, they'll come and either do a couple of modules or we've got two members of staff doing the whole Master's".*

Effective procurement of resources for SPL

Off-the-shelf simulation software was found to be expensive. Annual licence fees, with often a per-student and per-scenario cost, could run into tens of thousands of pounds for universities.

- *G: "That licence is £10,000 and that licence you only get three and it's £5,000 a year," and we were like, "Oh, my goodness me, where's this coming from?".*

Universities were having to think about what they can afford in the long term. Mistakes had been made by purchasing software that had unexpected requirements. Universities needed guidance in their procurement choices.

- *B: "We're just at that point now where the funding we received is coming to an end. And we're starting to think right, let's get our act together this time. What do we need? What don't we need? If you have that, which headsets do they go through with and are there any like data protection issues with that? We've learnt loads but it would be nice if at a national level, people were guided so we don't waste money".*

The placement tariff for nursing students was found not to cover the full cost of delivering SPL.

- *A: "We are expected to do it off the back of tariff but it's not a massive amount of money. It just literally covers our staffing costs but probably not quite".*

Challenges

There were several challenges running SPL. Meeting the differing requirements of several placement partners was one aspect.

- *M: "The only problem we've got is it's a challenge, as well, because we've got nine different practice partners and they've all got very different needs and ideas about simulation so, at times, that can be quite challenging".*

Student perception, expectations, and behaviour need to be carefully managed and supported.

- *J: "Students seeing this as practice. It's timetabled as practice. We know what it is. Initially, they just didn't value it and just didn't turn up, so we had student behaviour issues, attendance problems, unprofessional development, lack of interest in practice".*

Ensuring that SPL is compliant with the Standards of Student Supervision and Assessment (NMC, 2018) could require additional staff.

- *K: "We've recruited quite a lot of staff to support this endeavour".*

Measuring the impact of SPL

There were variations in how the impact was measured. There was heavy reliance on self-reported students' feedback and satisfaction. Whilst there was some feedback from clinical practice partners the evidence remained anecdotal. It was acknowledged that overall, the impact was positive, but the lack of standardisation in evaluation data made this difficult to quantify. There was a desire for a more effective approach to achieve this. In addition, high quality research was required to determine the true impact on proficiency and patient outcomes.

- *H: "Anecdotal feedback from our partners is that these students are different. They're coming in, they're getting involved straightaway. They're not sitting in the background. They're more eager. They're there and they're asking the right questions in terms of the different screening tools and assessment tools".*
- *G: "Partners are saying they're seeing a definite difference in terms of skill acquisition of the first-year students when they're going out, though we can't quantify that".*
- *M: "We interviewed our students and did some surveys where we pre-loaded their practice placement with the simulated practice learning. We got data before they went to placement, and then after, to see if there were any changes in feelings and thoughts and see if what they'd learnt from the simulated practice learning had been transferred, but it's not easy to know for certain".*
- *P: "We've got anecdotal evidence; we've got the evaluation data".*

Discussion of Phases Two, Three, and Four

This research project specifically looked at how simulation can transform practice by comparing existing learning approaches with emerging simulated and technology-enhanced learning approaches. This was achieved by undertaking a survey with HEIs delivering pre-registration nursing education (phase two). An in-depth case study of student experiences with SPL and the experiences of academic staff being in role as practice supervisors (phase three) and focus groups for CoDH members who have been approved to provide up to 600 hours of SPL (phase four).

Summary of results

Findings of phase two

The aim of phase two was to explore challenges, opportunities, and organisational readiness for SBE in pre-registration nurse education. Data were collected on SBE from nursing schools who deliver pre-registration nurse education and are members of CoDH, regardless of whether they delivered SPL. 60 out of 87 (69%) schools of nursing participated in this study. 89% percent of the sample (n=54) said that they are using hours for SPL. However, based on NMC data, there are only 17 institutions, 16 of which are CoDH members, which have pre-registration nursing programmes approved to offer up to 600 hours of SPL through the RN6D recovery standard at the time of research. This identifies a lack of clarity or understanding of used terminology and what is considered an NMC approved course with SPL. A large number of pre-registration nursing courses will be approved by the NMC to deliver nursing courses but are not approved to deliver SPL for up to 600 hours (RN6D).

There were higher levels of confidence in the use of low-fidelity simulations and human patient modalities compared to virtual or augmented realities and the use of desktop simulation. It is interesting to note that the higher the level of technology required in the simulation, the lower the staff confidence and use of that modality. This could be due to various factors such as the complexity of technology, the amount of education required to use it effectively, and the level of realism and immersion that can be achieved with technology. Overall, these findings highlight the importance of carefully considering the type of simulation modality used in nursing programmes and ensuring that staff receive appropriate education and support to effectively use it. The survey identified a few key areas that require further investment and development:

- *Knowledgeable, skilful staff.*
- *Administrative staff support.*
- *More time allocated for SBE.*
- *Physical space and equipment for SBE.*
- *Development of staff digital literacy.*
- *Recognition and value of the benefit and impact of SBE.*
- *Commitment from senior leadership in the university.*

The open-ended questions identified many more opportunities than challenges to SBE. In the UK, schools of nursing face various obstacles in integrating SBE, including resources, lack of faculty training, leadership awareness and commitments, and issues related to the maintenance of simulation equipment. However, SBE offers many opportunities and benefits for learners in nursing education, including:

- *A safe and controlled environment where students can practice clinical skills without the risk to patients and others.*
- *Increasing student confidence, self-awareness, and readiness for clinical practice.*
- *Enhancing student satisfaction and learning experiences.*

- *Hands-on experience and opportunities to apply theoretical knowledge of real-life scenarios.*
- *Increasing placement capacity and reducing pressure on clinical placement environments and staff.*

It is evident from both the quantitative and qualitative results that in order to effectively use and integrate SBE in nursing education, there is a need to focus on developing infrastructure, commitment by faculty leadership, and staff development. Skilful staff who are knowledgeable about SBE and its applications can help ensure that students receive high-quality education and are prepared to apply their knowledge in real-world settings. Similarly, administrative staff support is necessary to provide the resources and infrastructure needed to effectively deliver SBE. In addition, providing more time and physical space for SBE, developing staff digital literacy, and commitment from senior leadership is essential to ensure that SBE is given the necessary priority and resources to achieve its full potential. This survey identified a lack of understanding of the difference between SBE and SPL. Therefore, it is essential to increase clarity of the terminology used to describe different provision of clinical simulation.

Findings of phase three

The case study explored a two-week SPL for second year pre-registration mental health nursing students and a two-week SPL for pre-registration child nursing students. Most students agreed or strongly agreed that they had increased in confidence and developed a range of skills which would be beneficial for their future roles as registered nurses. There were also challenges identified that included digital readiness of students and academic staff to deliver and participate in interactive digital aspects of SPL.

In both the mental health and child nursing student SPL experiences, specific proficiencies from the Future Nurse Standards (NMC, 2018) were targeted for achievement. A comparison was made between the self-assessed proficiency achievement of the two fields of nursing. It was evident from the data that from their self-assessment, the mental health nursing students were more successful than the child nursing students in achieving the targeted proficiencies. In the SPL, over 86% of the mental health nursing students achieved six of their nine targeted proficiencies. For child nursing students 80% of the students only achieved two or more of the targeted proficiencies. The differences in proficiency achievement were likely due to variances in the construction of the SPL. The mental health nursing students had five SPL days in the skills labs on campus interspersed with the interactive patient focused (virtual) learning. The child nursing students had skills sessions on campus prior to the SPL. The construction of the skills sessions differed for the child nursing students. Careful consideration is needed to identify which simulated environments/modalities are suitable for assessment of attainment of individual proficiencies. It is appeared that the proficiencies targeted in the SPL for the mental health students were less suitable for achievement in the SPL than those selected by the child branch faculty. The modality of SPL therefore needs to be appropriate for the proficiency being assessed.

A focus group of mental health academic staff acting as practice supervisors (n=4) was also conducted within the in-depth case study . The themes reflected the importance of collaboration between academic staff and service users in the design, development, and delivery to create authentic, engaging SPLs. Academic staff created interactive, patient-focused activities that centred around field-specific knowledge and experience gaps, and proficiencies that students found difficult to achieve in clinical placement areas. The SPL was resource-intensive for academic staff, however there was a strong desire and motivation to continue with SPLs to prepare nursing students for future placements.

Findings of phase four

The motivation for universities seeking NMC approval for SPL (RN6D) stemmed from various factors. The initial driver for some was the scarcity of suitable placement learning environments and the pressing need to expand capacity, which was further exacerbated by the Covid-19 pandemic reducing the range of placements available. The rapid growth in student nurse recruitment intensified the demand for additional placement opportunities. The participants discussed how universities capitalised on the NMC emergency standards developed during the pandemic to incorporate SPL. This was seen to address the shortage of placements and a way to ensure students were able to either progress or complete their course. SPL also provided an opportunity to enhance the quality of the student experience by allowing them to practice skills that were challenging to achieve in clinical settings. Funding for simulation resources, such as immersive rooms and VR headsets, further facilitated the proliferation of SPL immediately after the Covid-19 pandemic.

The NMC approval process was generally viewed as supportive, offering universities an opportunity to showcase their innovative practices and engage in positive dialogue. However, challenges arose from uncertainty around the regulatory requirements and evolving terminology surrounding SPL. This resulted in anxiety among university staff regarding what would be considered acceptable and how many hours would be permitted. Nevertheless, the NMC approach was viewed as evolving and demonstrated a willingness to learn through the experience of trailblazer universities.

The participants described ways in which SPL was integrated into their nursing programmes. They highlighted the importance of creativity and innovation in designing models of simulation. Examples of collaboration included co-creating SPL with practice partners, students, and service users to enhance engagement, learning and authenticity. The universities incorporated SPL across all years of the nursing curriculum, with an emphasis on the first year, to aid the transition from theory to practice. While some participants lauded the benefits of VR technology, others expressed concerns regarding practicality and costs**,** especially for large student cohorts. Participants viewed SPL as an opportunity to enhance, rather than replace, clinical practice and viewed the future of simulation as dynamic and evolving.

The focus groups also identified an issue with the sustainability of SPL. The participants discussed a range of challenges including:

- *Funding and availability of facilities.*
- *Academic staff expertise.*
- *Resource intensity.*
- *Strain on academic staff.*
- *Lack of student engagement.*
- *Lack of expert leadership in simulation teams.*
- *Added bureaucracy of administration processes and assessment standards.*
- *Continuing professional development for staff.*
- *Effective use of funding and procurement expertise including simulation software*
- *Measuring the impact of simulated practice learning and lack of standardised evaluation data*
- *Limited research findings providing evidence comprehensive assessment of its effectiveness in nursing practice.*

Strengths and limitations

Phase two

The study successfully recruited 69% of the UK CoDH members that provide pre-registration nurse education, which is a significant strength of this research. The survey gathered data on the nursing faculties' confidence levels and use of various clinical simulation modalities in pre-registration nurse

education, which is a unique aspect of this study. Additionally, the study used a valid and reliable scale to measure simulation culture and organisational readiness for schools of nursing in the UK. The inclusion of both quantitative and qualitative questions further enhanced the validity of the study's findings. The voluntary participation and self-reported information have limitations for the interpretation of the study results. Selection and non-response biases may be generated due to the study design and the data collection strategy.

Phase three

A limitation during this phase was the small number of students within the case study, and students' self-assessed evaluation of proficiency achievement. The case study was conducted in a single university which has implications for the transferability of the findings. However, inferences can be made which will be useful for other universities delivering SPL for nursing students. In addition, the focus group for the academic staff acting as practice supervisors was very small. However, this did provide interesting insights regarding the evaluations, motivations and implications for the academic staff. The experiences of clinical practice supervisors/assessors and chief nurses were not sought, so the results may demonstrate an incomplete understanding of the SPL experience.

Phase four

This phase recruited 75% of the CoDH member HEIs which were approved to provide up to 600 hours of simulated practice learning in their pre-registration nursing programmes. This is the first study to look in-depth at experiences at a national and strategic level. The initial intention was to have one to two focus groups with six to eight simulation leads. Difficulties in availability of the participants at the same time led to smaller focus groups. These gave more details about what was happening and why, and any challenges that arose, could then build on and inform phases two and three. A limitation was that the experiences and motivations of HEIs who did not apply for RN6D were not included in this study.

Conclusion

This report provides a timely evidence base demonstrating how simulated learning can transform practice learning in nursing education and meet the NMC (2018) Future Nurse Standards of Proficiency for Registered Nurses.

The findings within this report emphasise the significant contribution that SPL provides in the delivery of pre-registration nursing programmes. The systematic review indicated that, on average, SBE is more effective than traditional clinical education in improving outcomes such as knowledge, clinical judgement, critical thinking, and measures of clinical competencies. Mapping the ability of simulation to meet individual proficiencies within the NMC (2018) Future Nurse Standards of Proficiency for Registered Nurses indicated SBE was more successful than clinical education.

The cross-section survey of HEIs with pre-registration nursing programmes highlighted their commitment to SBE with the recognition that infrastructure, commitment by faculty leadership, access to facilities, resources and funding were critical for ensuring success and sustainability. In the case study, students and academic staff acknowledged the positive benefits of SPL. It was acknowledged as an effective method that complements learning in clinical placements and enables attainment of the NMC (2018) Future Nurse Standards of Proficiency for Registered Nurses. Whilst SPL was viewed as a demanding learning experience for students and academic staff, it was recognised to offer opportunities to gain knowledge and skills in aspects of care that may not be experienced in clinical placements. Those HEIs with experience of approval by the NMC (RN6D)

showcased innovative and creative approaches to prepare pre-registration student nurses for clinical placements. These HEIs have significant experience that can be drawn upon to share lessons learnt from delivering SPL. This could provide guidance to other HEIs and stakeholders.

This research also highlights the difficulties HEIs face when delivering SPL which could risk hindering its transformative potential. For example, the lack of clear terminology for SBE was evident across all phases. In phase one, there were notable differences between UK and international terminology in the literature. Phases three and four revealed that whilst support was readily available from the NMC, HEIs still experienced uncertainty about what the regulator was expecting and what activities met the criteria for SPL. There were no standardised evidence-based tools to evaluate SPL despite the considerable number of regulatory standards (phase one). There was a strong desire for clarity and a benchmarking tool to ensure consistency in the approach of HEIs in phase four.

The sustainability of SPL was a dominant theme in phases two, three and four. HEIs in phase four, described making significant investments to their infrastructure for both physical and digital resources. Concerns were frequently raised about the stability and variability of funding across the four nations and the impact this would have on infrastructure if funding was withdrawn or reduced (phase four).

The importance of 'buy in' by faculty leadership for organisational readiness and delivery and staff development was reported in phase two. Expertise, skilled academic staff, administrative staff support, time for developing scenarios, and sufficient physical space for SBE (phase two, three and four) were considered important factors for effective use and integration of SBE (phase two) and SPL (phase three and four). Other challenges for academic staff related to the delivery and participation of SPL (phase three and four). In phase two, staff were generally more confident when there was increased use of simulation. Limited organisational capacity or readiness could make it difficult for HEIs to demonstrate effectiveness of SBE (phase two) and/or SPL (phase three and four). When preparing interactive patient-focused activities in SPL, there needs to be careful consideration of the type of modality used to achieve the proficiencies (phase three).

The planning, design, and delivery of simulation was viewed as an advanced skill for academic staff (phase two, three and four). It was important staff received the right type of education and training (phase three and four) so they could effectively support students (phase two). The importance of students being prepared for undertaking SPL was also evident in phase three and four. Whilst students liked the contextualised learning, they found this learning could be intense. This could result in variations in student engagement (phase three), posing its own set of challenges for academic staff acting as practice supervisors (phase three and four).

This research has been undertaken after a number of HEIs have incorporated SPL into their programmes. There is now an opportunity to expand the number of HEIs integrating SPL into their pre-registration nursing programmes. This is in line with the ambitions in the NHS England (2023) Long Term Workforce Plan. It will require a commitment for stakeholders to work in partnership to maximise the impact and benefits of SPL. The innovative approaches to practice learning developed during the pandemic need to be applauded and embedded in programmes as outlined in the CoDH (2022) publication 'Pandemic Powered Improvements: Best practice in innovative healthcare education placements created during the pandemic'.

The recently issued definition for SPL by the NMC (2023) focuses on using a 'variety of modalities' with opportunity for "repetition, feedback, evaluation and reflection". The emphasis is on the achievement of programme outcomes with up to a maximum of 600 hours of SPL. The NMC provides guidance around what is expected when delivering SPL, responding to the request from academic staff for further guidance. While helpful, the definition also presents challenges for universities relating to the significant investment in staff, lab space, equipment and training required to implement SPL using this definition. There is an expectation that the universities that have already been approved to deliver SPL (RN6D) as well as those considering this, will all adhere to this change.

NMC monitoring will also incorporate the new definition into their standards and processes. A more supportive developmental approach and transition period of a year to adapt to these changes would be welcomed by the NMC.

Likewise, there is a need to develop the evidence base of SPL and measure the impact and benefit on student learning and achievement of proficiencies. HEIs could collaborate and develop a standardised tool to evaluate the outcomes of SPL to provide a benchmark for all HEIs to use. It would also be useful for the NMC to monitor the impact of the new definition of SPL. This is particularly important given that HEIs have voiced concerns about having adequate facilities, resources and funding to do this. The leads for SPL in the NMC approved HEIs delivering RN6D should be utilised as an expert reference group to share their experiences and lessons learnt with other HEIs, NMC, CoDH and NHSE.

The findings from this report provide an important bedrock of evidence for future decisions such as regulatory and financial support for SPL in nursing education. Relevant stakeholders may take a range of positions on this subject but the evidence base this report provides will further inform the conversations ahead, better equipping decision-makers. Some next steps are suggested to ensure those important conversations now continue at pace.

Next steps

This research project has implications for a range of stakeholders including HEI senior leaders and academic staff, professional regulators, NHSE, service users and carers, nursing students and staff within practice provider organisations.

Evaluating factors such as infrastructure, resources, faculty expertise, and support systems is crucial. Recommending that organisations self-assess their capacity and readiness to SBE could be part of the approval process of a nursing programme. Clear terminology and guidance are essential for promoting consistency and understanding of simulation for skills learning and SPL.

Having clarity on funding models and continued availability of tariffs across all four nations is important to support the sustainability of simulation. Adequate financial resources enable institutions to invest in building additional lab space, simulation equipment, faculty education and training, and ongoing maintenance. However, the challenge lies in determining fair and equitable funding models that consider variations in institution size, location, and available resources. Policymakers should engage stakeholders from diverse educational settings to develop flexible funding models that support both large and small institutions, ensuring equal access to simulation resources. Policy should strike a balance between providing specific guidelines and allowing flexibility for innovation and adaptation in simulation methods.

Establishing standardised criteria for evaluating the effectiveness of SPL would be valuable to promote consistency and to allow for meaningful comparisons across different programmes. Policymakers should encourage the development of flexible evaluation frameworks that consider a range of outcome measures including student performance, clinical competency, patient outcomes, and learner satisfaction. Emphasising continuous quality improvement and sharing best practices can also enhance evaluation efforts.

Investing in staff development is critical for ensuring the effective integration of simulation into nurse education. Collaborative efforts between educational institutions, professional organisations, and regulatory bodies can promote the development of faculty development programmes, shared resources, mentorship opportunities, and communities of practice. Clinical staff in placements will need to interact with students who have experience of SPL and they may need to have a brief experience of SPL themselves to understand what students have learnt. It is important that all stakeholders work together to develop contemporary scenarios for use in SLP and for these to be

regularly reviewed. There could be a bank of scenarios developed and shared to be avoid to all HEIs rather than all HEIs creating these. Where and how this is achieved needs further exploration.

Reviewing the contribution SPL provides as an alternative to clinical placement hours will give clarity of its impact and effectiveness. Whilst up to 600 hours of SPL can be used for HEIs approved by the NMC, regulators will need to consider whether the intensive and repetitive nature of SPL remains equivalent to learning in a clinical placement where activities may be random and less focused on enabling proficient students. This is achieved through a variety of learning opportunities including observing and shadowing staff, reading trust policies and procedures, and patients case notes and reports. The development of knowledge is a core component of SPL and methods of achieving this need to have flexibility and need to be more greatly recognised.

Co-producing the design, development, and delivery of scenarios for SPL will require funding, time and resources. This will ensure activities are undertaken to a high standard and are as inclusive, collaborative, and supportive for all stakeholders as possible. Given the need for co-production, universities must consider who will benefit from what is being planned, assign clear responsibilities and roles for all involved, and establish learning outcomes to achieve pedagogical quality. This developed and sustained approach should be integrated into policy to improve student learning.

Future research

This research project has provided evidence of the benefits, challenges, and opportunities of SPL. Further research is required to expand upon the findings.

Many universities have developed creative and innovative approaches during the pandemic in the use of interactive, patient-focused online simulation which is complementary to face-to-face simulated learning scenarios. This needs to be more greatly valued, and further research to measure impact of this on learning is needed. Consideration by the NMC of the value of this method of learning within the new definition of SPL would be beneficial.

An examination of the experiences of universities which do not currently provide SPL would improve understanding of why some universities are choosing not to seek NMC approval for this mode of teaching and learning. Exploring the potential risks and barriers would provide a clearer understanding of what is required to provide effective SPL.

Researchers should look to recruit a university that has not previously provided SPL to assess the effectiveness of a simulation-based programme to prepare staff. The study could compare university staff knowledge at baseline, immediately post-training and seven days post-training.

Identifying how the use of technology in education can enhance practice learning and how this knowledge can benefit patients (through, for example, improved clinical effectiveness, patient safety, and patient experience) should be explored. This research would be of interest both nationally and internationally within health and social care service delivery. It would add to the knowledge base, both theoretically and practically, providing an evidenced based model of how educational resources targeted at students can be facilitated to benefit patients.

An exploration of the experiences and perceptions of clinical-based practice assessors/supervisors and chief nurses around SPL was not included in this study. This could address the question of how effective SPL is in enhancing nursing students' experiences in clinical placements and whether students are more able to achieve their proficiencies following SPL.

A collaboration with all universities currently approved by NMC to provide SPL to scope lessons learnt, solutions for challenges encountered and share good practice would be a beneficial exercise.

SBE and SPL infrastructure and equipment can be costly. Evaluations that yield information about the return on investment are scarce. Future research should investigate the efficiency of SPL approaches so that economic evaluations can be conducted concurrently alongside effectiveness studies.

Researchers could conduct a case study using a longitudinal design investigating whether SPL has a long-term impact on students and their achievement of the proficiencies. The contributions of SBL to student learning could be examined by using a before-and-after framework that spreads data collection over several measurements across time.

Understanding how student engagement, satisfaction and well-being are affected by SPL will help universities understand their benefits and disadvantages. Exploring the success of different modalities of simulation including patient focused interactive SPL would support this research. This research needs to include assessment of the impact of SPL at different stages during the pre-registration nursing course. Rigorous ways of testing and validating simulations are needed to establish whether the simulation captures the fundamental features of the task and environment and whether it elicits the expected behaviours.

Further research on SPL in nursing education, encompassing student engagement, satisfaction, well-being, and rigorous validation of different modalities, is the key to unlocking its full potential and benefits for all stakeholders.

Glossary

The language around simulated practice learning in healthcare education is evolving however for the purpose of this report, we will adopt the definitions below.

List of definitions and abbreviations

AEI	Approved Educational Institution – A higher education institution approved by the NMC to offer up to 600 hours of simulated practice learning.
ARU	Anglia Ruskin University.
ASPiH	Association for Simulated Practice in Healthcare.
Augmented reality (AR)	The combination of reality and overlay of digital information designed to enhance the learning process.
Avatar	A virtual object used to represent a physical object (for example, a human) in a virtual world.
CH	Child Health.
CoDH	Council of Deans of Health – A membership organisation representing the UK's university faculties engaged in education and/or research for nursing, midwifery and the allied health professions.
Computer-based or desktop simulation	The modelling of real-life processes with inputs and outputs exclusively confined to a computer, usually associated with a monitor and a keyboard or other simple assistive device.
FNFM	Future Nurse Future Midwife Strategic Advisory Board.
HEE	Health Education England (now incorporated into NHS England).
HEI	Higher Education Institution.
High-fidelity simulation	Simulation experiences that are extremely realistic and provide a high level of interactivity and realism for the learner.
Immersive simulation/room	A real-life situation/room that deeply involves the participants' senses, emotions, thinking, and behaviour; creating an immersive simulation depends on the alignment with learning objectives, the fidelity of the simulation (physical, conceptual, and emotional), and participant´s perception of realism.
In situ simulation	Simulation-based education that takes place in the clinical setting where participants usually work such as clinic-based or hospital-based.
INACSL	International Nursing Association for Clinical Simulation and Learning.
Innovation and Pedagogy Strategic Policy Group (SPG)	Council of Deans of Health-led group comprised of senior HEI representatives specialising in policy matters relating to innovation and pedagogy.
Low-fidelity simulation	Simulation experiences that may lack several components that make the scenario feel like the real world.
Mannequins	Mannequins can include a life-sized human-like simulator representing a patient for simulation, a full or partial body representation of a patient for practice or a full or partial body simulators that can have varying levels of physiologic function and fidelity.
Medium-fidelity simulation	Simulation experiences that are less realistic than high-fidelity simulation but have a higher level of realism compared to low-fidelity simulation.
MH	Mental Health.
NHSE	NHS England.
NMC	The Nursing and Midwifery Council, the independent regulator for nurses, midwives and nursing associates.
OSCE	Objective Structure Clinical Examination.
Placement tariff	A payment from NHSE (previously HEE) to placement providers to reimburse them for the training they provide students and to ensure the

	placements are high quality. NMC approved education institutions (AEIs) for SPL hours can also receive a placement tariff payment.
PS	Practice Supervisor.
Regulation Strategic Policy Group (SPG)	Council of Deans of Health-led group comprised of senior HEI representatives specialising in policy matters relating to regulation.
RN6D	The NMC's Emergency Standard for Nursing Education introduced during the Covid-19 pandemic which allowed for up to 600 hours of clinical placement to be replaced by simulated practice learning (SPL).
SBE	Simulation-Based Education.
SimMan	An adult-sized manikin (such as SimMan3G and Apollo) used to create high-fidelity simulation.
Simulation fidelity	The level of realism portrayed in a simulation experience and the similarity of the experience to the simulated situation or clinical situation.
SBE	Simulation-Based Education. Synonym of simulation learning, simulation-based learning experience.
SPL	Simulated Practice Learning. Simulated practice learning is a SBE provision that must meet the NMC (2023) Standards for Pre-registration Nursing Programmes and the NMC (2018) Standards for Student Supervision and Assessment for it to be validated to substitute for up to 600 hours of the 2300 hours of traditional clinical placement.

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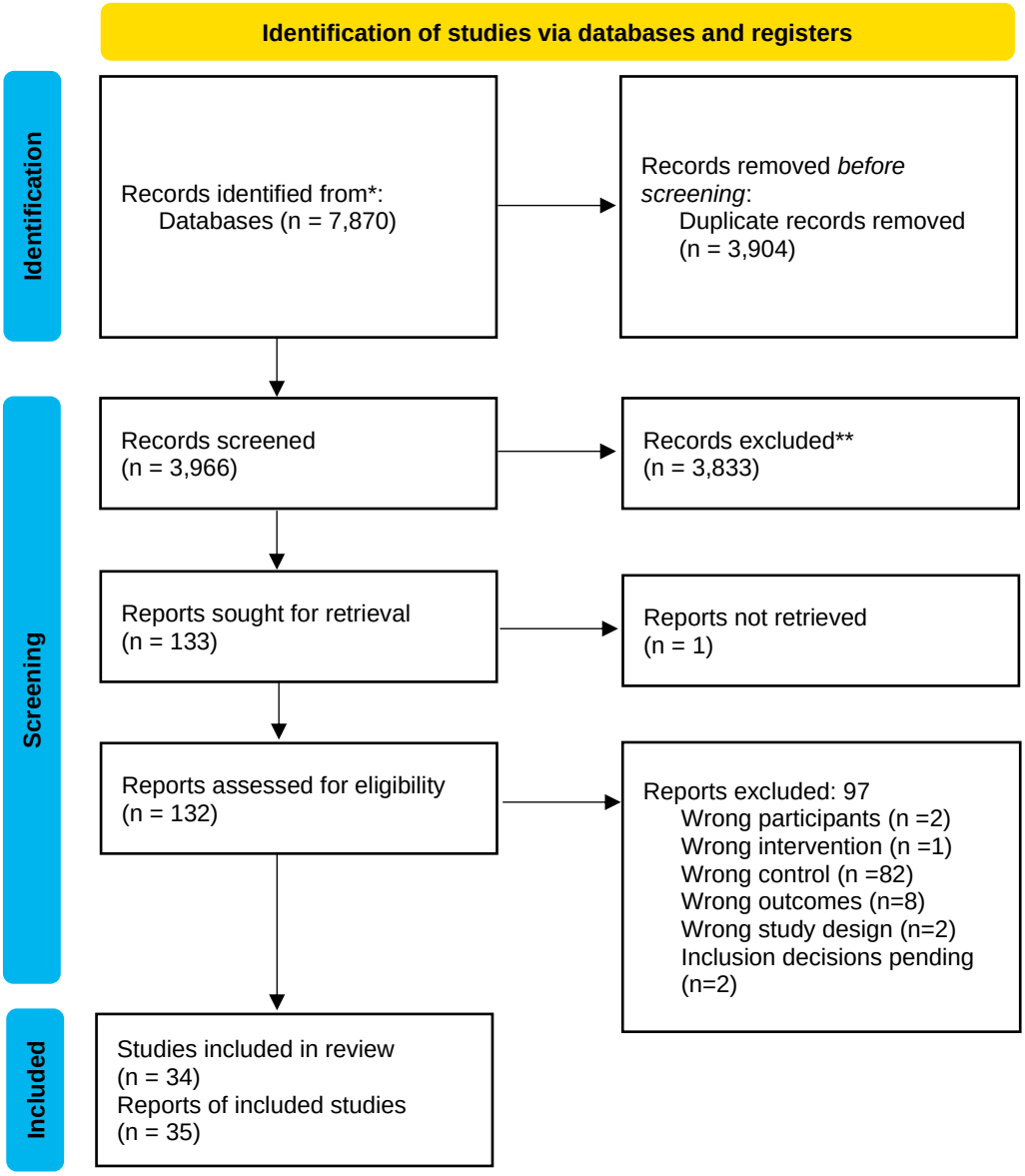
Appendices

Appendix 1. Systematic Review PRISMA Flow Diagram



Appendix 2. Table of excluded studies from systematic review and exclusion reasons

No.	Reference	Reason
1	Aebersold M, Voepel-Lewis T, Cherara L, Weber M, Khouri C, Levine R, Tait AR. Interactive anatomy-augmented virtual simulation training. Clinical Simulation in Nursing 2018;15:34-41	No patient-based education control group
2	Aggar C, Bloomfield JG, Frotiold A, Thomas TH, Koo F. A time management intervention using simulation to improve nursing students' preparedness for medication administration in the clinical setting: A quasi-experimental study. Collegian 2018;25:105–111	No patient-based education control group
3	Ahn MK, Lee CM. Development and Effects of Head-Mounted Display-Based Home-Visits Virtual Reality Simulation Program for Nursing Students. Journal of the Korean Academy of Nursing 2021;51(4):465	No patient-based education control group
4	Alinier G, Hunt WB, Gordon R. Determining the value of simulation in nurse education: study design and initial results. Nurse Education in Practice 2004;4:200–207	Can't tell what education the control group received
5	Alkalaf AA, Wazqar DY. The effect of high-fidelity simulation technology on the competency of nursing students in managing chemotherapy extravasation in patients with cancer. Journal of Professional Nursing 2022;42:1–7	No patient-based education control group
6	Anon. The use of immersive and virtual reality technologies to enable nursing students to experience scenario-based, basic life support training—exploring the impact on confidence and skills. CIN: Computers, Informatics, Nursing. 2020;38(6):320-1	Test of understanding about simulation teaching and learning
7	Aqel AA, Ahmad MM. High-fidelity simulation effects on CPR knowledge, skills, acquisition, and retention in nursing students. Worldviews on Evidence-Based Nursing, 2014;11:6:394–400.	Both groups received simulation training
8	Arabpur A, Farsi Z, Butler S, Habibi H. Comparative effectiveness of demonstration using hybrid simulation versus task-trainer for training nursing students in using pulse-oximeter and suction: A randomized control trial. Nurse Education Today 2022;110:105204	Control group received no training (simulation group had extra training)
9	Aronson B, Glynn B, Squires T. Competency assessment in simulated response to rescue events. Clinical Simulation in Nursing 2012;8:e289-e295	No patient-based education control group
10	Arslan FT, Turkmen AS, Celen R, Ozkan S, Altiparmak D, Sahin A. Comparing traditional and simulation-based experiences in pediatrics with undergraduate nursing students in Turkey Clinical Simulation in Nursing 2018;16:62-69	No competency measures
11	Azizi M, Ramezani G, Karimi E, Hayat AA, Faghihi SA, Keshavarzi MH. A comparison of the effects of teaching through simulation and the traditional method on nursing students' self-efficacy skills and clinical performance: a quasi-experimental study. BMC Nursing (2022) 21:283 https://doi.org/10.1186/s12912-022-01065-z	No patient-based education control group
12	Baginski MN. Use of low-fidelity simulation within a medication calculation nursing course to enhance students' understanding of accuracy. Nurse Educator 2017;42(3):110-111	No patient-based education control group
13	Baillie L, Curzio J. Students' and facilitators' perceptions of simulation in practice learning. Nurse Education in Practice 2009;9:297–306	Subjective outcomes only, no objective outcome measures
14	Ballard G, Piper S, Stokes P. Effect of simulated learning on blood pressure measurement skills. Nursing Standard. 2012;27(8):43-47.	Control group received no training (simulation group had extra training)
15	Bearnson CS, Wiker KM. Human patient simulators: a new face in baccalaureate nursing education at Brigham Young University. Journal of Nursing Education 2005;44(9):421-5	No patient-based education control group

16	Beddingfield S, Davis BW, Gilmore M, Jenkins L. The effect of high fidelity simulation on examination performance. Teaching and Learning in Nursing 2011;6:46-9	No numerical results per group given
17	Blum CA, Borglund S, Parcells D. High-fidelity nursing simulation: impact on student self-confidence and clinical competence. International Journal of Nursing Education Scholarship 2010 DOI: 10.2202/1548-923X.2035	No patient-based education control group
18	Bornais JA, Raiger JE, Krahn RE, El-Masri MM. Evaluating undergraduate nursing students' learning using standardized patients. Journal of Professional Nursing 2012;28:291–296	No patient-based education control group
19	Bryant R, Miller CL, Henderson D. Virtual clinical simulations in an online advanced health appraisal course. Clinical Simulation in Nursing 2015;11:437-444	No patient-based education control group
20	Chang Y-L, Hsieh M-J, Feng T-H, Shang S-T, Tsai Y-F. Effectiveness of multiple scenario simulations of acute and critical care for undergraduate nursing students: A quasi-experimental design. Nurse Education Today 2022;118:105526	No patient-based education control group
21	Chen J, Yang J, Hu F, Yu S-H, Yang B-X, Liu Q et al. Standardised simulation-based emergency and intensive care nursing curriculum to improve nursing students' performance during simulated resuscitation: A quasi-experimental study. Intensive & Critical Care Nursing 2018;46:51–56	No patient-based education control group
22	Chen H-M, Liu H-S, Chao S-Y. The effects of web-based situational learning on nursing students' transfer of learning in clinical practice. Nurse Education Today 2021;105:105052	No patient-based education control group
23	Chircop A, Cobbett S. Gett'n on the bus: evaluation of Sentinel City®3.0 virtual simulation in community/ population health clinical placement. International Journal of Nursing Education and Scholarship 2020;20190109 doi.org/10.1515/ijnes-2019-0109	Subjective outcomes only, no objective outcome measures
24	Choi H, Lee U, Jeon YS, Kim C. Efficacy of the computer simulation-based, interactive communication education program for nursing students. Nurse Education Today 2020;91:104467	No patient-based education control group
25	Coggins AR, Nottingham C, Byth K, Ho KR, Aulia FA, Murphy M et al. Randomised controlled trial of simulation-based education for mechanical cardiopulmonary resuscitation training. Emergency Medicine Journal 2019;36:266–272	No patient-based education control group
26	Cook NF, McAloon TM, O'Neill P, Beggs R. Impact of a web based interactive simulation game (PULSE) on nursing students'experience and performance in life support training — A pilot study. Nurse Education Today 2012;32:714–720	No patient-based education control group
27	Cooper EE, Prion SK, Pauly-O'Neill SJ. Comparison of student experience with critical events during simulation and acute care hospital rotations. Nurse Educator 2015 40(1):31-35	No patient-based education control group
28	Diaz DA, Eckhoff DO, Nunes M, Anderson M, Keiffer M, Salazar I et al. Discovery of methods to enhance the care of the LGBTQ+ community. The Journal for Nurse Practitioners 2021;17:1085e1090	No comparative results of simulation vs patient-based training
29	Edeer AD, Vural F, Damar HT, Yasak K, Damar M. The effect of web-based preoperative and postoperative patient care education on nursing students. A randomized controlled study. CIN: Computers, Informatics, Nursing 2019;37(10):541-7 DOI: 10.1097/CIN.0000000000000552	No patient-based education control group
30	Eghbalibabadi M, Ashouri E. Comparison of the effects of two teaching methods on the nursing students' performance in measurement of blood pressure. Iranian Journal of Nursing and Midwifery Research 2014;19(4):381-4	No patient-based education control group

31	Eom M-R, Kim H-S, Kim E-K, Seong K. Effects of teaching method using standardized patients on nursing competence in subcutaneous injection, self-directed learning readiness and problem-solving ability. Journal of the Korean Academy of Nursing 2010;40(2):151-160	No patient-based education control group
32	Erenel AS, Sozbir SY, Aksoy MU, GÜRCÜOĞLU AE, Aksu SP, Toprak FU et al. Effect of scenario-based simulation training on the obstetrics and gynecology nursing clinical practicum. The Journal of Nursing Research 2021;29(2):1-9	Subjective outcomes only, no objective outcome measures. No measures of clinical ability
33	Fawaz MA, Hamdan-Mansour AM. Impact of high-fidelity simulation on the development of clinical judgment and motivation among Lebanese nursing students. Nurse Education Today 2016;46:36–42	No patient-based education control group
34	Fugslang S, Bloch CW, Selberg H. Simulation training and professional self-confidence: A large-scale study of third year nursing students. Nurse Education Today 2022;108:105175	Both groups received simulation training
35	Gates MG, Parr MB, Hughen JE. Enhancing nursing knowledge using high-fidelity simulation. Journal of Nursing Education 2012;51(1):9-15	Both groups received simulation training
36	Goldsworthy S, Patterson JD, Dobbs M, Afzal A, Seboer S. How does simulation impact building competency and confidence in recognition and response to the adult and paediatric deteriorating patient among undergraduate nursing students? Clinical Simulation in Nursing 2019;28:25-32	Training control group received unclear
37	Goldsworthy S, Muir N, Baron S, Button D, Goodhand K, Hunter S et al. The impact of virtual simulation on the recognition and response to the rapidly deteriorating patient among undergraduate nursing students. Nurse Education Today 2022;110:105264	Training control group received unclear
38	Habibli T, Ghezeljeh TN, Haghani S. The effect of simulation-based education on nursing students' knowledge and performance of adult basic cardiopulmonary resuscitation: A randomized clinical trial. Nursing Practice Today 2020;7(2):87-96	No patient-based education control group
39	Haddeland K, Slettebo A, Svensson E, Tosterud RB, Wangensteen S, Fossum M. The effects of using high-fidelity simulation in undergraduate nursing education: A multicentre randomized controlled trial with a process evaluation. International Journal of Educational Research 2021;109:101813	No patient-based education control group
40	Hester L, Reed B, Bohannan W, Box M, Wells M, O'Neal B. Using an educational mobile application to teach students to take vital signs. Nurse Education Today 2021;107:105154	No patient-based education control group
41	Howard VM, Ross C, Mitchell AM, Nelson GM. Human Patient Simulators and Interactive Case Studies: A Comparative Analysis of Learning Outcomes and Student Perceptions. CIN: Computers, Informatics, Nursing 2010;28(1)42–48	No patient-based education control group
42	Hsu L-L, Chang W-H, Hsieh S-I. The effects of scenario-based simulation course training on nurses' communication competence and self-efficacy: A randomized controlled trial. Journal of Professional Nursing 2015;31:37–49	No patient-based education control group
43	Hur HK, Roh YS. Effects of a Simulation based Clinical Reasoning Practice Program on Clinical Competence in Nursing Students. Korean Journal of Adult Nursing 2013;25(5):574-584	No patient-based education control group
44	Ignacio J, Dolmans D, Scherpbier A, Rethans J-J, Chan S, Liaw SY. Comparison of standardized patients with high-fidelity simulators for managing stress and improving performance in clinical deterioration: A mixed methods study. Nurse Education Today 2015;35:1161–1168	Standard patient vs simulation
45	Ironside PM, Jeffries PR. Using multiple-patient simulation experiences to foster clinical judgment. Journal of Nursing Regulation 2010;1(2):38-41	No patient-based education control group

46	Jansson MM, Ala-Kokko TI, Ohtonen PP, Merilainen MH, Syrjala HP, Kyngas HA. Human patient simulation education in the nursing management of patients requiring mechanical ventilation: A randomized, controlled trial. American Journal of Infection Control 2014;42:271-6	Training control group received unclear
47	Jarvill M, Jenkins S, Akman O, Astroth KS, Pohl C, Jacobs PJ. Effect of simulation on nursing students' medication administration competence. Clinical Simulation in Nursing 2018;14:3-7	No patient-based education control group
48	Joo, GE, Sohng K-Y, Kim H-J. Effects of a Standardized patient simulation program for nursing students on nursing competence, communication skill, self-efficacy and critical thinking ability for blood transfusion. Journal of the Korean Academy of Fundamentals in Nursing 2015;22(1):49-58	No patient-based education control group
49	Kang K-A, Kim S, Kim S-J, Oh J, Lee M. Comparison of knowledge, confidence in skill performance (CSP) and satisfaction in problem-based learning (PBL) and simulation with PBL educational modalities in caring for children with bronchiolitis. Nurse Education Today 2015;35:315–321	No patient-based education control group
50	Karkada S, Radhakrishnan J, Natarajan J, Matua GA, Kaddoura M, Knowledge and competency of novice nursing students in nasogastric tube feeding: Is simulation better than case scenario? Oman Medical Journal 2019;34(6):528-533	No patient-based education control group
51	Khraisat AM, Hapadin H, Ahmad NS, Yusoff MD, Nurumal MS, Pardi W. How to teach intramuscular injection through virtual learning environment in Covid-19 pandemic time for nursing students. Indian Journal of Forensic Medicine & Toxicology 2020;14(4):697-704	No patient-based education control group
52	Kim S, Shin G. Effects of nursing process-based simulation for maternal child emergency nursing care on knowledge, attitude, and skills in clinical nurses. Nurse Education Today 2016;37:59–65	Participants are qualified nurses
53	Kim J, Heo N. Effect of a Simulated Education-based Hypoglycemia Scenario Using a High-fidelity Simulator on Acquisition and Retention of Diabetes Knowledge and Academic Self-efficacy in Nursing Students. Journal of the Korean Academy of Social Nurse Education 2017;23(3):319-329	No patient-based education control group
54	Kim M-G, Kim H-W. The effects of classes using virtual reality simulations of the hospital environment on knowledge of the hospital environment, academic self-efficacy, learning flow, educational satisfaction and academic achievement in nursing students. Journal of the Korean Academy of Fundamental Nursing 2021;28(4):520-529	No patient-based education control group
55	Ko S, Choi E-H. Effect of team debriefing in simulation-based cardiac arrest emergency nursing education. Korean Journal of Adult Nursing 2017;29(6):667-676	No patient-based education control group
56	Koo HY, Lee BR. Development and evaluation of a paediatric nursing competency-building program for nursing students in South Korea: a quasi-experimental study. Child Health Nursing Research, 2022;28(3):167-175	Training control group received unclear
57	Lee M-N, Kang K-A, Park S-J, Kim S-J. Effects of pre-education combined with a simulation for caring for children with croup on senior nursing students. Nursing and Health Sciences 2017;19:264–272	No patient-based education control group
58	Lee B-O, Liang H-F, Chu T-P, Hung C-C. Effects of simulation-based learning on nursing student competences and clinical performance. Nurse Education in Practice 2019;41:102646	Cannot tell whether the control group received patient-based teaching
59	Lee H, Han J-W. Development and evaluation of a virtual reality mechanical ventilation education program for nursing students. BMC	No patient-based education control group

	Medical Education 2022;22:775 https://doi.org/10.1186/s12909-022-03834-5	
60	Lee JS. Implementation and evaluation of a virtual reality simulation: Intravenous injection training system. International Journal of Environmental Research and Public Health 2022;19:5439. https://doi.org/10.3390/ijerph19095439	No patient-based education control group
61	Liaw SY, Scherpbier A, Rethans J_J, Klainin-Yobas P. Assessment for simulation learning outcomes: A comparison of knowledge and self-reported confidence with observed clinical performance. Nurse Education Today 2012;32:e35–e39	Control group received no training (simulation group had extra training)
62	Mather C, McCarthy R. Exploring the effects of a high-fidelity environment on nursing students' confidence and performance of CPR. Nursing Standard. 2021 doi: 10.7748/ns.2021.e11564	Both groups received simulation training
63	McIntosh KS, Gregor JC, Khanna NV. Computer-based virtual reality colonoscopy simulation improves patient-based colonoscopy performance. Canadian Journal of Gastroenterology and Hepatology 2014;28(4):203-206.	Participants were not nurses
64	Miranda RP, Chaves ED, Lima RS, Braga CG, Simoes IA, Fava SM et al. The effectiveness of a simulated scenario to teach nursing students how to perform a bed bath: A randomized clinical trial. Nurse Education Today 2017;57:17–23	Standard patient vs simulation
65	Onarici M, Karadag M. The effect of simulation method on nursing students' burn patient care planning: A randomized controlled trial. Journal of Burn Care & Research 2021;42(5):1011-6 doi:10.1093/jbcr/irab018	Control group received no training (simulation group had extra training)
66	Otero-Agra M, Hermo-Gonzalo MT, Santos-Folgar M, Fernandez-Mendez F, Barcala-Furelos R. Assessing ventilation skills by nursing students in paediatric and adult basic life support: A crossover randomized simulation study using bag-valve-mask (BMV) vs mouth-to-mouth ventilation (MMV). Signa Vitae 2020;16(2):44-51	Both groups received simulation training
67	Park J, Kim K-J. Effects of patient deterioration simulation using inattentional blindness for final year nursing students: A randomized controlled trial. Nurse Education Today 2021;106:105080	Both groups received simulation training
68	Park S-A, Kim HY. Development and effects of a labor nursing education program using a high-fidelity simulator for nursing students. Korean Journal of Women Health Nursing 2020;26(3):240-249	No patient-based education control group
69	Paul C, Bhokare N, Pathak S. Investigate the effect of role play on the skill among 2nd basic B.Sc. students if SRMMCON regarding selected community procedure. Indian Journal of Forensic Medicine & Toxicology, October-December 2020, Vol. 14, No. 4. 6457-60	No simulation used
70	Ross JG. The Effect of Simulation Training on Baccalaureate Nursing Students' Competency in Performing Intramuscular Injection. Nursing Education Perspectives 2015;36(1):48-9 doi: 10.5480/13-1075.1	No patient-based education control group
71	Rutty J, Biggs M, Dowsett D, Kitchener A, Coltman N, Rutty G. Post mortem computed tomography: An innovative tool for teaching anatomy within pre-registration nursing curricula. Nurse Education Today 2019;76:154–164	No patient-based education control group
72	Salameh B, Ayed A, Kassabry M, Lasater K. Effects of a complex case study and high-fidelity simulation on mechanical ventilation on knowledge and clinical judgment of undergraduate nursing students. Nurse Educator 2021;46(4):E64-E69. doi: 10.1097/NNE.0000000000000938	No patient-based education control group
73	Sarmasoglu S, Dinc L, Elcin M. Using Standardized Patients in Nursing Education Effects on Students' Psychomotor Skill Development. Nurse Educator 2016;41(2):E1-E5	Standard patient vs simulation

74	Sarvan S, Efe E. The effect of neonatal resuscitation training based on a serious game simulation method on nursing students' knowledge, skills, satisfaction and self-confidence levels: A randomized controlled trial. Nurse Education Today 2022;111:105298	No patient-based education control group
75	Secomb J, McKenna L, Smith C. The effectiveness of simulation activities on the cognitive abilities of undergraduate third-year nursing students: a randomised control trial. Journal of Clinical Nursing 2012;21:3475–3484, doi: 10.1111/j.1365-2702.2012.04257.x	Both groups received simulation training
76	Sezgunsay E, Basak T. Is moulage effective in improving clinical skills of nursing students for the assessment of pressure injury? Nurse Education Today 2020;94:104572	Both groups received simulation training
77	Son HK, Kim DH. Effect of SEGUE-based communication education on nursing simulation practice: a quasi-experimental design. Contemporary Nurse, 2019;55(4–5:330–340, doi.org/10.1080/10376178.2019.1641421	Both groups received simulation training
78	Sparacino, L. Della Vecchia, E. Using high- fidelity simulation to close the teaching and learning gap. Online Journal of Nursing Informatics (OJNI), 2013;17(1):2392	No patient-based education control group
79	Speeney N, Kameg KM, Cline T, Szpak JL, Bagwell B. Impact of a standardized patient simulation on undergraduate nursing student knowledge and perceived competency of the care of a patient diagnosed with schizophrenia. Archives of Psychiatric Nursing 2018;32:845–849	No patient-based education control group
80	Svellingen AH, Forstronen A, Assmus J, Roykenes K, Brattebo G. Simulation-based education and the effect of multiple simulation sessions - A randomised controlled study. Nurse Education Today 2021;106:105059	Both groups received simulation training
81	Svellingen AH, Forstronen A, Assmus J, Roykenes K, Brattebo G. Examining predictive factors of nursing students' self-confidence in multiple simulation sessions: A randomized controlled study. Nurse Education in Practice 2021;57:103231	Both groups received simulation training
82	Takhdat K, Eddabbah M, Hamzaoui H, Lamtali S, Adib AR. High-fidelity simulation effects on cardiopulmonary resuscitation self-efficacy and knowledge retention in undergraduate nursing students: A Two-Group, Experimental, Longitudinal Pilot Study. Nursing Education Perspectives 2022;43(6):E118-20	No patient-based education control group
83	Tamaki T, Inumaru A, Yokoi Y, Fuji M, Tomita M, Inoue Y et al. The effectiveness of end-of-life care simulation in undergraduate nursing education: A randomized controlled trial. Nurse Education Today 2019;76:1–7	No patient-based education control group
84	Tan AJ, Lee CC, Lin PY, Cooper S, Lau LS, Chua WL et al. Designing and evaluating the effectiveness of a serious game for safe administration of blood transfusion: A randomized controlled trial. Nurse Education Today 2017;55:38–44	Control group received no training (simulation group had extra training)
85	Thomas C, Mackey E. Influence of a clinical simulation elective on baccalaureate nursing student clinical confidence. Journal of Nursing Education 2012;51(4):236-9	Subjective outcomes only, no objective outcome measures. No measures of clinical ability
86	Tuzer H, Dinc L, Elcin M. The effects of using high-fidelity simulators and standardized patients on the thorax, lung, and cardiac examination skills of undergraduate nursing students. Nurse Education Today 2016;45:120–125	Standard patient vs simulation
87	Tuzer H, Yilmazer T. Standardized patient education in nursing students' effect of postoperative care management. Turkiye Klinikleri Journal of Nursing Science. 2020;12(3):366-70	Control group received no training (simulation group had extra training)

88	Uzen Cura S, Kocatepe V, Yildirum D, Küçükakgün H, Atay S, Unver V. Examining knowledge, skill, stress, satisfaction, and self-confidence levels of nursing students in 3 different simulation modalities. Asian Nursing Research 2020;14:158e164	No patient-based education control group
89	Veltri LM, Rowe JM, Bell KJ, Arwood EL, Kindler LL. The maternal-newborn assessment study: can simulation replicate the clinical learning experience in undergraduate nursing education? JOGNN, 43, S81-S85; 2014. DOI: 10.1111/1552-6909.12438	Conference presentation
90	Vural Dogru B, Aydin LZ. The effects of training with simulation on knowledge, skill and anxiety levels of the nursing students in terms of cardiac auscultation: A randomized controlled study. Nurse Education Today 2020;84:104216	Both groups received simulation training
91	Woda A, Hansen J, Paquette M, Topp R. The impact of simulation sequencing on perceived clinical decision making. Nurse Education in Practice 2017;26:33e38	Randomised crossover trial of simulation vs hospital training but no midpoint assessment
92	Xi S, Li L, Wei H, Gu Y. Application of evidence-based scene simulation combined with problem-based learning in clinical teaching of critical care for nursing students. Chinese Journal of Integrative Nursing 2022;8(3):19-22	No patient-based education control group
93	Yang F, Wang Y, Yang C, Zhou MH, Shu J, Hu H. Improving clinical judgment by simulation: A randomized trial and validation of the Lasater clinical judgment rubric in Chinese. BMC Medical Education 2019;19:20 https://doi.org/10.1186/s12909-019-1454-9	No patient-based education control group
94	Yilmaz DU, Sari D. Examining the effect of simulation-based learning on intravenous therapy administration' knowledge, performance, and clinical assessment skills of first-year nursing students. Nurse Education Today 2021;102:104924	Both groups received simulation training
95	Yong Y, Ying Z. Application of emergency care simulator in the teaching of clinical skills for nursing undergraduate students. Nursing of Integrated Traditional Chinese and Western Medicine 2020;6(5):193-5	No patient-based education control group
Potentially includable		
1	Cao L, Cao X. Application of staged simulated examination and mini-CEX in nursing practice teaching of obstetrics and gynaecology. Chines Nursing Research 2015;29(8):2964-7	N/A
2	Lee M, Ahn Y, Cho I, Sohn M. Effectiveness of simulation integrated with problem-based learning on clinical competency and self-efficacy in nursing students. Child Health Nursing Research 2014;20(2):123-131	N/A

Appendix 3. Systematic review characteristics of included studies

Study name, year (country)	Participants (number)	Study design	Type of course	Specific teaching	Simulation	Debriefing	Control condition	Evaluation	Comment
Alinier 2006 (UK)	Diploma of Higher Education in Nursing (n=99)	RCT	2nd year of course	Clinical scenarios (not described) plus clinical course	Sim man – not described how used	Given	Clinical course as usual	OSCEs	
Ataee 2019 (Iran)	Bachelor of nursing students (n=37)	RCT	7th semester of course	Coronary care - CPR, working with electroshock device, heart rhythm monitoring, operating ECG	Mannequins	Not mentioned	Internship programme of the CCU	OSCEs	
Banjo-Ogunnowo 2022 (USA)	Licenced vocational nurses training to be associate degree nurses (N=33)	Case control,	Maternal-paediatric course	Didactic component 4 week credit (64 contact hours) clinical component 3 credit (96 contact hours). Topics not given	i-Human virtual patient computer program (4-hour virtual lectures, two 2-hour virtual lab sessions, and 12 hours of virtual simulation each week for 8 weeks)	Not mentioned	4-hour classroom lectures, two 2-hour labs, and one 12-hour clinical experience per week for 8 weeks	HESI Maternal-paediatric Specialty exam and conversion scores, and HESI end of program (Exit) exam	Before and during Covid-19 comparison
Centrella-Nigro 2016 (USA)	Prelicensure students in a two-year nursing program (N=43)	Case control	Whole course	Nursing skills, inter-professional working	Medium-fidelity simulators of adult, child, infant, and birthing mother	Not mentioned	Attended course in the previous year	Basic Knowledge Assessment Tool	
Craig 2021 (USA)	3rd Year BSN students (N=80)	RCT	medical-surgical nursing course	Medication administration	Three scenarios over weeks. Week 1: low-fidelity simulation Week 2: high-fidelity simulation	Week 1. enhanced medication administration debrief session Week 4 debrief for all	Week 1: standard training during a skills lab Week 2: standard training on clinical unit medication administration simulation	Medication Safety Knowledge Assessment, Medication Safety Critical Element Checklist	Weeks 3 and 4 same for both groups: clinical rotation then high-fidelity simulation
Curl 2016 (USA)	Associate degree nursing students (n=124)	Case control, volunteer s for	Obstetrics, paediatrics, mental health and critical care	Throughout course (50% course simulation)	Simulation plus clinical teaching (1 hr simulation = 2 hrs clinical teaching)	Debriefing (lasting as long or up to twice as long as the HFS), focused	Clinical teaching alone	Medical-surgical post-test and overall exit exam, Health	No significant differences between groups' mean standard

Study name, year (country)	Participants (number)	Study design	Type of course	Specific teaching	Simulation	Debriefing	Control condition	Evaluation	Comment
		simulation group			Using HFS in skills lab	on clinical reasoning with reflection on decision-making		Education Systems Inc. (HESI) exams (higher score better)	scores on medical-surgical pre-test,
Dery 2019 (Ghana)	Community health nursing students (N=50)	RCT	Family planning	Training to insert contraceptive implants	Low-tech PVC pipe, latex foam, cotton, and leather simulator with a semi-hollow, cylindrical, PVC base to mimic bone and a piece of cloth for firmly securing it to the arm of the patient	Not reported	Classroom training then watching midwives insert contraceptive implants on the wards	Performance assessment score by clinical expert observer	Very specific training
Guerrero 2021 (Saudi Arabia)	Nursing interns with GPA 3.5 and above (n=30)	RCT	Women's health, children's health, medical-surgical, critical care	Throughout course	HFS 1 day per week plus 4 days hands on clinical education using HFS	Group debriefing after each session	5 days hands on clinical education	Clinical placement grades, direct observation of procedural skills, clinical evaluations, case study presentations	
Guerrero 2022 (Saudi Arabia)	Bachelor of Science in Nursing students (n=192)	RCT	Adult health nursing, critical care nursing courses	Throughout course	HFS along with traditional laboratory teaching and clinical education.	GAS debriefing model (described in text)	Attending maternal-health nursing and child health nursing courses	midterm and final OSCE results	
Hall 2015 (USA)	Senior nursing baccalaureate students (n=279)	Retrospective cohort	Nursing course	Maternal-newborn module	Three critical care scenarios	Debriefing given but not described	Traditional clinical experience	NCLEX proficiency level categories (higher = better)	

Study name, year (country)	Participants (number)	Study design	Type of course	Specific teaching	Simulation	Debriefing	Control condition	Evaluation	Comment
Hansen 2017 (USA)	Nursing students (n=71 enrolled, n=48 finished full trial)	Randomised crossover trial	Nursing course	first medical-surgical practicum course	3 HFS days and 1 medium-fidelity virtual simulation on pain management, heart failure, COPD/ pneumonia and diabetes mellitus.	Sim TRACT model debriefing	Traditional clinical experiences on wards	Creighton Competency Evaluation Instrument (CCEI) Scores	Mid-trial results used
Harris 2011 (USA)	Junior level baccalaureate nursing students (n=71)	RCT	Paediatric nursing	Paediatric and neonatal nursing care	Human patient simulator - basic care of infants, medication administration, infant HPS, and child HPS	Individual and full group discussion after each simulation	Hospital session – orientation and introduction to the wards and facilities	Comprehensive paediatric examination, clinical grades	Control and intervention groups had different sessions
Hayden 2014 (USA) (plus Ingwerson 2015)	Prelicensure nursing students (n=847 enrolled, n=666 completed))	Cohort (volunteers to take part in study)	Entire 2-year course	Throughout course	Simulation for 50% of course or for 25% of course Using mannequins in simulation labs	Not reported	Simulation for 10% or less of course	Knowledge, Clinical competency New Graduate Nurse Performance survey, National Council Licensure Examination (NCLEX)	
Hwang 2020 (S Korea)	Third-year nursing students (n=66)	Case control	Women's nursing	Preoperative nursing for high-risk pregnant women who were scheduled for a caesarean section	Standardised patient scenarios	Reported but not described	Case study then clinical practice for the week	Clinical judgement, nursing performance, communication skill, problem-solving ability	
Luctkar-Flude 2012 (Canada)	Second-year undergraduate nursing (n=44)	RCT	Health assessment course	Respiratory assessment	High-fidelity simulation or standard patient	Not mentioned	Untrained community volunteers	Respiratory assessment performance scores	

Study name, year (country)	Participants (number)	Study design	Type of course	Specific teaching	Simulation	Debriefing	Control condition	Evaluation	Comment
Mancini 2019 (USA)	Associate Degree in Nursing and Bachelor of Science in Nursing students (n=586)	Case control	Four semesters of course	Medical, surgical, paediatric, maternal, critical care, final project simulations	Skills laboratories and simulation laboratories	Not mentioned	Clinical hours on same course	NCLEX scores	
Meyer 2011 (USA)	Junior paediatric nursing students (n=120 started, n=116 finished)	Cohort (all cohort volunteered to take part in study)	Clinical placement (8 weeks)	Emergency clinical skills, acute care, post-op care, skills.	Simulation for 25% of course (varied order) using mannequin and mini-skills lab.	Unclear	Before students had the simulation component	Clinical performance scores	
Olaussen 2022 (Norway)	Batchelor of Nursing (n=116 started, n=88 finished)	RCT	Clinical practice of 224 hrs plus simulation	Chronic respiratory disease, dementia, heart failure	Simulation scenarios for 10.7% of the course	facilitated debriefing that lasted at least 90 min.	7-week practice period of 224 hrs in nursing homes	Knowledge test	
Raman 2019 (Oman)	Level 4 undergraduate nursing students (n=80 started, n=74 finished)	Case control	maternity course	Simulation (SP) plus clinical vs clinical	Simulation for 25% of course - normal and high-risk obstetrics, foetal distress, and cardiotocography	Debriefing for 30 to 45 mins	135 hours clinical education	Knowledge questionnaire, Creighton Competency Evaluation Instrument	
Reid 2020 (USA)	Baccalaureate and associate degree nursing students (n=62)	Case control	Maternal newborn clinical course	Postpartum haemorrhage	High-fidelity mannequins	For both groups at end of day	Clinical experience of same topic	Lasater Clinical Judgment Rubric	
Roberts 2022 (USA)	Prelicensure baccalaureate of nursing students (n=224)	Cohort	Whole course	Simulated clinical teaching	Avatars to simulate patients	synchronous online debriefings	Standard course before Covid-19 pandemic, including low- to high-fidelity mannequins, standardized participants, and commercial virtual simulations	National Council Licensure Examination (NCLEX)	Pre vs during Covid-19

Study name, year (country)	Participants (number)	Study design	Type of course	Specific teaching	Simulation	Debriefing	Control condition	Evaluation	Comment
Schlairet 2010 (USA)	Undergraduate nursing students (n=74 started, n=71 finished)	Randomised crossover trial	Fundamentals of nursing	Clinical scenarios	Simulation for 2 weeks, using mannequin and mini-skills lab.	Faculty guided debrief	Before students had the simulation component	Knowledge test	
Sears 2010 (Canada)	Second-year Bachelor of Science in Nursing students (n=54)	RCT	Medical surgical or maternal child nursing	Medication administration	Simulated scenarios regarding medicine administration	Bedside debrief then follow up whilst students filled their knowledge gaps	Medication administration on clinical wards	Medication errors	
Seo 2021 (S. Korea)	Senior-year nursing students (n=45)	Case control	Not described	GI tract bleeding, acute MI	Simulation for 2 weeks, using videos (otherwise not described)	Mentioned but not described	Intensive care unit clinical practice	Clinical reasoning, problem solving, self-efficacy, clinical competency	
Soccio 2017 (USA)	Baccalaureate nursing students (n=48)	RCT	Mental health	PTSD, bipolar disorder, mania hearing voices, psychosis, depression and wrist cutting psychiatric emergency scenarios	Simulation for 25% of clinical hours using trained drama students	Theory-based debriefing method	Clinical hours only	Knowledge (ATI RN Mental Health Mastery Examination)	
Son 2020 (S Korea)	Third-year nursing students (n=98 started, n=78 finished)	RCT	Maternity nursing	Height of fundus measurement, abdominal circumference measurement, Leopold's manoeuvres, foetal monitoring, foetal heart sound auscultation via fetoscope and	Simulation for 1 week using a high-fidelity simulator	On completion of each scenario	Clinical experience of pregnancy, delivery, and postpartum nursing, or surgical operations	Learning attitude, meta-cognition and critical thinking	

Study name, year (country)	Participants (number)	Study design	Type of course	Specific teaching	Simulation	Debriefing	Control condition	Evaluation	Comment
				Doppler, nitrazine test, nursing care for uterine contraction and delivery pain, vertex delivery mechanism, Ritgen's manoeuvre, foetal and placental expulsion, umbilical ligation, postpartum uterine contraction, and bleeding risk assessment					
Tawalbeh 2020 (Jordan)	Baccalaureate nursing students (n=76)	RCT	Critical care	CVD, respiratory and head injury management	Simulation plus lectures plus clinical education using skills lab	2o mins debrief after each 2-hr scenario	Lectures plus clinical education	Knowledge	
Terzioğlu 2016 (Turkey)	Nursing students (n=60)	Case control	Obstetrics and Gynaecology Nursing	Leopold's manoeuvres, teaching breastfeeding, family planning education, teaching vulvar self-examination and teaching breast self-examination	Nursing skills lab (videos and models) vs standard patient	After each activity for all students	clinical practice	Psychomotor skill Communicatio n skill State anxiety level	
Thomas 2022 (USA)	Traditional and advanced second-degree undergraduate nursing students (n=395)	Case control	Simulation elective	Wound care, medication administration, urinary catheter insertion, and cardiopulmonary resuscitation	High-fidelity mannequin-based scenarios, or standardized patients	30-40 mins after each session	Traditional clinical teaching	NCLEX pass rates, grade point averages, Assessment Technologies Institute (ATI) comprehensiv e predictor scores	

Study name, year (country)	Participants (number)	Study design	Type of course	Specific teaching	Simulation	Debriefing	Control condition	Evaluation	Comment
White 2021 (USA)	Undergraduate nursing students (n=640)	Cohort with historical control	Maternal-newborn and paediatric courses	Throughout course	Simulation as part of course, using standardised simulation scenarios	Not described	No simulation in course	National benchmark exam scores	
Witt 2018 (USA)	Bachelor of Science in Nursing (n=32)	RCT	Mental health	Examination skills, communication skills, appropriate treatments for conditions	Standardised patients (paid professional actors)	Guided scripted debriefing	28 hours of mental health theory and 84 hours of clinical experience	National Council Licensure Examination	
Woda 2019 (USA)	Baccalaureate nursing students (n=71)	Case control	Medical-surgical adult nursing	conflict resolution, interdisciplinary teamwork, and a multiple-patient simulation	14 supplementary simulations, descriptions not given	None given	Standard clinical teaching with 4 simulation sessions	Creighton Competency Evaluation Instrument	
Yu 2017 (S Korea)	Senior nursing students (n=62)	Case control	Internal medicine, surgery, paediatrics, and emergency nursing	Handover scenarios in hypoglycaemic attack, postoperative bleeding and dyspnoea, acute bronchiolitis, high fever, and mental status change, and acute myocardial infarction	Role play and team-based simulation	Not mentioned	theoretical lectures and exposure to clinical practice	Communicatio n scores,	
Yu 2021 (S Korea)	Senior nursing students (n=51)	Case control	Paediatrics	Neonatal infection control - basic care, feeding management and skin care and environmental management	Virtual reality simulation	20 min discussion after scenarios	Clinical practice with no simulation	High-risk neonatal infection control knowledge	

Appendix 4. Systematic review numerical results

Study	Group definition and numbers	Outcome description	Intervention result	Second intervention result	Control result	Statistical tests used	Comparative results and p values
Alinier 2006	Simulation+ clinical (n=49) vs clinical course (n=50)	OSCE results (mean (SD))	61.7 (7.5)	N/A	56.0 (9.5)	Independent sample t-test	p=0.001
Ataee 2019	Simulation (n=19) vs clinical care (n=18)	OSCE total score	34.1 (4.1)	N/A	16.6 (3.8)	T tests	p=0.030
Banjo-Ogunnowo 2022	Simulation (n=18) vs traditional teaching (n=14)	Raw score maternal-paediatric specialty exam (mean (SD))	752.9 (148.9)	N/A	766.0 (145.4)	Independent-samples t-test	p=0.81
		Conversion score maternal-paediatric specialty exam (mean (SD))	68.0 (10.6)	N/A	69.7 (11.6)		p=69
		Maternal-paediatric specialty exam NLN nursing judgment subscale (mean (SD))	750.8 (142.5)	N/A	765.6 (147.1)		p=78
		Maternal-paediatric specialty exam NLN nursing practice subscale (mean (SD)	764.2 (143.9)	N/A	766.5 (146.2)		p=97
		Maternal-paediatric specialty exam Clinical judgment, clinical decision making, critical thinking subscale (mean (SD))	752.9 (148.9)	N/A	761.7 (152.1)		p=87
		Raw score HESI Exit Exam (mean (SD))	896.8 (148.5)	N/A	859.1 (105.7)		p=0.43
		Conversion score HESI Exit Exam (mean (SD))	81.1 (11.3)	N/A	78.6 (8.4)		p=0.48
		HESI Exit Exam NLN nursing judgment subscale (mean (SD))	891.86 141.75	N/A	863.3 (107.5)		p=0.52
		HESI Exit Exam NLN nursing practice subscale (mean (SD))	901.21 145.57	N/A	862.5 (120.1)		p=0.42
		HESI Exit Exam Clinical judgment, clinical decision making, critical thinking subscale (mean (SD))	896.8 (148.5)	N/A	863.2 (106.6)		p=0.48
Centrella-Nigro 2016	Simulation group (n=21) vs previous year (n=22)	Medical–Surgical Basic Knowledge Assessment Tool	68.2 (3.5)	N/A	67.1 (6.6)	T test	p=0.49
Craig 2021	Additional simulation (n=35) vs standard teaching (n=45)	High-fidelity Simulation Performance: Medication Safety Critical Element Checklist Scores at Week 4 (mean (SD))	14.69 (2.92)	N/A	11.98 (3.12)	Independent-samples t-test	p<0.001
		Medication Safety Knowledge Assessment Scores at week 4 (mean (SD))	18.45 (1.94)	N/A	17.82 (2.03)		p=NR
		Week 4 – Week 1 difference (mean (SD))	1.52 (2.22)	N/A	0.64 (2.02)		p=0.075
Curl 2016	Simulation plus clinical teaching (n=59) vs clinical teaching alone (n=65)	Post Medical-Surgical Standard Score (mean (SD)	931.0 (NR)	NA	884.0 (NR)	ANOVA (not described)	p=0.08
		Post Medical-Surgical Conversion Score (mean (SD)	85.1 (NR)	NA	81.1 (NR)		p=0.05
		Exit Exam Standard Score (mean (SD)	936.5 (NR)	NA	885.6 (NR)		p=0.01
		Exit Exam Conversion Score (mean (SD)	86.9 (NR)	NA	82.6 (NR)		p=0.01
		HESI Clinical Specialty Exam Obstetrics (mean (SD)	837.4 (NR)	NA	801.0 (NR)		p=0.35

Study	Group definition and numbers	Outcome description	Intervention result	Second intervention result	Control result	Statistical tests used	Comparative results and p values
		HESI Clinical Specialty Exam Paediatrics (mean (SD)	873.7 (NR)	NA	823.4 (NR)		p=0.08
		HESI Clinical Specialty Exam Mental Health (mean (SD)	850.4 (NR)	NA	802.7 (NR)		p=0.12
Dery 2019	Simulation (n=25) vs clinical teaching (n=25)	Accuracy of insertion, (n (%))	119 (95.2)	NA	98 (78.4)	T-tests	p<0.001
		Insertion time, (mean (SD))	33.62 (1.20)	NA	42.24 (1.99)		p<0.001
		Number of errors committed, (mean (SD))	1.93 (0.11)	NA	2.48 (0.16)		p=0.005
Guerrero 2021	HFS 1 day per week plus hands on clinical education (n=15) vs hands on clinical education only (n=15)	Women's health nursing (mean (SD)	93.8 (3.4)	NA	79.6 (10.1)	T tests	p<0.01
		Child health nursing (mean (SD)	91.5 (6.1)	NA	83.1 (9.9)		p<0.01
		Medical-surgical nursing (mean (SD)	94.6 (3.9)	NA	79.5 (12.6)		p<0.01
		Critical care nursing (mean (SD)	97.4 (1.7)	NA	80.8 (9.)		p<0.01
		General average of clinical placement grades (mean (SD)	94.6 (2.9)	NA	80.7 (8.0)		p<0.01
		Final written exam (mean (SD)	78.0 (9.1)	NA	92.0 (16.1)		p<0.01
		Final internship grades (mean (SD)	91.2 (3.8)	NA	82.9 (7.4)		p<0.01
		Grade categories	Excellent – 11, Very Good - 4	NA	Excellent – 3 Very Good – 6 Good - 6	NA	
		Marking categories	A+ - 3 A – 8 B+ - 4	NA	A+ - 1 A – 2 B+ - 4 B - 2 C+ - 4 C - 2	NA	
Guerrero 2022	Courses with HFS (n= 91) vs those without (n=101)	Mid-term OSCE results (mean (SD)	90.86 (13.13)	NA	80.75 (11.29)	NR	p<0.01
		Final OSCE results (mean (SD)	93.44 (7.15)	NA	83.62 (8.11)	NR	p<0.01
Hall 2015	Simulation (n=132) vs non-simulation (n=147)	Level 0 (N, (%))	0 (0.0)	NA	7 (5.3)	NA	NA
		Level 1 (N, (%))	14 (9.5)	NA	44 (33.3)		
		Level 2 (N, (%))	126 (85.7)	NA	76 (57.6)		
		Level 3 (N, (%))	7 (4.8)	NA	5 (3.8)		
Hansen 2017	Simulation first (n=22) vs clinical first (n=26)	Total score	21.73 (3.1)	NA	20.01 (2.8)	NA	p=NR
		Assessment	2.64 (0.90)	NA	2.04 (0.92)		
		Communication	4.73 (0.70)	NA	4.77 (0.71)		
		Clinical judgment	8.73 (0.77)	NA	8.15 (0.88)		
		Patient safety	5.64 (1.0)	NA	5.08 (1.2)		
Harris 2011	Simulation (N=16) vs clinical (n=55)	Comprehensive paediatric examination	65.3 (6.9)	NA	67.5 (8.4)	T tests	p=0.19
		Clinical grades	3.7 (0.1)	NA	3.4 (0.3)		p=0.001

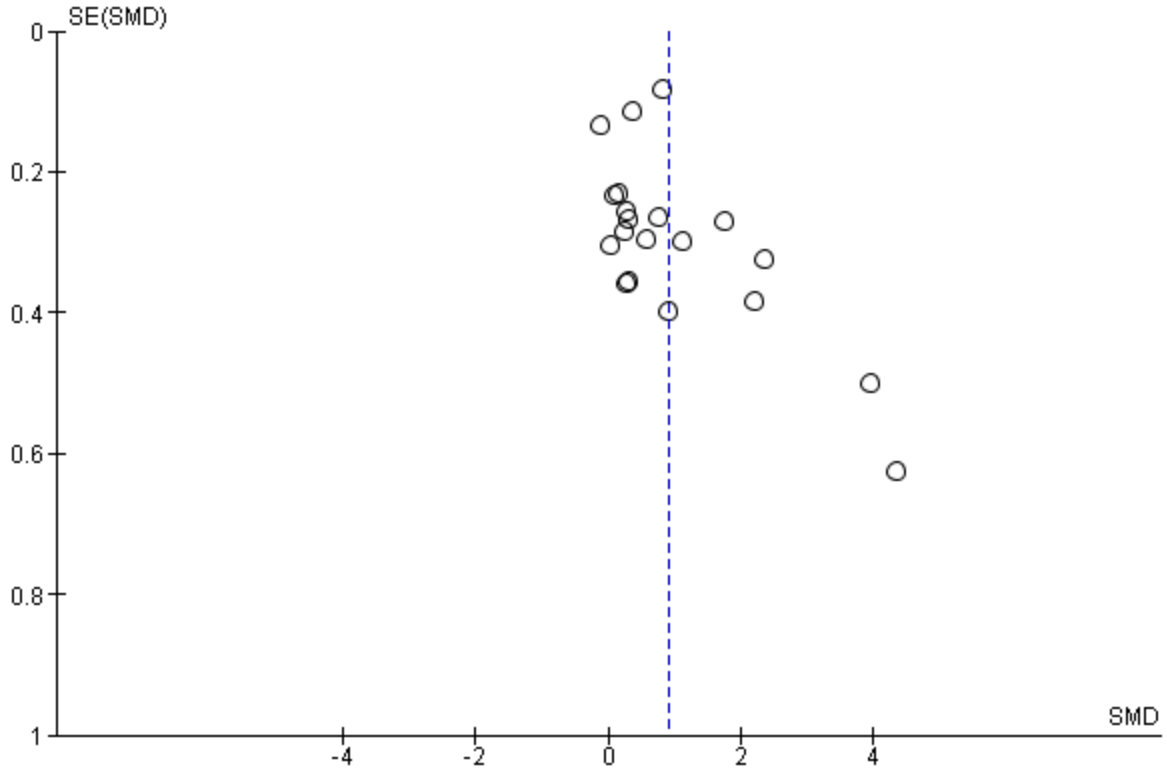
Study	Group definition and numbers	Outcome description	Intervention result	Second intervention result	Control result	Statistical tests used	Comparative results and p values
Hayden 2014	50% (n=210) vs 25% (234) vs 10% (216)	First time NCLEX pass rates	87.1%	85.5%	88.4%	MANOVA	p=NS
	50% (n=211) vs 25% (221) vs 10% (209)	Knowledge (Assessment Technologies Institute Comprehensive Predictor) (mean (SD)	70.1 (7.1)	69.5 (8.6)	69.1 (8.7)	ANOVA (not described)	p=0.478
	50% (n=154) vs 25% (165) vs 10% (153)	Global Assessment of Clinical Competency and Readiness for Practice (mean (SD)	8.23 (1.1)	7.78 (1.14)	7.83 (1.3)		50% > 25% and 10%, p=0.001
	50% (n=230) vs 25% (268) vs 10% (216)	Fundamentals of Nursing Final CCEI Clinical Ratings (mean (SD)	93.9 (14.4)	97.1 (6.2)	96.4 (7.6)		25% + 10% > 50%, p=0.001
	50% (n=231) vs 25% (251) vs 10% (210)	Medical=surgical Nursing Final CCEI Clinical Ratings (mean (SD)	97.9 (7.7)	97.5 (5.6)	96.5 (8.9)		p=NS
	50% (n=167) vs 25% (181) vs 10% (180)	Advanced Medical=surgical Nursing Final CCEI Clinical Ratings (mean (SD)	98.4 (5.1)	99.0 (3.2)	97.6 (5.9)		25%>10%, p=0.025
	50% (n=218) vs 25% (250) vs 10% (225)	Maternal-newborn Nursing Final CCEI Clinical Ratings (mean (SD)	96.3 (8.6)	96.4 (9.2)	98.2 (5.7)		10%> 25% + 50%, p=0.022
	50% (n=210) vs 25% (248) vs 10% (228)	Paediatric Nursing Final CCEI Clinical Ratings (mean (SD)	95.2 (10.9)	97.8 (6.7)	97.5 (6.2)		25% + 10% >50%, p=0.001
	50% (n=225) vs 25% (220) vs 10% (220)	Mental Health Nursing Final CCEI Clinical Ratings (mean (SD)	95.8 (12.5)	95.1 (15.8)	97.9 (7.6)		10%>25% p=0.05
	50% (n=67) vs 25% (90) vs 10% (95)	Community Health Nursing Final CCEI Clinical Ratings (mean (SD)	97.6 (7.1)	99.7 (1.9)	96.9 (7.6)		25%>10%, p=0.008
	50% (n=286) vs 25% (293) vs 10% (268)	Rate of withdrawal (percentages)	19.2%	11.9%	9.3%	Not described	p=0.002
		Dropped out because no longer wished to participate in study (numbers)	N=31	N=21	N=7		p=NR
Hwang 2020	Simulation (n=34) vs clinical practice (n=32)	Clinical judgement,	3.0 (0.5)	N/A	2.2 (0.5)	ANCOVA	p=<0.001
		nursing performance,	2.5 (0.2)	N/A	1.9 (0.3)		p=<0.001
		communication skill,	3.9 (0.8)	N/A	2.9 (0.9)		p=<0.001

Study	Group definition and numbers	Outcome description	Intervention result	Second intervention result	Control result	Statistical tests used	Comparative results and p values
		problem-solving ability	2.8 (0.7)	N/A	2.6 (0.5)		p=0.057
Luctkar-Flude 2012	HFS (n=14) vs SP (n=14) vs community volunteer (N=16)	Respiratory assessment performance scores (mean (SD))	32.9 (4.2)	27.4 (4.9)	28.9 (4.5)	MANOVA?	p<0.01
Mancini 2019	Simulation cohort (n=315) vs clinical chort (n=271)	Final NCLEX pass rates	84.4%	N/A	88.6%	Not stated	p=0.15
Meyer 2011	Been to simulation in first 2 weeks (n=28) vs not yet been to simulation (n=89, 60, 29)	2 weeks performance scores (mean (SD)	24.3 (SD 3.8) (28 observations)	N/A	23.1 (SD 4.0) (89 observations)	Compound Symmetry covariance model with SAS Mixed procedure, repeated measure analysis.	p=0.19
		4 weeks performance scores (mean (SD)	26.3 (SD 4.0) (28 observations)	N/A	24.3 (SD 3.8) (60 observations)		p=0.03)
		6 weeks performance scores (mean (SD)	26.3 (SD 3.7) (28 observations)	N/A	27.3 (SD 3.2) (29 observations)		p=0.36
Olaussen 2022	Simulation plus clinical (n=50) vs clinical only (n=38)	Knowledge test (mean (SD))	17.6 (3.6)	N/A	14.0 (4.1)	independent sample t-tests	p < 0.01
		Dropout rate	20.8%	N/A	3.8%	N/A	p=NR
Raman 2019	Simulation (n= 40) vs clinical (n=34)	Knowledge (mean (SD))	21.13 (4.09)	N/A	20.20 (3.35)	ANCOVA	p=0.306
		Creighton Competency Evaluation Instrument – competency (mean (SD))	19.81 (2.28)	N/A	19.59 (3.19)		p=0.683
Reid 2020	Simulation (n= 27) vs clinical (n=35)	Lasater Clinical Judgment Rubric (mean (SD))	31.96 (5.44)	N/A	30.29 (6.72)	Independent samples t-test	p=0.295
Roberts 2022	Covid-19 group (n=112) vs pre-Covid group (n=112)	NCLEX exit exam scores	944.3 (116.5)	N/A	956.9 (99.4)	Independent samples t-test	p = 0.387
Schlairet 2010	Been to simulation (N=NR) vs not yet been to simulation (N=NR)	Knowledge test (time 1 only) (mean (SD))	62.9 (NR)	N/A	62.4 (NR)	T tests	p=NS

Study	Group definition and numbers	Outcome description	Intervention result	Second intervention result	Control result	Statistical tests used	Comparative results and p values
Sears 2010	Simulation group (n=24) vs clinical (n=30)	Medication errors in course assessment (number)	7	N/A	24	Chi-squared test	p < 0.001
Seo 2021	Simulation (n=25) vs clinical practice (n=20)	Clinical reasoning (mean (SD))	32.0 (16.5)	N/A	18.3 (12.9)	ANCOVA controlling for covariates (not described)	p=NR
		Problem solving (mean (SD))	99.9 (11.4)	N/A	76.6 (17.5)		p=NR
		Self-efficacy (mean (SD))	137.4 (22.2)	N/A	112.4 (27.2)		p=NR
		Clinical competency (mean (SD))	31.9 (4.5)	N/A	18.9 (7.2)		p=NR
Soccio 2017	Simulation (n=24) vs no simulation (n=24)	ATI test passes (score ≥80) (percentages)	67%	N/A	50%	N/A	p=NR
		ATI test mean scores	NR	N/A	NR	Dependent t test	p = 0.590
Son 2020	Simulation (n=47) vs clinical practice (n=31)	Learning attitude	63.4 (6.6)	N/A	62.2 (6.0)	t-tests	p=0.319
		Metacognition	48.1 (5.9)	N/A	48.7 (5.4)		p=0.140
		Critical thinking	106.3 (10.5)	N/A	104.6 (11.4)		p=0.798
Tawalbeh 2020	Simulation (n=38) vs no simulation (n=38)	Knowledge (mean (SD)	29.8 (4.3)	N/A	23.8 (2.2)	T test	p<0.001
Terzioğlu 2016	Nursing skills lab (n=20), standardized patient lab (n=19) clinical practice (n=20)	Psychomotor skill (median (range))	73.1 (21–98)	81.5 (45–99)	88.6 (46–100)	Kruskal–Wallis variance analysis	p=0.001
		Communication skill (median (range))	64.9 (32–86)	71.6 (4–97)	79.0 (16–100)		p=0.001
		State anxiety level (median (range))	33.0 (21–67)	32.0 (20–73)	31.0 (20–69)		p=0.418
Thomas 2022	Simulation elective (n=102) vs not (n=293)	Assessment Technologies Institute (ATI) comprehensive predictor scores (mean (SD)	74.6 (5.5)	N/A	72.2 (6.9)	NR	p=0.0001
		Grade point averages, (mean (SD)	3.55 (0.22)	N/A	3.53 (0.23)		p=0.551
		NCLEX pass rates, (percentages)	94%	N/A	88%	NR	p=0.16
White 2021	Simulation (n=358) vs no simulation (n=282)	Benchmark exam scores for maternal-newborn course (mean (SD))	76.3 (8.0)	N/A	70.2 (6.9)	T test	p<0.0001
		Benchmark exam scores for paediatric course (mean (SD)	76.8 (7.3)	N/A	72.4 (7.4)		p<0.0001
Witt 2018	Simulation (n=17) vs no simulation (n=15)	Final examination scores (mean (SD))	87.9 (7.6)	N/A	85.8 (5.7)	Wilcoxon signed rank test	p=0.30
		Kaplan Mental Integrated examination rank (mean (SD))	66.2 (22.3)	N/A	78.0 (19.3)		p=0.12
Woda 2019		Creighton Competency Evaluation Instrument total score (mean (SD))	14.17 (NR)	N/A	12.44 (NR)	NR	p=NR

Study	Group definition and numbers	Outcome description	Intervention result	Second intervention result	Control result	Statistical tests used	Comparative results and p values
	More simulation (n=36) vs less simulation (n=35)	Creighton Competency Evaluation Instrument Assessment subscale (mean (SD))	2.28 (NR)	N/A	1.9 (NR)	NR	p=NR
Yu 2017	Simulation (n=31) vs no simulation (n=31)	Overall SBAR communication scores (mean (SD))	17.3 (3.3)	N/A	14.7 (3.4)	Independent t-tests	p= 0.003
		Overall communication clarity scores (mean (SD))	28.6 (3.5)	N/A	23.7 (3.5)		p < 0.001
		Handover confidence score (mean (SD))	5.4 (1.5)	N/A	4.5 (1.8)		p = 0.054
Yu 2021	Simulation (n=25) vs no simulation (n=25)	High-risk neonatal infection control knowledge (mean (SD))	22.8 (2.3)	N/A	22.1 (3.3)	Independent t-test	p=0.288

Appendix 5. Funnel plot of studies in the simulation vs no simulation/clinical education only comparison



Appendix 6. Mapping of SBE in systematic review included studies to proficiencies in the UK Future Nurse Standards

Study name, year (country)	Topic of teaching	Future Nurse Standard outcome	Topic of assessment	Future Nurse Standard outcome
Alinier 2006 (UK)	Not described	N/A	OSCE assessing clinical knowledge, technical ability and communication skills	Not possible to map
Ataee 2019 (Iran)	Diagnosing and caring for common arrhythmia, diagnosing myocardial infarction and its types, administering common CCU drugs, CPR, working with electroshock device, heart rhythm monitoring, operating ECG	Outcome 4.5 - demonstrate the knowledge and skills required to support people with commonly encountered physical health conditions, their medication usage and treatments	OSCE on these skills and abilities	As with teaching topic
Banjo-Ogunnowo 2022 (USA)	Whole course	Not possible to map	Whole course assessment	Not possible to map
Centrella-Nigro 2016 (USA)	Whole course	Not possible to map	Whole course assessment	Not possible to map
Craig 2021 (USA)	Medication safety	Annexe B Part 2, 11- Procedural competencies required for best practice, evidence-based medicines administration and optimisation	Medication Safety Knowledge Assessment checklist test on these skills and abilities	As with teaching topic
Curl 2016 (USA)	Clinical activities in obstetrics, paediatrics, mental health, and critical care	Outcome 4.5 - demonstrate the knowledge and skills required to support people with commonly encountered physical health conditions, their medication usage and treatments	Whole course assessment	Not possible to map
Dery 2019 (Ghana)	Inserting a subcutaneous contraceptive implant	Part 2, 11.7 administer injections using intramuscular, subcutaneous, intradermal and intravenous routes and manage injection equipment	Correct implant technique	As with teaching topic
Guerrero 2021 (Saudi Arabia)	Basic nursing procedures, child health in neonatal intensive care unit/ paediatric intensive care unit and paediatric unit; maternal health in the obstetric unit, labour, and delivery room; adult health in the	Outcome 4.5 - demonstrate the knowledge and skills required to support people with commonly encountered physical health conditions, their medication usage and treatments	Final written exam and internship grades	Not possible to map

Study name, year (country)	Topic of teaching	Future Nurse Standard outcome	Topic of assessment	Future Nurse Standard outcome
	medical-surgical unit, operating room, and haemodialysis unit; and critical care in intensive care unit, coronary care unit, and emergency department			
Guerrero 2022 (Saudi Arabia)	Adult health and critical care nursing courses	Outcome 4.5 - demonstrate the knowledge and skills required to support people with commonly encountered physical health conditions, their medication usage and treatments	Final OSCE grades	Not possible to map
Hall 2015 (USA)	Maternal-newborn module critical care	Not possible to map	Pregnancy-induced hypertension, placental abruption, and postpartum haemorrhage	Not possible to map
Hansen 2017 (USA)	Pain management, heart failure, chronic obstructive pulmonary disease/ pneumonia, diabetes mellitus	Outcome 4.5 - demonstrate the knowledge and skills required to support people with commonly encountered physical health conditions, their medication usage and treatments	Clinical competency grades	Not possible to map
Harris 2011 (USA)	Paediatric acute care - basic care of infants, medication administration, bronchiolitis, dehydration and the administration of intravenous fluids and oxygen	Outcome 4.5 - demonstrate the knowledge and skills required to support people with commonly encountered physical health conditions, their medication usage and treatments	Paediatric examination scores and clinical course grades	Not possible to map
Hayden 2014 (USA) (plus Ingwerson 2015)	Whole course	Not possible to map	Final exams and assessments	Not possible to map
Hwang 2020 (S Korea)	Preoperative nursing care for high-risk pregnant women who will undergo a caesarean section	Not possible to map	Clinical judgment, nursing performance competency communication ability, problem solving ability	Not possible to map
Luctkar-Flude 2012 (Canada)	Mild asthma exacerbation	Outcome 4.5 - demonstrate the knowledge and skills required to support people with commonly encountered physical health	Respiratory assessment checklist	3.5 demonstrate the ability to accurately process all information

Study name, year (country)	Topic of teaching	Future Nurse Standard outcome	Topic of assessment	Future Nurse Standard outcome
		conditions, their medication usage and treatments		gathered during the assessment process to identify needs for individualised nursing care and develop person-centred evidence-based plans for nursing interventions with agreed goals
Mancini 2019 (USA)	10 surgical and 10 medical scenarios at different levels. Cases ranged from obtaining vital signs to recognizing and managing life-threatening complications. The Paediatric and Obstetric scenarios addressed learning objectives applicable to all types of undergraduate nursing programs	Not possible to map	Overall clinical competency	Not possible to map
Meyer 2011 (USA)	Prepare students for acute paediatric care such as respiratory syncytial virus, asthma, type I diabetes with ketoacidosis (recovering), postoperative appendectomy care. Provide practice of emergency clinical skills with seizures and sepsis. Provide professional nursing care and patient/family teaching in the home.	Outcome 4.5 - demonstrate the knowledge and skills required to support people with commonly encountered physical health conditions, their medication usage and treatments. Annexe 1. Underpinning communication skills for assessing, planning, providing and managing best practice, evidence-based nursing care	Overall paediatric clinical performance score (which included preparation, student-client-communication, clinical judgment, therapeutic skills and interprofessional communication)	Outcome 4.5 plus Annexe 1 plus 7.1 understand and apply the principles of partnership, collaboration and interagency working across all relevant sectors
Olaussen 2022 (Norway)	Chronic pulmonary disease deterioration, Nursing home patient dementia, developing delirium caused by urinary retention, Administration of medications to nursing home patient with left ventricular heart failure	Outcome 4.5 - demonstrate the knowledge and skills required to support people with commonly encountered physical health conditions, their medication usage and treatments.	Knowledge test on respiration, circulation, elimination and drug handling	As with teaching topic

Study name, year (country)	Topic of teaching	Future Nurse Standard outcome	Topic of assessment	Future Nurse Standard outcome
Raman 2019 (Oman)	Maternity nursing normal and high-risk obstetrics, foetal distress, and cardiotocography	Not possible to map	Clinical competency - critical thinking, communication, assessment, and technical skills	Not possible to map
Reid 2020 (USA)	First time mother–newborn dyad following either vaginal or Caesarean section birth	Not possible to map	Clinical judgement assessment	Not possible to map
Roberts 2022 (USA)	Whole course	Not possible to map	End of course assessments	Not possible to map
Schlairet 2010 (USA)	Simulated clinical experience scenarios that reflected clinical diversity and increasing complexity, faculty cues and feedback to promote refinement of theoretical knowledge through reflection on practice in simulated clinical experiences	Not possible to map	Knowledge scores	Not possible to map
Sears 2010 (Canada)	Medication administration	Annexe B 11.4 undertake accurate drug calculations for a range of medications	Medication error count	As with teaching topic
Seo 2021 (S. Korea)	Clinical reasoning and problem-solving in gastro-intestinal bleeding and acute myocardial infarction	3.5 demonstrate the ability to accurately process all information gathered during the assessment process to identify needs for individualised nursing care and develop person-centred evidence-based plans for nursing interventions with agreed goals 4.5 demonstrate the knowledge and skills required to support people with commonly encountered physical health conditions, their medication usage and treatments	Clinical competency	Not possible to map
Soccio 2017 (USA)	Mental health - posttraumatic stress disorder, bipolar disorder, mania, hearing voices and psychosis, depression and wrist cutting psychiatric emergency scenarios.	4.4 demonstrate the knowledge and skills required to support people with commonly encountered mental health, behavioural, cognitive and learning challenges,	Mental health Assessment Technologies Institute (ATI) scores	As with teaching topic
Son 2020 (S Korea)	Maternity nursing – delivery suite	Not possible to map	Critical thinking - personal disposition and habits that nursing students use to	Not possible to map

Study name, year (country)	Topic of teaching	Future Nurse Standard outcome	Topic of assessment	Future Nurse Standard outcome
			solve problems and make decisions	
Tawalbeh 2020 (Jordan)	Cardiac, respiratory and neurological health problems	4.5 demonstrate the knowledge and skills required to support people with commonly encountered physical health conditions, their medication usage and treatments	Knowledge test about cardiac, respiratory and neurological health problems	As with teaching topic
Terzioğlu 2016 (Turkey)	Leopold's manoeuvres, teaching breastfeeding, family planning education, teaching vulvar self-examination and teaching breast self-examination	2.5 promote and improve mental, physical, behavioural and other health related outcomes by understanding and explaining the principles, practice and evidence-base for health screening programmes Annexe A: Communication and relationship management skills	Cognitive, psychomotor and communication skills	Annexe A: Communication and relationship management skills
Thomas 2022 (USA)	Communication, wound care, high-alert medications and blood administration, chest tube assessment, urinary catheter insertion	4.5 demonstrate the knowledge and skills required to support people with commonly encountered physical health conditions, their medication usage and treatments Annexe A: Communication and relationship management skills	Next Generation National Council Licensure Examination (NCLEX)	Not possible to map
White 2021 (USA)	Maternal-newborn and paediatric clinical experiences	4.5 demonstrate the knowledge and skills required to support people with commonly encountered physical health conditions, their medication usage and treatments	Next Generation National Council Licensure Examination (NCLEX)	Not possible to map
Witt 2018 (USA)	Mental health assessment, therapeutic communication skills, cognitive processes, assessment of mood/affect	4.4 demonstrate the knowledge and skills required to support people with commonly encountered mental health, behavioural, cognitive and learning challenges, Annexe A: Communication and relationship management skills	Mental health knowledge test	As with teaching topic
Woda 2019 (USA)	Whole course	Not possible to map	Final exams and assessments	Not possible to map
Yu 2017 (S Korea)	Nurse to doctor handover	Annexe A. 4.1.2 clear instructions and check understanding when delegating care responsibilities to others	Communication scores	Annexe A: Communication and

Study name, year (country)	Topic of teaching	Future Nurse Standard outcome	Topic of assessment	Future Nurse Standard outcome
				relationship management skills
Yu 2021 (S Korea)	Basic neonatal care, feeding management and skin care and environmental management for prevention of neonatal infection	3.9 recognise and assess people at risk of harm and the situations that may put them at risk, ensuring prompt action is taken to safeguard those who are vulnerable	High-Risk Neonatal Infection Control Competency Knowledge Scale	As with teaching topic

Appendix 7. Regulatory standards of SBE for educating nurses and midwives at undergraduate and postgraduate level

Organisation	Title	Countries	Area	Publication date	Number of pages	Link to webpage
The International Nursing Association for Clinical Simulation and Learning (INACSL)	The Healthcare Simulation Standards of Best Practice (4th ed.)	US	Nursing	2021	58	https://www.inacsl.org/healthcare-simulation-standards
This project was supported through the Ako Aotearoa National Project Fund 2011	Clinical Simulation in Nursing: A literature review and guidelines for practice	New Zealand	Nursing	2013	29	https://ako.ac.nz/assets/Knowledge-centre/NPF-11-001-Collaboration-in-clinical-simulation/GUIDE-Clinical-Simulation-in-Nursing-A-Literature-Review-and-Guidelines-for-Practice.pdf
Nursing & Midwifery Council (NMC)	Simulated practice learning (webpage)	UK	Nursing (pre-registration only)	2023	8	https://www.nmc.org.uk/standards/guidance/supporting-information-for-our-education-and-training-standards/simulated-practice-learning/
The National Council of State Boards of Nursing (NCSBN)	NCSBN Simulation Guidelines for Prelicensure Nursing Education Programs	US	Nursing (pre-registration only)	2016	11	https://www.ncsbn.org/public-files/16_Simulation_Guidelines.pdf
National League for Nursing (NLN)	A Vision for Teaching with Simulation	US	Nursing	2015	8	https://www.nln.org/docs/default-source/uploadedfiles/about/nln-vision-series-position-statements/vision-statement-a-vision-for-teaching-with-simulation.pdf?sfvrsn=e847da0d_0
World Health Organisation (WHO)	Simulation in nursing and midwifery education	Europe	Nursing and midwifery	2018	25	file:///C:/Users/lp9457/Downloads/WHO-EURO-2018-3296-43055-60253-eng.pdf
-	NLN Jeffries Simulation Framework	-	Nursing	2021	88	Jeffries P. Simulation in nursing education. New York, NY: Natl League for Nursing Pr; 2007:21–31. And Jeffries P. R. (2022). The NLN Jeffries simulation theory (2nd ed.). National League for Nursing.

Appendix 8. Regulatory standards that mention use of SBE for educating healthcare professionals

Organisation	Title	Countries	Area	Publication date	Number of pages	Link to webpage
The Association for Simulated Practice in Healthcare (ASPiH)	ASPiH Standards for Simulation-Based Education (SBE)	UK	Healthcare	2016 (under review)	27	http://aspih.org.uk/wp-content/uploads/2017/07/standards-framework.pdf
Department of Health	A Framework for Technology Enhanced Learning	UK	Healthcare	2011	46	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/215316/dh_131061.pdf
Health Education England	National Framework for Simulation Based Education (SBE)	England	Healthcare	2018	8	https://www.hee.nhs.uk/sites/default/files/documents/National%20framework%20for%20simulation%20based%20education.pdf
Health Education England	Enhancing education, clinical practice and staff wellbeing. A national vision for the role of simulation and immersive learning technologies in health and care Technology Enhanced Learning (TEL)	England	Healthcare	November 2020	39	https://www.hee.nhs.uk/sites/default/files/documents/National%20Strategic%20Vision%20of%20Sim%20in%20Health%20and%20Care.pdf
Society for Simulation in Healthcare (SSH)	Accreditation Standards (2021) (6 accreditation areas. All must apply for Core, the remaining areas are optional (must apply for at least 1 of Assessment, Research, or Teaching/Education). Links to webpages provided for 'Core' and 'Teaching/Education' (standard and companion documents)	Global	Healthcare	2021	Unknown, 12 separate documents	https://www.ssih.org/Portals/48/2021%20SSH%20CORE%20ACCREDITATION%20STANDARDS.pdf https://www.ssih.org/Portals/48/2021%20SSH%20CORE%20STANDARDS%20COMPANION%20DOCUMENT.pdf https://www.ssih.org/Portals/48/2021%20SSH%20TEACHING%20EDUCATION%20ACCREDITATION%20STANDARDS%20%281%29.pdf https://www.ssih.org/Portals/48/2021%20SSH%20TEACHING-EDUCATION%20STANDARDS%20COMPANION%20DOCUMENT_1.pdf

Appendix 9. Simulation Culture Organisational Readiness Survey (SCORS) Items

A.	Defined Need and Support for Change	Mean score	SD	Minimum	Maximum
1	To what extent are innovation, experiential learning and quality student experiences clearly described as central to the mission and philosophy of your institution?	4.25	1.068	1	5
2	To what extent has your organization clearly defined the need to consider simulation--- based education (SBE) integration?	4	1.235	1	5
3	To what extent have leadership within your organization communicated a clear strategic vision for SBE?	3.7	1.306	1	5
4	To what extent have leadership within your organization provided a written commitment to SBE?	3.57	1.345	1	5
5	To what extent have leadership within your organization provided funding to support the commitment to SBE?	3.6	1.224	1	5
6	To what extent does your organization promote the need for SBE based on current evidence, standards, and guidelines?	3.93	1.133	1	5
7	To what extent is SBE currently being used as a teaching modality in your institution?	3.92	1.062	2	5
8	To what extent have the educators you work with articulated a need for SBE integration into the curriculum?	4.08	1.046	1	5
9	To what extent have the educators in your institution verbalized a commitment to SBE integration into the curriculum?	4.12	1.027	1	5
B. Readiness for Culture Change					
10	To what extent is there a critical mass of professionals who already possess strong SBE:				
	a. Knowledge	4.10	1.069	1	5
	b. Skills	3.22	1.391	1	5
	c. Positive Attitudes	3.83	1.028		5
11	To what extent do leaders support culture change including the efforts required to implement and sustain SBE program integration?	3.45	.999	2	5
12	To what extent are there credentialed simulation practitioners who mentor/coach others, including, other simulation practitioners?	2.78	1.342	1	5
13	To what extent does your organization have individuals who model SBE best practice?	3.53	1.255	2	5
14	To what extent are staff/faculty proficient in the use of technology? (for example, computer systems, AV and IT systems)	2.95	1.227	2	5
15	To what extent are there graduate level prepared researchers available to assist in research to develop new knowledge, as appropriate to your organization's mission?	4.37	.974	1	5
16	To what extent are librarians available within your organization to help search for evidence---based practice and related simulation resources?	3.48	1.000	1	5

17	To what extent are your librarians accessed to search for evidence--- based practice and related simulation resources?	3.57	1.015	1	5
18	To what extent do you believe that now is the right time to implement a culture change to support SBE?	3.97	.956	1	5
C. Time, Personnel, and Resource Readiness					
	To what extent are fiscal resources available to support SBE in the following areas:				
	a. Human resources (simulation personnel)?	4.37	.920	2	5
	b. Education?	4.07	1.023	2	5
	c. Release time to lead integration of SBE?	3.03	1.275	1	5
	d. Development of physical learning spaces?	3.40	1.153	1	5
	e. Equipment?	3	1.235	1	5
20	To what extent do employees in your institution have access to quality technology, including computers, audiovisual equipment, and other institutional technologies?	3.87	1.186	1	5
21	To what extent is support available to learn and manage technologies that support education?	4.05	.964	1	5
22	To what extent are there existing simulation champions (people who will go the extra mile to advance simulation) in the current environment among:				
	a. Leaders?	3.92	1.319	1	5
	b. Clinicians/ practitioners?	3.60	1.265	1	5
	c. Educators?	3.98	1.066	1	5
	d. Technology Specialists?	3.62	1.277	1	5
	e. Administrative Assistants and Support Staff?	2.65	1.205	2	5
D. Sustainability Practices to Embed Culture					
23	To what extent is the measurement and sharing of outcomes part of the culture of the organization in which you work?	3.87	1.096		5
24	To what extent are decisions regarding SBE influenced by:				
	a. Clinicians?	3.55	1.171	1	5
	b. Educators?	4.20	.860	2	5
	c. Administration/ leadership?	3.37	1.262	1	5

Appendix 10. Future Nurse Standards Key Proficiencies targeted in the mental health SPL

Part 2 Proficiencies

- Support people to make informed choices to promote their wellbeing and recovery, assessing their motivation and capacity for change using appropriate therapeutic interventions for example, cognitive behavioural therapy techniques.
- Apply the principles underpinning partnerships in care demonstrating understanding of a person's capacity in shared assessment, planning, decision- making and goal setting.
- Provide people, their families, and carers with accurate information about their treatment and care, using repetition and positive reinforcement when undergoing a range of interventions and accesses translator services as required.
- Work in partnership with people, families, and carers to monitor and evaluate the effectiveness of agreed evidence-based care plans and readjust goals as appropriate, utilising appropriate negotiation strategies, drawing on the person's strengths and assets.
- Make informed judgements and initiates appropriate evidence-based interventions in managing a range of commonly encountered presentations.
- Provide information and explanation to people, families and carers and responds appropriately to questions about their treatment and care.
- Apply an understanding of the differences between risk management, positive risk taking and risk aversion to avoid compromising quality of care and health outcomes.
- Demonstrate awareness of strategies that develop resilience in themselves and others and applies these in practice for example, solution focused therapies or talking therapies.

Part 3 Proficiencies

- Recognise signs of deterioration (mental distress/emotional vulnerability/ physical symptoms) and takes prompt and appropriate action to prevent or reduce risk of harm to the person and others, for example, positive behavioural therapy or distraction and diversion strategies.

Appendix 11. Proficiencies mapped against the child SPL

Proficiencies

- Recognise people at risk of self-harm and/or suicidal ideation and demonstrates the knowledge and skills required to support person-centred evidence-based practice using appropriate risk assessment tools as needed.
- Demonstrate an understanding of the needs of people and families for care at the end of life and contributes to the decision-making relating to treatment and care preferences.
- Utilise aseptic techniques when understanding wound care and in managing wound and drainage processes (including management of sutures and vacuum removal where appropriate).
- Insert, manage, and remove urinary catheters for all genders and assist with clean, intermittent self-catheterisation where appropriate. Manages bladder drainage where appropriate.
- Undertake, responds to, and interpret neurological observations and assessments and can recognise and manage seizures (where appropriate).
- Undertake a comprehensive respiratory assessment including chest auscultation for example, peak flow and pulse oximetry (where appropriate) and manages the administration of oxygen using a range of routes.
- Undertake an effective cardiac assessment and demonstrates the ability to undertake an ECG and interpret findings.
- Demonstrate knowledge and skills related to safe and effective cannulation in line with local policy.
- Can identify signs and symptoms of deterioration and sepsis and initiate appropriate interventions as required.
- Demonstrate knowledge and skills related to safe and effective venepuncture and can interpret normal and abnormal blood profiles.

Appendix 12. Student self-assessed achievement of Part 2 proficiencies Mental Health and Child SPL

	Part 2 Proficiencies	**Mental health Achieved**	**Mental health Not Achieved**	**Mental health No response**	**Child Achieved**	**Child Not Achieved**	**Child No response**
1	Support people to make informed choices to promote their wellbeing and recovery, assessing their motivation and capacity for change using appropriate therapeutic interventions for example, cognitive behavioural therapy techniques.	22	0	0	21	2	3
2	Apply the principles underpinning partnerships in care demonstrating understanding of a person's capacity in shared assessment, planning, decision- making and goal setting.	21	1	0	21	2	2
3	Recognise people at risk of self-harm and/or suicidal ideation and demonstrates the knowledge and skills required to support person-centred evidence-based practice using appropriate risk assessment tools as needed.	21	1	0	23	1	2
4	Demonstrates an understanding of the needs of people and families for care at the end of life and contributes to the decision-making relating to treatment and care preference.	21	1	0	11	11	4
5	Provides people, their families, and carers with accurate information about their treatment and care, using repetition and positive reinforcement when undergoing a range of interventions and accesses translator services as required.	21	1	0	22	2	2

	Part 2 Proficiencies	Mental health Achieved	Mental health Not Achieved	Mental health No response	Child Achieved	Child Not Achieved	Child No response
6	Works in partnership with people, families and carers to monitor and evaluate the effectiveness of agreed evidence-based care plans and readjust goals as appropriate, utilising appropriate negotiation strategies, drawing on the person's strengths and assets.	20	2	0	19	5	2
7	Maintains accurate, clear and legible documentation of all aspects of care delivery, using digital technologies where required.	20	2	0	20	4	2
8	Makes informed judgements and initiates appropriate evidence-based interventions in managing a range of commonly encountered presentations.	20	2	0	20	4	2
9	Assesses skin and hygiene status and demonstrates knowledge of appropriate products to prevent and manage skin breakdown.	19	3	0	14	8	4
10	Utilises aseptic techniques when understanding wound care and in managing wound and drainage processes (including management of sutures and vacuum removal where appropriate.	18	4	0	7	15	4
11	Effectively uses evidence based nutritional assessment tools to determine the need for intervention.	17	5	0	12	10	4
12	Demonstrates understanding of artificial nutrition and hydration and is able to insert, manage and remove oral/nasal gastric tubes where appropriate.	17	5	0	13	10	3

	Part 2 Proficiencies	Mental health Achieved	Mental health Not Achieved	Mental health No response	Child Achieved	Child Not Achieved	Child No response
13	Assess the level of urinary and bowel continence to determine the need for support, intervention and the person's potential for self-management.	15	7	0	13	11	2
14	Insert, manage, and remove urinary catheters for all genders and assist with clean, intermittent self-catheterisation where appropriate. Manages bladder drainage where appropriate.	14	8	0	4	18	4
15	Undertakes, responds to and interpret neurological observations and assessments and can recognise and manage seizures (where appropriate).	13	9	0	21	3	2
16	Uses contemporary risk assessment tools to determine need for support and intervention with mobilising and the person's potential for self-management.	13	9	0	16	8	2
17	Effectively manages the risk of falls using best practice approaches.	13	9	0	15	9	2
18	Uses appropriate safety techniques and devices when meeting a person's needs and support with mobility providing evidence-based rationale to support decision making.	12	10	0	14	10	2
19	Undertakes a comprehensive respiratory assessment including chest auscultation, for example, peak flow and pulse oximetry (where appropriate) and manages the administration of oxygen using a range of routes.	12	10	0	16	7	3

	Part 2 Proficiencies	Mental health Achieved	Mental health Not Achieved	Mental health No response	Child Achieved	Child Not Achieved	Child No response
20	Uses best practice approaches to undertake nasal and oral suctioning techniques.	12	10	0	15	8	3
21	Effectively uses standard precaution protocols and isolation procedures when required and provides appropriate rationale.	12	10	0	17	7	2
22	Provide information and explanation to people, families and carers and responds appropriately to questions about their treatment and care.	12	10	0	20	4	2
23	Undertakes assessments using appropriate diagnostic equipment, in particular blood glucose monitors and can interpret findings.	12	10	0	14	9	3
24	Undertakes an effective cardiac assessment and demonstrates the ability to undertake an ECG and interpret findings.	11	11	0	12	11	3
25	Demonstrates knowledge and skills related to safe and effective venepuncture and can interpret normal and abnormal blood profiles.	10	12	0	7	15	4
26	Demonstrates knowledge and skills related to safe and effective cannulation in line with local policy.	10	12	0	11	11	4
27	Manage and monitor blood component transfusions in line with local policy and evidence-based practice.	10	2	0	7	15	4
28	Can identify signs and symptoms of deterioration and sepsis and initiate appropriate interventions as required.	9	13	0	18	6	2

	Part 2 Proficiencies	Mental health Achieved	Mental health Not Achieved	Mental health No response	Child Achieved	Child Not Achieved	Child No response
29	Applies an understanding of the differences between risk management, positive risk taking and risk aversion to avoid compromising quality of care and health outcomes.	8	14	0	15	8	3
30	Demonstrates awareness of strategies that develop resilience in themselves and others and applies these in practice. For example, solution focused therapies or talking therapies.	8	14	0	18	5	3
31	Participates in the planning to ensure safe discharge and transition across services, caseloads and settings demonstrating the application of best practice.	8	14	0	18	6	2
32	Negotiates and advocates on behalf of people in their care and makes reasonable adjustments to the assessment, planning and delivery of their care.	8	14	0	19	5	2
33	Demonstrates effective persons and team management approaches in dealing with concerns and anxieties using appropriate de-escalation strategies when dealing with conflict.	7	15	0	19	5	2

Appendix 13. Future Nurse Part 3 proficiencies

	Part 3 Proficiency	Mental Health Achieved	Mental Health Not Achieved	Mental Health No Response	Child Achieved	Child Not Achieved	Child No Response
34	Recognises signs of deterioration (mental distress/emotional vulnerability/physical symptoms) and takes prompt and appropriate action to prevent or reduce risk of harm to the person and others using for example, positive behavioural therapy or distraction and diversion strategies.	19	3	0	21	5	0
35	Manages the care of people with specific elimination needs for example, urinary and faecal incontinence and stoma care.	10	12	0	17	9	0
36	Manages the care of people who are receiving IV fluids and accurately records fluid intake and output, demonstrating understanding of potential complications.	8	14	0	17	9	0
37	Demonstrates an understanding of the need to administer enemas and suppositories and undertake rectal examination and digital rectal evacuation as appropriate.	8	14	0	15	11	0
38	Manages the care of people receiving fluid and nutrition via infusion pumps and devices including the administration of medicines as required in line with local policy.	7	15	0	12	14	0
39	Manage and monitor the effectiveness of symptom relief medication, with the use of infusion pumps and other devices.	7	15	0	11	15	0