Title: A Systematic Scoping Review and Textual Narrative Synthesis of Undergraduate Paediatric Nursing Simulations: What, Why and How?

ABSTRACT

Background: Simulation is increasingly being used to train healthcare professionals however there is limited knowledge on how paediatric simulation is being used to train undergraduate nurses. This article systematically scopes the literature on the types of undergraduate paediatric nursing simulations taking place, their value, the research methods used and areas of research focused on.

Methods: A systematic scoping literature review, combined descriptive synthesis, and textual narrative synthesis was undertaken.

Results: 139 studies were identified by the search strategy. Of these, 32 articles were included for appraisal and synthesis. 17 papers were quantitative, five qualitative, and eight mixed-methods. The research took place in six different geographical locations. The total participant sample was 2,039. Studies were categorised according to their aims and objectives, and simulation types.

Conclusions: This review revealed the heterogeneity of studies on this subject. Ultimately, studies were small and confined to single institutions or geographical locations. Studies that described or explored simulation as an intervention provided more interesting insights than those that evaluated or tested effectiveness.
The variety of simulation types was wide and the fidelity of the simulations being described was frequently noted, however no reference was made as to how this was determined. Future studies would benefit from detailing the low, medium or high technological, psychological or environmental aspects of the simulation and how this was determined.

Key points

- A systematic scoping literature review, combined descriptive synthesis, and textual narrative synthesis was undertaken to explore the types of undergraduate paediatric nursing simulations taking place, their value, the research methods used and areas of research focused on.
- A total of 32 articles were included for appraisal and synthesis. Of these 17 papers were quantitative, five qualitative, and eight mixed-methods. The research took place in six different geographical locations. The total participant sample was 2,039.
- The studies that were included were heterogenous, often small and confined to single institutions or geographical locations. Studies that described or explored simulation as an intervention provided more interesting insights than those that evaluated or tested effectiveness.

Key words: paediatric nursing, baccalaureate nursing, children's nursing, undergraduate, preregistration, simulation, scoping review, systematic review, textual narrative synthesis

INTRODUCTION

Simulation is increasingly being used to train healthcare professionals. However, there are a range of simulation types used, clinical areas of focus, and levels of fidelity described. Additionally, the research methodologies used to address simulation-based research questions are highly varied revealing the complexities of this pedagogical tool.

There is limited knowledge on how simulation is used specifically to train undergraduate nurses in paediatric care. Therefore, this review aims to gain a better understanding of what types of paediatric nursing undergraduate simulation is taking place and what questions the research being conducted asks. As far as we are aware, this is the first review of this type to be undertaken.

BACKGROUND

Simulation is a way of replicating real-world scenarios for educational and preparedness requirements (Bratley, Fox, & Schrage, 1983). It is used across many sectors such as the military, aviation, and aerospace (Naseer, Eldabi, & Jahangirian, 2009). It is increasingly being used in healthcare to train undergraduate students and postgraduate professionals, however its use and evidence-base is still developing and further insight is needed to understand the fundamental nature of simulation, its uses and effectiveness as a pedagogical tool.

Paediatrics and concomitantly paediatric nursing emerged in the 19th century as concerns over child poverty and welfare and associated infectious diseases increased, while the industrial revolution meant that children's health became a focus due to the need for a fit and healthy workforce (Mahnke 2000). The first children's hospital opened in Paris in 1802, with London's Great Ormond Street (GOS) and the Children's Hospital in Boston opening in 1852 and 1862 respectively (Mahnke 2000, Connolly 2005, Clarke 2017); many more children's' hospitals followed in cities across the UK, USA and Europe.

In the 20th century research which visually documented the detrimental effects of hospitalization on children was highly influential (Robertson and Bowlby 1952; Robertson and Robertson 1968). The research changed hospital policies on the care of hospitalised children in the UK, Australia, Canada and European nations, the research giving rise to a raft of reports which made recommendations for the care of hospitalised children and included recommendations on the need for children to be cared for by nurses (and doctors) trained specifically in the care of children (Bradley 2003).

The formal training of children's nurses commenced at Great Ormond Street in 1878, pre-dating the formal training established by Florence Nightingale. In the UK the first nursing register overseen by the General Nursing Council was established in 1919. Initially children's nursing was a supplementary part of the register, this a reflection of debates which still exist today, namely whether children's nursing is a generalist (pre-registration) or specialist (post-registration) qualification (Bradley 2003). Notwithstanding this, the need for children's nurses is firmly established, with research indicating that growth in this area of the nursing workforce is associated with 'memorable events' (Davis 2008), these events including social change, failures within UK child health services and changes in nurse education.

Currently in the UK, children's nursing remains a generic qualification (along with adult, mental health and learning disability nursing). This is not reflected elsewhere, with significant variation across Europe (Paediatric Nursing Associations of Europe, 2010), while the USA and Australia view children's nursing as a specialist (post-registration) area of practice. However, irrespective of whether children's nursing is seen as a generic or specialist qualification, the need for training in the specific needs of children is now universally accepted, in recognition that children are not small adults, and due to their immaturity have specific physical, psychological and emotional needs that not only differ from adults but vary as children progress through infancy to childhood and on to adolescence.

In the UK simulation is increasingly used in nurse and midwifery education. However, a consultation on the use of simulation undertaken by the Nursing and Midwifery Council (NMC 2018) revealed some anxiety and reluctance amongst the profession about increasing the use of simulation in pre-registration nursing and midwifery education, respondents to the consultation cited concerns about the availability of high level facilities, lack of readily available simulated learning tools, and the promotion of simulated learning being driven by cost. Nevertheless, reviews of the use of simulation in undergraduate education indicate that simulation is an effective means of increasing knowledge, confidence and competence, clinical skills' acquisition, and self-efficacy (Foronda et al 2013, Cant and Cooper 2017.) However, these reviews draw on a range of studies, few of which consider specifically children's nursing undergraduate education. How simulation is used to train undergraduate nursing students in paediatric care is relatively unknown. With an increasing amount of

studies appearing in this field it is important to gain a more in-depth understanding of what is happening, where, why and how.

METHODS

Aims

The aim of this systematic scoping review is to summarize and synthesize the global empirical literature in order to provide a comprehensive understanding of paediatric simulations used to train undergraduate nurses. The guiding research question is: What types of simulation are being used, what is their value, and what methodologies are being used to assess/understand their usage?

Design

A systematic scoping review methodology was employed as the purpose of this review was to gain a deeper understanding of what literature and research existed on the topic rather than generate a single outcome of interest. Thus, the data synthesis in this context sought to generate a better understanding and overview of the subject in order to identify strengths and weaknesses that will inform future studies and identify what is required to further our understanding and knowledge in this area. Such a review can be an important step in understanding an area of interest when it is complex and has not been previously reviewed (Arksey & O'Malley, 2005).

This systematic scoping review has therefore taken the following steps: identification of area of interest, systematic literature search, data extraction, quality appraisal, data synthesis and presentation. This review follows a results-based convergent synthesis design meaning that qualitative, quantitative and mixed-methods studies are identified in a single search, presented, reported and analysed separately, and integrated during data summary and synthesis (Hong, Pluye, Bujold, & Wassef, 2017; Noyes et al., 2019). In addition, PRISMA and ENTREQ reporting guidelines have been followed (Moher, Liberati, Tetzlaff, Altman, & Group, 2009; Tong, Flemming, McInnes, Oliver, & Craig, 2012).

Search methods

A systematic search was undertaken in February 2020 using EBSCO (including CINAHL), Scopus, Science Direct, and Cochrane. In addition, the resulting papers were hand searched for specific references, which may have been missed.

Search terms used were: Simul*, AND Prereg* (OR baccalaureate, undergraduate), AND Child* (OR Paediatric, Nurs*). Articles were searched between 2005 and 2020. The start date reflects the first framework developed for the designing, implementing and evaluating of nursing simulation (Jeffries, 2005). The selected database limiters were: academic journals, English language articles, and published from 2005 as presented in Figure 1.

Search inclusion/exclusion criteria

The search returned 139 articles, which were reduced to 76 after the removal of duplicates. At the screening stage, titles and abstracts were assessed against the following inclusion criteria:

- Undergraduate paediatrics' nursing simulation
- General nursing students who undertake a specific paediatric simulation
- Paediatric simulation that utilises a multidisciplinary sample but includes undergraduate general nursing students
- Physical forms of simulation that use contexts and props

Exclusion criteria were:

- E-learning/computer-based simulations (unless physical elements are included)
- OSCE's
- Role-playing
- Vignettes
- Registered / post-graduate paediatric nurses / general nurses (unless the study also included students)

Following screening, a further 42 articles were removed, the full-text of one article was irretrievable (authors emailed but no response was received), leaving 32 articles to be included in the review and analysis.

Data extraction

Data from the included studies was extracted by two authors (SMW & RE) and categorised according to the source, country of where the research took place, study aims and objectives, research methods/design and sample information, type of simulation used, included participants and simulation time, measures of analysis, main outcomes, and quality appraisal scores and issues (see Table 1). Categories were kept broad due to methodological differences across and within studies and therefore summary measures were not possible.

Quality appraisal

Two researchers (SMW & RE) independently assessed 32 full-text articles using the Mixed Methods Appraisal Tool (MMAT), Version 2018 (Hong et al., 2018). Articles were segregated according to whether they were of quantitative (descriptive; non-randomized; randomized), qualitative or mixed-methods design and assessed using the criteria for their category within the tool.

Data summary and synthesis

Due to heterogeneity across studies and even within similar study methodologies, a meta-analysis or combining of quantitative data for further analysis or a meta-synthesis for qualitative data was not possible. Instead studies were combined to summarise descriptive statistics of the study characteristics, followed by a textual narrative synthesis. This approach arranges disparate study types into more homogenous sub-groups which aids in the synthesising of different types of evidence. Study characteristics, context, quality, and findings are reported according to a standard format, and similarities and differences are compared across studies (Lucas, Baird, Arai, Law, & Roberts, 2007).

Figure 1. PRISMA Flow Diagram

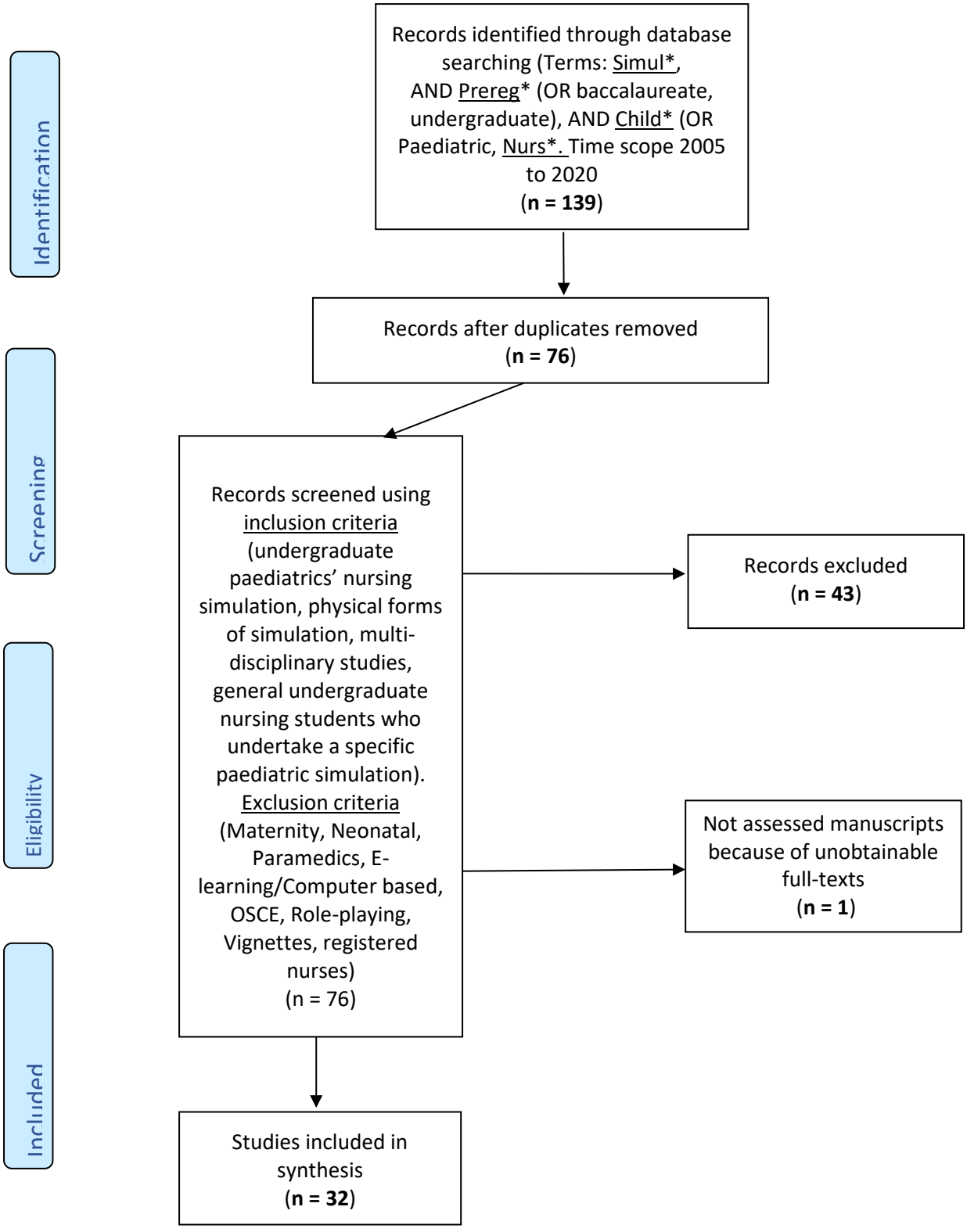


Table 1 Summary of included papers

Reference	Country	Aims & Objectives	Methods/design & Sample information	Type of Simulation	Included participants; Simulation time	Measures/analysis	Outcomes	Quality Appraisal (MMAT Tool)
1. Aldridge (2017)	US	To describe how the characters (standardised patients) were created, how standardized patients were trained, and the importance of psychosocial care with standardized patients in a paediatric end of life simulation	Anecdotal evidence: Describes the roles, creation, training and logistics of managing standardised patients for a paediatric simulation	High fidelity simulation of a two-month-old infant, who was depicted by a high fidelity mannequin, and the infant's parents, portrayed by SPs.	Baccalaureate nurses "Because this was not a research study, formal data were not collected." Time: N.S.	Anecdotal feedback	The SP's made the simulation more realistic and favourable to the student children's nurses	N/A
2. Alinier et al. (2014)	UK	To explore knowledge and perceptions of students in relation to immersive clinical simulation	Quantitative study: Quasi-randomized control group investigation Questionnaire Sample size: 1885 Convenience sample	Extracurricular immersive simulation sessions for multiprofessional groups of final year health care students	N = 237 students from adult/children/learning disability/mental health nursing, paramedic, radiography, physiotherapy, and pharmacy 12 student children's nurses Time: N.S.	Delphi validated questionnaire assessing areas of pre-simulation experience, 'discipline-specific knowledge, and a post-simulation experience evaluation	The study shows that even limited interprofessional simulation exposure enabled students to acquire knowledge of other professions and develop a better appreciation of interprofessional learning	**1/5** Randomization not appropriately performed Groups not comparable at baseline Outcome data not reported clearly Blinding of assessors not

								mentioned
3. Arslan et al. (2018)	Turkey	To determine the effect of classical and simulation-based paediatric nursing training on students' perception of self-efficacy and anxiety levels.	Quantitative study: Two-group, nonrandomized, and quasi-experimental study Sample size: 264 Convenience sample	Simulation-based paediatric nursing training session covering paediatric assessment, anthropometric measurement, vital signs, medication administration, and care practice.	Undergraduate nursing students Control group N = 115 Experimental group N = 132 Total N = 247 5-10 minutes per simulation	Data were collected using the Demographic Characteristics and Perceived Self-Efficacy about Paediatric Practice Skills for Student Form and State Trait Anxiety Scale in a two step process	The perceived self-efficacy levels of students in the experimental group were higher than in the control group. There was no significant difference for state anxiety average scores between the two groups	**3/5** Not representative of the target population No complete outcome data No confounders accounted for
4. Cole et al. (2019)	US	To explore if an instructional model integrated into an end-of-life simulation for undergraduate paediatric nursing course allows students to practice caring for a child and their family while developing an understanding of the unique needs of a dying paediatric patient	Qualitative study: analysis post simulation Sample size: 216 Convenience sampling	Paediatric end-of-life simulation. The case begins with "report" on an unresponsive young child experiencing a sudden hypoxic-ischemic brain injury. A high fidelity junior manikin is utilized and a faculty member or student portrays the role of the parent.	Undergraduate nursing students N = 149 20 minute simulation	Debriefing session and open ended four question survey (researcher developed)	Several themes emerged: What to say / managing symptoms at the end of life, emotional care, practice implications.	**0/5** Qualitative approach not described Data collection methods inadequate Findings not adequately derived from the data Interpretation and coherence of interpretation poor
5. Davies et al. (2012)	UK	To evaluate a complex simulated scenario with	Mixed-methods study: evaluative methodology	A four-bedded ward, with the assessment unit located downstairs, in a two-bedded high	Student paediatric nurses	6 item Likert questionnaire Open-ended	The themes that have emerged from the data collected in the three cohorts are all fundamental aspects of	**5/5**

		final year undergraduate children's nursing students	Sample size: 41 Convenience sample	dependency unit	N = 40 Time: N.S.	questions Post-simulation debriefing and evaluation	children and young people's nursing practice.	
6. Fitzgerald (2019)	US	To examine nursing students' performance in providing family-cantered care and empathic communication in a paediatric simulation.	Mixed method study: convergent parallel design Questionnaire, participants were also debriefed with open-ended questions. Sample size: 162 Convenience sample	The simulation content reflected two common paediatric medical situations: asthma and fever	Undergraduate nursing students 89 traditional baccalaureate nursing students (BSN) and 57 nursing students N = 146 15 minute simulation	A modified version of The Jefferson Scale of Patient Perception of Physician Empathy (JSPPPE) was used. Descriptive comparative data and content analysis	The researchers compared standardized actors' assessment of student empathy to the peer assessments of student empathy. Peer ratings on the JSPPPE were significantly higher. Debriefing yielded results that give insight into demonstrating empathy, observing and understanding the situation.	**4/5** Rationale for mixed-methods not described
7. Gamble (2017)	Australia	To evaluate the short and medium term impact of an extended multi-scenario simulation for 3rd year undergraduate students enrolled in a paediatric nursing subject	Mixed Methods study: longitudinal study and evaluation Sample size: 28 Convenience sample	A simulated paediatric ward included 9 patients using medium and high-fidelity mannequins, two SP's as patients and four as parents with various clinical needs	Undergraduate nursing students N = 28 3.5 h simulation ward shift	Likert Scale on achievement of simulation objectives, impact on confidence, team work and the effect of feedback on learning Free text comment sheet Simulation Experience Scale 3 question paper based evaluation focused on perceived impact	Positive impacts on critical nursing concepts and psychomotor skills resulted for participants in both clinical placement and beyond into the first months of employment.	**4/5** Rationale for mixed-methods not described
8.	Canada	To test the	Quantitative study:	High-fidelity cases	Nursing students	Two primary	The results suggest that hybrid	**3/5**

Goldsworthy (2019)		effects of a 16-hour simulation intervention on third-year undergraduate nursing students' confidence and competence in the recognition and response to the rapidly deteriorating adult and paediatric patient	Quasi-experimental pre/post study Sample size: 59 Convenience sample	included the following: angina/cardiac arrest, COPD/respiratory failure, post-op haemorrhage, paediatric sepsis, paediatric asthma, neonatal seizures	N = 43 16 hour simulation	measures were used in this study. A self-efficacy measure (researcher developed) and a knowledge assessment.	simulation intervention that included a total of six high-fidelity simulation cases (three paediatric and three adult) and two virtual simulation cases (paediatric asthma and adult myocardial infarction) showed statistically significant in-creases in clinical self-efficacy among treatment participants in all domains. Furthermore, the treatment group showed significant increases in knowledge on three of the six domains.	Randomization not described No blinding
9. Harris (2011)	US	To determine the effect of simulation enhanced orientation on paediatric acute care examination scores and paediatric clinical course grades	Quantitative study: Pilot randomized quasi-experimental design Sample size: 71 Convenience sample	Four simulations – basic care of infants, medication administration, infant HPS and child HPS. Child manikins used – SimBaby and PediaSIM	Baccalaureate nurses N = 71. 16 in intervention (simulation group) and 55 in control group (did not participate in simulation) Time: N.S.	RN Nursing Care of Children Content Mastery Test (2008) and course grades	No difference between groups of paediatric examination scores. Significant difference in course grades, with intervention (simulation) group having higher grades ($p < 0.001$)	**3/5** Randomization not described Groups not comparable at baseline
10. Kim (2014)	South Korea	To develop a simulation-based fever management module for treating children with febrile convulsion, and to evaluate students' performance and	Quantitative study: Delphi tool designed questionnaire and evaluation questionnaire Sample size: 147 from two universities	Fifteen-month-old baby with febrile convulsion was based on a real febrile convulsion case that had occurred in a general hospital. The simulations were scheduled in simulation rooms in which the high-fidelity patient simulators were used.	Undergraduate nursing students N = 147 20-30 minute simulation	Student satisfaction was measured using the Satisfaction of Simulations Experience [SSE] scale. Debriefing data were analyzed using the Matrix Method.	Internal Consistency, Reliability, and Correlation Matrix of the Evaluation Checklist – Chronbachs alpha .71 to .81. Feedback from student debriefing and SSE scale - The total mean score of SSE was high at 4.48	**4/5** No sampling strategy

		satisfaction.	Convenience sample					
11. Kirkpatrick (2018)	US	To test baccalaureate nursing (BSN) students self-efficacy in communication and leadership pre and pot simulation	Quantitative study: Pre–post quasi-experimental design Sample size: 205 Convenience sample	High fidelity - The two scenarios included a febrile infant with meningitis and a school age child with asthma exacerbation	Baccalaureate nursing students (intraprofessional) 88 senior-level traditional students, 34 junior-level accelerated students, and 78 junior-level traditional students N = 205 8 hour simulation	Six-question five-item Likert scale pre-test post-test related to APN role identification and collaboration. In addition, BSN student self-efficacy in communication and leadership was measured in a 17-question Likert-item post-test (researcher developed)	More than 90% of BSN students agreed that they benefited from the simulation in the areas of leadership, skill development, communication, and collaboration. In addition, a statistically significant increase ($p < .0001$) in BSN students' reported understanding of the roles and relationships between a physician, APN-, and a BSN-prepared nurse was revealed.	**3/5** Not representative of the target population Confounders not accounted for
12. Kubin and Wilson (2017)	US	To examine the impact of using community volunteer children on physical assessment abilities and comfort levels.	Quantitative study: Quasi-randomized control group investigation Sample size: 99 Convenience sample	High-fidelity clinical simulation/ non-acting children	Baccalaureate nurses N = 99 20-minute simulation	Pre and Post Paediatric Student Comfort and Worry Assessment Tool The Lasater Clinical Judgment Rubric Self-evaluation Faculty Evaluation	Study results indicate that having students practice paediatric assessments prior to clinical experiences can reduce stress and worry whether they practice with high-fidelity simulators or community volunteer children	**3/5** Randomization not described Groups not comparable at baseline
13. Lee et al. (2017)	South Korea	To determine if knowledge, confidence, ability and satisfaction with learning differ	Quantitative study: Randomized quasi-experimental design Sample size: 190	The simulation took place in a dedicated room via a high fidelity human patient simulator. The two schools that implemented the	Undergraduate nursing students N = 127 20-minute	Knowledge, confidence and ability instruments were developed by the researchers. Satisfaction was	Simulation merged with pre-education helped students build knowledge, confidence in performance, ability in nursing practice, and satisfaction with the learning method in the	**4/5** Groups not comparable at baseline

		when students are educated through simulation combined with pre-education/ simulation only/ and pre-education only	Convenience sample	simulation used the same scenarios, evaluation tools, and a high-fidelity simulator; SimBaby mannequin.	simulation	measured by a validated scale	context of child health nursing practice.	
14. Lubbers et al. (2017)	US	To evaluate the use of medium fidelity simulation by measuring self confidence and satisfaction among novice learners	Quantitative study: Quasi-experimental design Sample size: 61 Convenience sample	Medium fidelity - Five simulations were utilized representing a variety of ages, diagnoses, and paediatric nursing roles. Adapted to represent community versus acute care experiences	Undergraduate nursing students N = 61 45-minute simulation	Educational Practices Questionnaire, Self-Confidence in Learning Questionnaire, and Simulation Design Scale	Students were satisfied and self-confident following their simulation experience. They also reported high levels of satisfaction with the fidelity of the simulation experience.	**2/5** Not representative of the target population Confounders not accounted for
15. Marken et al. (2010)	US	To design and implement a demonstration project (of which simulation was included) to teach interprofessional teams how to recognize and engage in difficult conversations with patients	Quantitative study: Questionnaire design and evaluation Sample size: 12 Convenience sample	A human simulator (the child) and a standardized patient (the mother) were used to model a situation where a mother had a sick child who needed attention.	Interdisciplinary teams consisting of pharmacy students and residents, student nurses, and Medical resident N = 12 Time: N.S.	Difficult conversations - Inter-professional Teams in Difficult Conversations Self-Assessment and the directed questions on past difficult conversations. Students' performance within simulations was assessed using a rubric completed by faculty observers. Student satisfaction	A significant change occurred in the pre- and Post intervention test or each question on the Inter Professional Teams in Difficult Conversations Survey. For all items, at least 50% of students moved 1 stage higher in the matrix. When evaluating the program, students said the course was thought provoking and led to self-reflection. They found debriefing to be a positive process and the feedback allowed them to see how to better approach patient situations in the future.	**3/5** No sampling strategy Not representative of the target population Statistical test used not reported on

						with the program was evaluated by a separate survey instrument administered at the end of the session		
16. McKeon et al. (2009)	US	To compare the effectiveness and efficiency of computer-based versus traditional manikin-based simulation on student learning	Quantitative study: Pre-test-post-test case study design Sample size: 65 Convenience sample	Computer based simulation created using SimWriter and traditional Manikin based simulation. The pre-test simulation was a paediatric Hispanic patient in sickle cell crisis; The post-test involved an adult intensive care unit patient with a severe closed head injury	Baccalaureate nurses N = 53 completed pre and post-test. 10-minute simulations	Four-item decision point that tested knowledge related to Quality and Safety Education for Nurses QSEN Competencies (QSEN) competencies.	There was a significant improvement (P<0.001) in the overall patient- centered care competency score for all students; no differences in scores were found by simulation intervention	**2/5** No sampling strategy Not representative of the target population Statistical test used not reported on
17. Megel et al. (2012)	US	To determine the effect of practice with a high-fidelity infant simulator on anxiety.	A mixed-methods study: quasi-experimental design Sample size: 52 Convenience sample	Low-fidelity learning experience without a human patient simulator. High-fidelity simulation experience with SimBaby manikin.	Undergraduate nursing students N = 52 1-hour simulation per group	Pre and post State anxiety (STAI) National League for Nursing (NLN) Student Satisfaction and Self Confidence in Learning Questionnaire Semi-structured, open-ended questions to elicit perceptions of students' comfort level Audiotaped focus	Pre anxiety scores were significantly lower than attention intervention students for students who practiced assessment with the manikin. Anxiety scores for both groups before and after simulation experiences in the LRC were not significantly different	**4/5** Rationale for mixed-methods not described

						group discussions		
18. Nagelkerk et al. (2014)	US	To determine whether staff and student Patient safety practices in a hospital-based, paediatric unit enhanced by didactic instruction, simulation experiences and clinical rounds with a safety coach to model and reinforce desired safety behaviours?	Quantitative study: quasi experimental design Sample size: 212 Convenience sample	The simulation for students focused on a premature 2 month old (3 weeks corrected age) infant hospitalized with respiratory syncytial virus either (a) experiencing respiratory distress or (b) subjected to IV fluid running too fast.	Interdisciplinary 78 undergraduate nursing students, 37 third-year medical students, 49 paediatric residents and the pilot unit staff of 48 registered nurses and nurse technicians N = 78 Time: N.S.	The Safety Knowledge Tool, the Safety Program Satisfaction Tool, the Behaviour Observation Tool (Healthcare Performance Improvement, 2006), the METI (Medical Education Technologies Inc., 2012) Simulation Effectiveness Tool and the Safety Dashboard.	Significant increases in students' safety-related knowledge Some increase for technicians and residents. RNs knowledge remained stable. Overall, the simulation was rated as being most successful with helping respondents think critically, communication and decision skills	**5/5**
19. Osman (2014)	US	To explore the impact of simulation when delivered at a district general hospital	Qualitative study Sample size: 6 Convenience sample	A real-time, high-fidelity simulation session in which groups of medical and nursing students managed a simulated patient as a team, using assessment and communication skills developed in previous sessions	Interdisciplinary Four final-year nursing and two final-year medical students 15 minute simulation	Focus group post simulation	The programme was well received, with students finding it 'helpful' and 'worthwhile'	**1/5** Data collection methods inadequate Findings not adequately derived from the data Interpretation and coherence of interpretation poor

20. Parker et al. (2011)	US	To examine learning outcomes (knowledge) and student perceptions of the simulation experience	Quantitative study: quasi-experimental randomized design Randomly assigned to either a traditional or hybrid (one third simulated clinical experience and two thirds traditional clinical experience) clinical group. Sample size: 41 Convenience sample	Child health clinical experts from the collaborating schools of nursing developed four scenarios that included foundational concepts important for all students rotating through a child health clinical experience (e.g., fluid, electrolyte, and acid-base balance, and oxygenation). Medium- to high-fidelity simulators and standardized patients were used.	Undergraduate nursing students N = 41 45 minute simulation	Final course grade was used as a measure to determine knowledge acquisition in the Child Health course. Three tools were used to assess students' perceptions of the clinical simulation. The Simulation Design Scale (SDS), The Educational Practices in Simulation Scale (EPSS), The Self-Confidence in Learning Using Simulations Scale	No statistically significant difference for course grades. The SDS results showed that the design of the simulation was rated as important or highly important to students. The EPSS scores demonstrated that the four educational practices measured were deemed important by students. SSSCLS indicated that students were satisfied with the simulation experience overall, and half of the students reported increased confidence with skills.	**3/5** Randomization not described Groups not comparable at baseline
21. Pauly-O'Neil & Nguyen (2013)	US	To determine if paediatric simulation settings offer the opportunity to practice the six QSEN competencies? And whether the activities available in each setting are comparable	Quantitative study: Observational design Sample size: 13 Convenience sample	Not stated	Undergraduate nursing students N=13 210 minutes simulation	Authors created Time on task/clinical observation tool to measures behaviour related to QSEN competencies	Students spent more time on QSEN activities in hospital than the simulation lab. In both hospital and simulation the variety of the 6 QSEN competencies did not receive significant amounts of time.	**3/5** No sampling strategy Not representative of the target population
22, Pauly-O'Neill & Prion (2013)	US	To determine the overall influence of a mixed	Quantitative study: Evaluative pre-test post-test pilot	Integrated simulation with clinical rotation. Each scenario contained	Undergraduate nursing students	Pre and post Knowledge of paediatric	Contributions of each instructional strategy was not separated. The overall impact	**3/5** No sampling

		educational approach on student knowledge and self-confidence with paediatric intravenous medication administration	design Sample size: 32 Convenience sample	medication administration opportunities.	N = 32 40 hours worth of simulation	medication administration – researcher-developed instrument	of an integrated approach to bridge the theory to practice gap may have great potential	strategy Not representative of the target population
23. Pohl (2017)	US	To compare paediatric knowledge and clinical simulation performance between hospital- and community-based paediatric clinical experiences	Mixed methods study: descriptive comparative design Sample size: 79 Convenience sample	Four paediatric simulations with the following diagnoses: meningitis, respiratory syncytial virus, urinary tract infection and cystic fibrosis	Prelicensure baccalaureate nursing students N = 79 Time: N.S.	Nursing care of children assessment test, Creighton Simulation Evaluation Instrument, Focus Groups	No significant difference in paediatric knowledge between the hospital and community group. Community based group scored higher on communication subscale (re. simulation performance) no other significant differences. In regard to focus groups, participants raised two concerns – lack of acute care paediatric experience and general feeling of discomfort and anxiety due to unfamiliar situations.	**1/5** Rationale for mixed-methods not described Methods not integrated Inconsistencies not adequately addressed Quality criteria of each method not adhered to
24. Rholdon (2018)	US	To examine the effect of simulation-based learning experiences on the acquisition and retention of knowledge, behaviour, and skills of nursing students regarding safe sleep practices.	Mixed-methods study: interventional pilot pre-test post-test design Sample size: 118 Convenience sample	Maternal-child simulation laboratory. Scenarios contained various aspects of an unsafe infant safe sleep environment and/or modifiable risk factors. A low-fidelity infant model and trained standardized patients to represent the mother and the nurse were used	Baccalaureate nursing students N = 51 15 minute simulation	10-item multiple-choice test to evaluate students' baseline knowledge of safe sleep practices and acquisition and retention of knowledge of safe sleep practice (researcher developed)	Statistically significant differences between mean pre-intervention / post-intervention written test scores, overall simulation performance scores, and safe sleep specific simulation scores were found. Four themes emerged: fidelity of simulation experience, simulation as a learning experience, benefits of debriefing, and new information gleaned about SUIDs.	**0/5** No rationale for using mixed methods Quant/qual elements not adequately integrated Methods not integrated

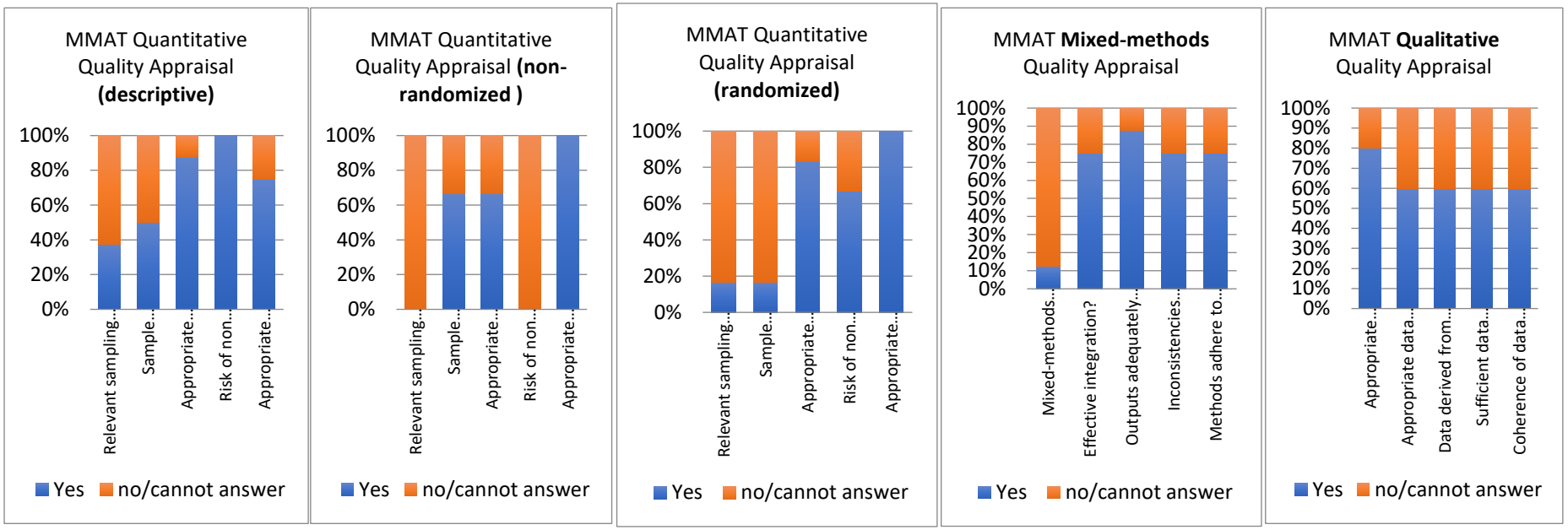
								Inconsistencies not adequately addressed Quality criteria of each method not adhered to
25. Searl et al. (2014)	Australia	To report on an innovative simulation technique that blends interpersonal theory with puppets	Qualitative study: evaluation using focus group method Sample size: 15 Convenience sample	Puppets behaving as children	Undergraduate nursing students N = 15 Time = N.S.	Thematic Analysis of Focus Groups	The study deepened insights about the educative process and led to learning impacts that suggest that puppet-based learning is a powerful medium to bridge theory and practice, bringing the importance of interpersonal theory to life for students	**5/5**
26. Shin (2014)	South Korea	To examine the effect of integrated paediatric nursing simulation courseware on students' critical thinking and clinical judgment	Quantitative study: pre-test post-test design Sample size: 100 Convenience sample	The scenarios consisted of simple and complex paediatric nursing cases, as well as basic nursing assessment and interventions. Basic nursing assessment and intervention included checking vital signs in infants; using respiratory interventions; interacting among nurses, children, and parents; applying fever management techniques; administering oxygen; prioritizing medications ordered by physicians; and monitoring oxygen saturation and blood pressure	Senior undergraduate nursing students N = 95 Time = N.S.	Learning outcomes were evaluated by the critical thinking disposition tool, the Lasater Clinical Judgment Rubric (LCJR) and the Simulation Effectiveness Tool	Critical thinking scores increased significantly (pre to post). LCJR scores were similar for both simple and complex simulation. Most were satisfied with the simulation.	**4/5** Not representative of the target population

27. Stewart (2010)	UK	To develop, implement and evaluate an interprofessional undergraduate programme using simulation to learn clinical competencies, and communication and team working skills.	Mixed-methods study: validated evaluative questionnaire. Sample size: 85 Convenience sample	Six clinical scenarios were developed (bronchiolitis, croup, asthma, meningococcal septicaemia, acute gastroenteritis and heart failure)	Interdisciplinary Fourth-year medical and third-year nursing students N= 85 20 minute simulation max	Validated quant and qual responses on 32 item questionnaire Examined 4 domains – acquisition of knowledge and skills, communication and teamwork, professional identity and attitudes to shared learning	Scores were high on quantitative measures suggesting participants were generally positive about simulation. A number of themes also emerged related to the domains discussed in the questionnaire.	**4/5** Rationale for mixed-methods not described
28. Small (2018)	Canada	To learn about baccalaureate nursing students' lived experience of high-fidelity simulation of paediatric cardiopulmonary arrest.	Qualitative study: phenomenological methods Sample drawn from a group of third-year BN students Purposive sampling	High-fidelity simulation of paediatric cardiopulmonary arrest.	Baccalaureate nursing students N = 12 Time = N.S.	Unstructured interviews digitally recorded and transcribed	The students found the simulation to be a surprisingly realistic nursing experience as reflected in their perceiving the manikin as a real patient, thinking that they were saving their patient's life, feeling like a real nurse, and feeling relief after mounting stress. It was a surprisingly valuable learning experience	**5/5**
29. Valler-Jones (2014)	UK	To analyse the effectiveness of peer-led simulations	Mixed Methods study: observation and pre-test post-test questionnaire, open-ended questions Sample size: 24 Purposive sampling	Peer-led simulations Students designed and facilitated a simulation based on the care of a critically ill child.	Child field of practice preregistration student nurses N = 24 15 - 20 minute simulation	Facilitators examined performance via video-recordings. Students completed an evaluation of their perceived confidence and competence levels. Thematic analysis	There was 100% pass rate in the assessment of students' clinical competence following the simulation. Thematic analysis of the evaluation highlighted the learning achieved by the students, not only of their clinical skills but also their personal development.	**4/5** Rationale for mixed-methods not described
30. Victor-Chmil	US	To examine students (a)	Quantitative study – evaluative post-	Child Abuse Reporting Interprofessional	Interdisciplinary	Online survey, researcher created.	Overall, 86% of the responding participants felt that the quality	**3/5**

(2016)		being immersed in a realistic yet safe situation in which child abuse needs to be reported, (b) work together to problem solve, and (c) collaborate and communicate to effectively assess, provide care, and evaluate family dynamics in a community setting.	simulation questionnaire Sample size: 129 Convenience sampling	Simulation-Based Experience (CAR-IBSE)	55 nursing and 74 pharmacy students N = 36 (66% response rate) 20 minute simulation		of the CAR-ISBE was high. 84% reported that they would recommend this simulation to other students, and 77% expressed an interest in participating in more interprofessional simulation activities.	Measures and statistical analysis not appropriate
31. Wyllie (2019)	UK	To provide a formal evaluation to assess the value of simulation as a method of delivery for safeguarding children in pre-registration preparation of children's nurses.	Qualitative study: Observation of simulation and semi-structured interviews Sampling consisted of a single cohort of second year student children's nurses Purposive sampling	A simulation exercise was developed in which students working in small groups within the Clinical Simulation Unit are assigned to a particular "patient". Each patient has some physical signs of abuse or neglect (e.g. an adult bite mark) and a small amount of background information is provided	Pre-registration nursing students (child branch) N = 6 Time = N.S.	Thematic analysis	The results suggest that the selection of simulation as a teaching approach to developing knowledge and skills in respect of safeguarding children does merit further exploration	**5/5**
32. Zimmerman et al. (2019)	US	To describe the development of paediatric simulation	Evaluative study / anecdotal evidence	Each child and parent simulation encompasses a systems assessment, an SBAR report to the	Baccalaureate nurses N = 37 for the	Percentages of Likert scale evaluation responses	This novel approach satisfies the students' expressed learning needs to "walk in the shoes" of a sick child's parent	N/A

		experiences that actively incorporates the role of a parent.	Describes the simulation designed, how it has been refined through experience and the evaluation of one class undertaking the simulation	nurse practitioner, medical math calculations, an embedded error in the orders, and a need for patient education.	evaluation component 75-minute simulation		and more confidently inter- act empathetically with parents.	

Figure 2. Quality appraisal graphs/tables



RESULTS

Quality appraisal results

Overall the quality of the studies combined was average to good with the appropriate methods being used to answer the questions being raised (Figure 2). The mixed-methods and qualitative studies had the highest quality, with the quantitative designs having a lower overall quality. Individually, the descriptive quantitative studies had shortcomings related to sampling strategy and size and therefore had a higher degree of risk of bias. None of the non-randomized quantitative studies met their target population or addressed potential confounders in the design or analysis. They also lacked in the type of measurements used to address the research question and the reporting of complete outcome data. The randomized quantitative studies generally failed to describe how they conducted the randomization, and failed to provide baseline characteristics; this significantly increased the potential for bias. The mixed-methods studies mainly lacked in describing their rationale for using the approach. Whereas the qualitative studies slightly lacked in the data collection methods used, and the interpretation of the results. Two studies (one qualitative and one mixed-methods) didn't meet any of the quality criteria (Cole & Foito, 2019; Rholdon, Lemoine, & Templet, 2018), and five (three qualitative, one quantitative and one mixed-methods) met all of the quality criteria for their study type (Davies, Nathan, & Clarke, 2012; Nagelkerk et al., 2014; Searl et al., 2014; Small, Colbourne, & Murray, 2018; Wyllie & Batley, 2019).

Combined study descriptive results

17 papers were based on quantitative research approaches (eight x descriptive; three x non-randomized; six x randomized), five employed qualitative methods, and eight employed mixed-methods. A further two produced only anecdotal evidence. The research took place in six different geographical locations with the majority taking place in the USA (19), UK (5), and South Korea (3). Two were undertaken in Australia and Canada, and one in Turkey. The combined quantitative population target sample was 3,395 with an actual sample of 1,372. The combined mixed-methods sample population was 589 with a response/participant rate of 483. There were a total of 184 participants included in the qualitative studies. Simulation time ranged

from five minutes to 40 hours with the average being 20 minutes. The earliest study was published in 2009, however the majority of studies were published from 2014 onwards.

Textual narrative synthesis results

The included studies have been categorized according to the aims and objectives of the studies, the simulation types used, and simulation fidelity. Sub-headings within each category narrate and synthesize the studies included.

Study aims & objectives types

Effectiveness studies

The majority of studies identified through the search aimed to test the effectiveness of a simulation intervention (Arslan et al., 2018; Fitzgerald & Ward, 2019; Goldsworthy, Patterson, Dobbs, Afzal, & Deboer, 2019; Harris, 2011; Kirkpatrick et al., 2018; Kubin & Wilson, 2017; Lee, Kang, Park, & Kim, 2017; Marken, Zimmerman, Kennedy, Schremmer, & Smith, 2010; McKeon, Norris, Cardell, & Britt, 2009; Megel et al., 2012; Nagelkerk et al., 2014; Parker et al., 2011; Pauly-O'Neill & Prion, 2013; Pohl, Jarvill, Akman, & Clark, 2017; Rholdon et al., 2018; Shin & Kim, 2014; Valler-Jones, 2014). This was achieved through comparing traditional forms of pedagogical approaches to simulation-based approaches, assessing examination scores and grade changes, testing pre and post changes in levels of confidence, satisfaction, self-efficacy, knowledge, critical thinking, skills acquisition, and clinical judgement and competence. All studies showed a significant increase in effectiveness across all domains. One study (Harris, 2011) saw no difference between groups of paediatric nursing examination scores but saw a significant difference in course grades, with the intervention (simulation) group ultimately having higher grades. However, none were able to demonstrate that any positive changes were long-lasting and transferred to practice. The type and quality of the research designs used mean that the findings are not generalizable beyond the local institution where the simulations were conducted. Additionally, because many of the quantitative-based studies did not assess comparability of participants at baseline, conduct appropriate randomization of groups (where required), or address potential confounding factors, the risk of bias in the studies is high and therefore the results should be treated with caution.

Evaluative studies

Many studies evaluated the perceptions of students and their use of a range of paediatric nursing simulations (Davies et al., 2012; Gamble, 2017; Kim, Oh, Kang, & Kim, 2014; Lubbers & Rossman, 2017; Stewart, Kennedy, & Cuene-Grandidier, 2010; Victor-Chmil & Foote, 2016; Wyllie & Batley, 2019). All studies deemed the simulation intervention as favourable. The overall quality of these types of studies was good to high, however they say little beyond giving insight into participant satisfaction and acceptability of the simulation. Furthermore these studies were often prone to risk of bias.

Explorative studies

Several studies aimed to explore the value of paediatric simulations in terms of how students perceived specific types of simulations (such as immersive simulations), the impact of where the simulation was delivered (in clinical practice), whether or not the approach offered students the chance to practice particular competencies and scenarios, and to explore the students lived-experience of undertaking a paediatric simulation (Alinier et al., 2014; Cole & Foito, 2019; Osman, 2014; Pauly-O'Neill, Prion, & Nguyen, 2013; Small et al., 2018). The overall quality of the studies was very poor, however, Small et al. (2018) was of a high standard and was unusual in its focus being that of the lived experience of simulation; something that is often not considered in simulation-based research but which provided a new insight and understanding.

Descriptive studies

Three studies described a simulation intervention (Aldridge, 2017; Searl et al., 2014; Zimmermann & Alfes, 2019). Two of the studies did this using anecdotal evidence and one using a qualitative evaluative approach. Those that used anecdotal evidence described how the simulation was developed, and reported on student feedback they had recalled. The qualitative study described a unique approach to simulation that blended interpersonal theory with puppets behaving as children, arguing that any medium that aims to bridge the gap between theory and practice is beneficial for learning. The quality of this study was deemed high and provided a unique approach to simulation as well as a unique insight.

Simulation types

Individual-based simulations

Just over half of the studies used simulations that had a single-patient focus (Aldridge, 2017; Cole & Foito, 2019; Goldsworthy et al., 2019; Harris, 2011; Kim et al., 2014; Lee et al., 2017; Marken et al., 2010; McKeon et al., 2009; Megel et al., 2012; Nagelkerk et al., 2014; Osman, 2014; Parker et al., 2011; Pohl et al., 2017; Rholdon et al., 2018; Small et al., 2018; Valler-Jones, 2014; Victor-Chmil & Foote, 2016). These studies therefore tended to focus on specific skills needed to assess and care for a sick child. Some ensured the role of the parent was included whereas the majority solely included the child.

Group-based simulations

The other half of the studies included more than one child patient and multiple students as healthcare providers (Alinier et al., 2014; Arslan et al., 2018; Davies et al., 2012; Fitzgerald & Ward, 2019; Gamble, 2017; Kirkpatrick et al., 2018; Lubbers & Rossman, 2017; Osman, 2014; Pauly-O'Neill & Prion, 2013; Searl et al., 2014; Shin & Kim, 2014; Stewart et al., 2010; Wyllie & Batley, 2019; Zimmermann & Alfes, 2019). These were usually presented as ward-based simulations, immersive simulations, or community-based simulations. They often provided a more holistic team-based approach to the care of children within a healthcare system.

Simulation fidelity

The type of simulation fidelity that was used for the study was often given, however, how the fidelity had been assessed was often not described. Where studies did try to describe the rationale for the studies fidelity level, it was often based on whether a high-functioning mannequin was used or not, or based on how complex the simulation was deemed to be. For example, Megel et al. (2012) compared a ‘low-fidelity learning experience (without a human patient simulator)’ with a ‘high-fidelity simulation experience (with a SimBaby Mannequin)’. Goldsworthy et al. (2019) on the other hand refers to high-fidelity cases; relating to the level of complexity the case presents the learner. Osman (2014) refers to ‘high-fidelity’ as an interdisciplinary simulation involving a simulated patient, and Alinier et al. (2014) refers to it in relation to the level of immersion involved.

DISCUSSION

The types of studies included in the search results varied widely with a range of methodologies used and clinical areas of focus. The overall sample population was small considering the number of undergraduate nurses trained globally each year. The majority of studies were conducted in the USA even though their undergraduate programme doesn't train undergraduate paediatric nurses specifically. This is surprising when there are whole countries in Europe that do train nurses in the sub-specialties as undergraduates. It could therefore be assumed that this form of early specialization would provide more scope for studies of this sort to be conducted in these countries. The type and length of the simulations undertaken also varied greatly; this highlights the sheer variety and complexity of not only the simulations themselves but also the healthcare systems that they mirror.

The lack of studies in this area pre 2009, and the increase in reporting studies of these types since 2014 reveals an increasing interest in and use of paediatric simulations to train undergraduate nurses. This review is therefore timely and provides a much needed insight into this field of study.

The textual narrative synthesis of this review proved a useful way to describe difference in the included studies, making explicit the diversity in study designs and contexts. It also described gaps in the literature, both by showing where evidence was absent and by making an evaluation of the strength of evidence in different areas. Using this method has enabled us to comment on the types of paediatric-based simulation studies being conducted, and the lack of evidence in regards to transferring these skills to practice and long-term changes to student's knowledge. It also highlighted the different types of paediatric simulation being undertaken globally, revealing the vast number of ways simulation can be researched. In order to ensure that the research is better equipped to provide a greater understanding of paediatric nursing simulations, defining the types of simulation (design) used in paediatric undergraduate nurse training is essential. This would also allow for better comparisons amongst studies as well as replication of the simulations themselves.

The studies included in this review focused on two distinct simulation designs. The individual-based approach focused on specific skills important for caring for a child, whereas the group-based approach focused more on the teamwork and systemic aspects of caring for multiple children alongside other healthcare professionals at anyone time. Both are crucial for student

paediatric nurses to learn. However, an individual-based approach may be more useful for those who are more novice than those who are more experienced and a group-based approach for those who have had more exposure to the clinical world. This should be an important consideration in designing future simulations and studies.

Simulation fidelity is a complex issue that is debated globally (Massoth et al., 2019; Munshi, Lababidi, & Alyousef, 2015). Fidelity relates to the realism that a simulation creates (Bratley et al., 1983). There have been many attempts to categorize what fidelity means and to generate levels from low to high. Tun, Alinier, Tang, and Kneebone (2015) argue that the notion of fidelity is manufacture driven and related purely to the equipment used rather than the design or experience. Pelletier and Kneebone (2016) state that fidelity has a different meaning for different professions. Where a high-functioning, but ultimately plastic mannequin may work well for performing certain procedures (Blood Pressure, Heart Rate, Taking bloods, etc.) it is still unable to convey important human physical conditions and emotions such as raised intercostal muscles when a patient is in pain, skin temperature and pallor. Therefore, the realism or 'fidelity' is dependent on the learning outcomes to be achieved and the level of healthcare at which the student has been exposed to. For example, an anesthetist in a surgical simulation may find a high functioning model extremely realistic, as most of their clinical tasks will be based on the machinery attached to the patient and not the patient themselves. However, a simulation of a child presenting in A&E where a nurse has to quickly assess how unwell a child is based on little information may rely more on the child's behavior and responsiveness, something a mannequin would struggle to replicate but a simulated patient could do well. Ultimately, all types of simulation require a trade off on what can be achieved and what can't in order to create a good level of fidelity. While fidelity was reported in a number of the studies above, how this was determined was either unclear or varied between studies. Before a simulation is designed, the learning objectives and needs of the students/participants and research should be carefully considered, working backwards to determine what types of simulation could achieve these requirements. This also arguably highlights the need for greater theoretical engagement with the issue of fidelity more generally.

Limitations

Due to the broadness and limited studies within the field of paediatric simulation for undergraduate nurses, we were unable to generate any strong evidence on any particular components or uses of simulation in this context. However, the review has provided simulation providers and researchers with a better understanding of what is being undertaken globally, its value and what further research is needed to strengthen our understanding and advance the field.

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CONCLUSION

This review revealed a high heterogeneity of studies in this subject area. Ultimately, studies were small and confined to single institutions or geographical locations. A range of existing validated questionnaires, scales and assessment techniques were used to test effectiveness; however, all bar one did not meet the requirement for high quality. Evaluation studies were of a higher quality although this approach says little beyond outlining participant satisfaction. Those that described or explored simulations as an intervention provided more interesting insights.

The variety of simulation types was wide but two distinct approaches were revealed, those that focused on a single patient and those that took a more systems-based approach, as in how healthcare systems are currently run. Therefore, this distinction should be justified from the outset when designing a simulation alongside more detail of what the simulation entails.

The fidelity of the simulations being described was frequently noted in the included studies, however no reference was made as to how this was determined. Therefore more distinction between whether a simulation is deemed low, medium or high in technological, psychological or environmental aspects is required.

Including all these considerations will make for clearer reporting and more consistent approaches to developing undergraduate paediatric nursing simulation-based research.

Conflict of Interest statement

None

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REFERENCES

Aldridge, M. D. (2017). Standardized Patients Portraying Parents in Pediatric End-of-Life Simulation. *Clinical Simulation In Nursing, 13*(7), 338-342.

Alinier, G., Harwood, C., Harwood, P., Montague, S., Huish, E., Ruparelia, K., & Antuofermo, M. (2014). Immersive clinical simulation in undergraduate health care interprofessional education: Knowledge and perceptions. *Clinical Simulation In Nursing, 10*(4), e205-e216.

Arksey, H., & O'Malley, L. (2005). Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology, 8*(1), 19-32.

Arslan, F. T., Türkmen, A. S., Çelen, R., Özkan, S., Altıparmak, D., & Şahin, A. (2018). Comparing traditional and simulation-based experiences in pediatrics with undergraduate nursing students in Turkey. *Clinical Simulation In Nursing, 16*, 62-69.

Bradley, S.F. (2003). Pride or prejudice – issues in the history of children's nurse education. *Nurse Education Today* 23, 362–367.

Bratley, P., Fox, B. L., & Schrage, L. E. (1983). A Guide to Simulation (2nd ed.). London: Springer-Verlag.

Cant, R.P. Cooper, S.J. (2017). Use of simulation-based learning in undergraduate nurse education: An umbrella systematic review. *Nurse Education Today, 49*, 63-71.

Clarke, S. (2017). The History of Children's Nursing and Its Direction Within the United Kingdom. *Comprehensive Child and Adolescent Nursing,* 4(3), 200-214.

Connolly, C. (2005). Historical perspectives in pediatrics. *Pediatric Nursing*, 31 (3), 211-215

Cole, M. A., & Foito, K. (2019). Pediatric end-of-life simulation: Preparing the future nurse to care for the needs of the child and family. *Journal of Pediatric Nursing, 44*, e9-e12.

Davies, J., Nathan, M., & Clarke, D. (2012). An evaluation of a complex simulated scenario with final year undergraduate children's nursing students. *Collegian, 19*(3), 131-138.

Davis. R. (2008). Children's nursing and future directions: Learning from 'memorable events'. *Nurse Education Today.* 28, 814–821

Fitzgerald, M., & Ward, J. (2019). Using standardized actors to promote family-centered care. *Journal of Pediatric Nursing, 45*, 20-25.

Foronda, C., Liu, S., & Bauman, E. B. (2013). Evaluation of simulation in undergraduate nurse education: an integrative review. *Clinical Simulation In Nursing.* 9, e409-e416.

Gamble, A. S. (2017). Simulation in undergraduate paediatric nursing curriculum: Evaluation of a complex 'ward for a day'education program. *Nurse Education in Practice, 23*, 40-47.

Goldsworthy, S., Patterson, J. D., Dobbs, M., Afzal, A., & Deboer, S. (2019). 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, 28*, 25-32.

Harris, M. A. (2011). Simulation-enhanced pediatric clinical orientation. *Journal of Nursing Education, 50*(8), 461-465.

Hong, Q. N., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., et. al. (2018). The Mixed Methods Appraisal Tool (MMAT) version 2018 for information professionals and researchers. *Education for Information, 34*(4), 285-291.

Hong, Q. N., Pluye, P., Bujold, M., & Wassef, M. (2017). Convergent and sequential synthesis designs: implications for conducting and reporting systematic reviews of qualitative and quantitative evidence. *Systematic Reviews, 6*(1), 61.

Kim, S.-J., Oh, J., Kang, K.-A., & Kim, S. (2014). Development and evaluation of simulation-based fever management module for children with febrile convulsion. *Nurse Education Today, 34*(6), 1005-1011.

Kirkpatrick, A., Ball, S., Connelly, S., Hercinger, M., Hanks, J., Potthoff, M., et. al. (2018). Intraprofessional Simulation's Impact on Advanced Practice and Baccalaureate Student Self-Efficacy. *Clinical Simulation In Nursing, 16*, 33-39.

Kubin, L., & Wilson, C. E. (2017). Effects of community volunteer children on student pediatric assessment behaviors. *Clinical Simulation In Nursing, 13*(7), 303-308.

Lee, M. N., Kang, K. A., Park, S. J., & Kim, S. J. (2017). Effects of pre-education combined with a simulation for caring for children with croup on senior nursing students. *Nursing & Health Sciences, 19*(2), 264-272.

Lubbers, J., & Rossman, C. (2017). Satisfaction and self-confidence with nursing clinical simulation: Novice learners, medium-fidelity, and community settings. *Nurse Education Today, 48*, 140-144.

277 Lucas, P. J., Baird, J., Arai, L., Law, C., & Roberts, H. M. (2007). Worked examples of
278 alternative methods for the synthesis of qualitative and quantitative research in systematic
279 reviews. *BMC Medical Research Methodology, 7*(1), 4.
280 Mahnke, C.B. (2000). The growth and development of a specialty: The history of
281 pediatrics. *Clinical Pediatrics. 39*, 705–714.
282 Marken, P. A., Zimmerman, C., Kennedy, C., Schremmer, R., & Smith, K. V. (2010). Human
283 simulators and standardized patients to teach difficult conversations to interprofessional
284 health care teams. *American Journal of Pharmaceutical Education, 74*(7).
285 Massoth, C., Röder, H., Ohlenburg, H., Hessler, M., Zarbock, A., Pöpping, D. M., & Wenk, M.
286 (2019). High-fidelity is not superior to low-fidelity simulation but leads to
287 overconfidence in medical students. *BMC Medical Education, 19*(1), 29.
288 McKeon, L. M., Norris, T., Cardell, B., & Britt, T. (2009). Developing patient-centered care
289 competencies among prelicensure nursing students using simulation. *Journal of Nursing*
290 *Education, 48*(12), 711-715.
291 Megel, M. E., Black, J., Clark, L., Carstens, P., Jenkins, L. D., Promes, J., et. al. (2012). Effect of
292 high-fidelity simulation on pediatric nursing students' anxiety. *Clinical Simulation In*
293 *Nursing, 8*(9), e419-e428.
294 Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Group, a. t. P. (2009). Preferred Reporting
295 Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *Annals of*
296 *Internal Medicine, 151*(4), 264-269.
297 Munshi, F., Lababidi, H., & Alyousef, S. (2015). Low-versus high-fidelity simulations in
298 teaching and assessing clinical skills. *Journal of Taibah University Medical Sciences,*
299 *10*(1), 12-15.
300 Nagelkerk, J., Peterson, T., Pawl, B. L., Teman, S., Anyangu, A. C., Mlynarczyk, S., & Baer, L.
301 J. (2014). Patient safety culture transformation in a children's hospital: An
302 interprofessional approach. *Journal of Interprofessional Care, 28*(4), 358-364.
303 Naseer, A., Eldabi, T., & Jahangirian, M. (2009). Cross-sector analysis of simulation methods: a
304 survey of defense and healthcare. *Transforming Government: People, Process and Policy*
305 3(2), 181–189.
306 Noyes, J., Booth, A., Moore, G., Flemming, K., Tunçalp, Ö., & Shakibazadeh, E. (2019).
307 Synthesising quantitative and qualitative evidence to inform guidelines on complex

interventions: clarifying the purposes, designs and outlining some methods. *BMJ Global Health, 4*(Suppl 1), e000893.

Nursing & Midwifery Council. (2018). *Education Standards Consultation Response.* May 2018. https://www.nmc.org.uk/globalassets/sitedocuments/education-standards/education-standards-consultation-reponse-may-2018.pdf. Accessed February 2020.

Osman, A. (2014). Undergraduate interprofessional paediatric simulation in a district general hospital. *Medical Education, 48*(5), 527-528.

Parker, R. A., McNeill, J. A., Pelayo, L. W., Goei, K. A., Howard, J., & Gunter, M. D. (2011). Pediatric clinical simulation: A pilot project. *Journal of Nursing Education, 50*(2), 105-111.

Pauly-O'Neill, S., & Prion, S. (2013). Using integrated simulation in a nursing program to improve medication administration skills in the pediatric population. *Nursing Education Perspectives, 34*(3), 148-153.

Pauly-O'Neill, S., Prion, S., & Nguyen, H. (2013). Comparison of Quality and Safety Education for Nurses (QSEN)–Related Student Experiences During Pediatric Clinical and Simulation Rotations. *Journal of Nursing Education, 52*(9), 534-538.

Pelletier, C., & Kneebone, R. (2016). Fantasies of medical reality: an observational study of simulation-based medical education. *Psychoanalysis, Culture & Society, 21*(2), 184-203.

PNAE (Paediatric Nursing Associations of Europe). (2010). Paediatric Nurse Education across Europe 2010 Summary of key findings. https://www.nsf.no/Content/801048/Findings%20Paediatric%20Nurse%20Education%20across%20Europe%202010.pdf. Accesed February 2020.

Pohl, C., Jarvill, M., Akman, O., & Clark, S. (2017). Adapting pediatric clinical experiences to a changing health care environment. *Nurse Educator, 42*(2), 105-108.

Rholdon, R. D., Lemoine, J., & Templet, T. A. (2018). Simulation: Improving knowledge and retention of infant safe sleep practices. *Clinical Simulation In Nursing, 19*, 38-42.

Robertson, J., & Bowlby, J. (1952) Responses of young children to separation from their mothers. Courrier de la Centre International de l'Enfance, 2, 131-142.

Robertson, J., & Robertson, J. (1968) Jane 17 Months; in Fostercare for 10 Days (Film). Tavistock Institute of Human Relations, London. https://www.youtube.com/watch?v=s14Q-_Bxc_U Last accessed February 2020.

Searl, K. R., McAllister, M., Dwyer, T., Krebs, K. L., Anderson, C., Quinney, L., & McLellan, S. (2014). Little people, big lessons: An innovative strategy to develop interpersonal skills in undergraduate nursing students. *Nurse Education Today, 34*(9), 1201-1206.

Shin, H., & Kim, M. J. (2014). Evaluation of an integrated simulation courseware in a pediatric nursing practicum. *Journal of Nursing Education, 53*(10), 589-594.

Small, S. P., Colbourne, P. A., & Murray, C. L. (2018). High-Fidelity Simulation of Pediatric Emergency Care: An Eye-Opening Experience for Baccalaureate Nursing Students. *Canadian Journal of Nursing Research, 50*(3), 145-154.

Stewart, M., Kennedy, N., & Cuene-Grandidier, H. (2010). Undergraduate interprofessional education using high-fidelity paediatric simulation. *The Clinical Teacher, 7*(2), 90-96.

Tong, A., Flemming, K., McInnes, E., Oliver, S., & Craig, J. (2012). Enhancing transparency in reporting the synthesis of qualitative research: ENTREQ. *BMC Medical Research methodology, 12*(1), 181.

Tun, J. K., Alinier, G., Tang, J., & Kneebone, R. L. (2015). Redefining simulation fidelity for healthcare education. *Simulation & Gaming, 46*(2), 159-174.

Valler-Jones, T. (2014). The impact of peer-led simulations on student nurses. *British Journal of Nursing, 23*(6), 321-326.

Victor-Chmil, J., & Foote, E. (2016). An interprofessional simulation for child abuse reporting. *Clinical Simulation In Nursing, 12*(3), 69-73.

Wyllie, E., & Batley, K. (2019). Skills for safe practice–A qualitative study to evaluate the use of simulation in safeguarding children teaching for pre-registration children's nurses. *Nurse Education in Practice, 34*, 85-89.

Zimmermann, E., & Alfes, C. M. (2019). Simulating the Role of the Parent: Promoting Family-Centered Nursing Care. *Nursing Education Perspectives, 40*(2), 121-122.