A Scoping Review on the Status of Clinical Simulation in Healthcare Education in the Philippines

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ABSTRACT

Background. Simulation immerses learners in guided replications of real-life experiences. Simulation-based learning in the health profession allows trainees and professionals to practice skills in a controlled environment using various modalities, enhancing patient safety and minimizing clinical errors.

Objective. To describe the profile of Philippine studies on clinical simulation in healthcare professional education and assess the methodological quality of these studies.

Methods. We conducted a scoping review of studies on clinical simulation studies in healthcare education in the Philippines. We followed the methods for scoping review and reported using the PRISMA Scoping review checklist. We searched for relevant studies from electronic databases (PubMed, Scopus, CENTRAL, Herdin, and Cochrane) as of May 17, 2024, and summarized descriptive data on the characteristics of the study, population, clinical simulation technique, and outcomes, using graphical summaries and tables. We assessed the methodological quality of included studies using the Modified Medical Education Research Study Quality Instrument (MMERSQI).

Results. We included 13 studies mostly published in the 2020s (7), by faculty as main author (9), with hospital affiliation (10), single-center (11), setting in NCR (11), analytic (10), medical field (10), educational purpose (7), using task trainers (5), low- to medium-fidelity (11), with technical competencies (mostly skills) as desired outcome (9), median sample size of 40, and including mostly postgraduate level participants (7). There was moderate methodological quality (median MMERSQI score, 51 [range, 40, 77] with the 'type of data' item being highly reported and 'validity of instrument tool' item poorly reported.

Conclusion. The observed gaps in methodological rigor, study design, and fidelity of simulation techniques in healthcare education in the Philippines highlight opportunities for advancing the field. Future research should aim to address these gaps, particularly by increasing the use of RCTs, enhancing the validity of measurement tools, and incorporating comprehensive simulation components.

Keywords: clinical simulation, simulation-based education, simulation training, scoping review, healthcare education, Philippines

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INTRODUCTION

Simulation is defined as a technique that creates a situation or environment for participants to experience a representation of an event for the purposes of practice, learning, evaluation, and testing.[1] Moreover, it is a technique intended to immerse learners in guided representations of real-life experiences in a fully interactive manner, giving them a deeper understanding of human actions or systems.[1,2] It may also consist of modalities to promote, improve, or validate participants to improve their real life performances.[3]

In the healthcare setting, simulation is often used to promote patient safety by creating a situation or environment that represents a real-life health care event, which is experienced by the participant.[1] Originating from the field of nursing in the 1910s,[4] the practice of simulation eventually spread to other fields of medicine, notably Anesthesiology in the 1960s[5]. In medicine, clinical simulation or simulation-based medical education is the innovative and experiential pedagogical approach that allows healthcare trainees to practice clinical skills in a controlled and safe environment.[6] This technique utilizes various simulation modalities within environments that closely mimic real-life clinical scenarios, enabling participants to rehearse their responses and actions.[7] Both the modality and execution of the simulation contributes to the fidelity of the activity, dictating the physical, semantic, emotional, and experiential accuracy that controls the extent of the experience.[8] Simulation modalities include manikins, task trainers, standardized patients with actors (i.e., role players), computer-based and virtual reality, visually-enhanced models (VEMs), and cadavers.[9] The structure of clinical simulation is meticulously organized into stages that include prebriefing, the scenario enactment, and debriefing. Clinical simulation serves four main purposes – education, assessment, research, and health systems integration.[10] It plays a critical role in healthcare education, particularly in enhancing patient safety and minimizing clinical errors.[11,12] As such, it is valuable in improving healthcare systems and processes by providing a platform for diagnosing issues and testing new methodologies before they are implemented in actual practice.[7]

In the Philippines, healthcare professionals encompass a wide range of practitioners regulated by various laws. This includes doctors, dentists, nurses, pharmacists, nutritionists, optometrists, physical and occupational therapists, and midwives, as defined by specific Republic Acts.[13] The diversity and scope of healthcare professions underline the importance of clinical simulation in providing comprehensive and practical training across different fields. Understanding the role and impact of clinical simulation within the context of Philippine healthcare education is crucial for developing more effective teaching strategies and improving overall healthcare delivery.

Previous systematic reviews were conducted on clinical simulation for healthcare education, but none included the Philippine setting, highlighting a gap in the global literature (Appendix A). Most existing reviews are restricted to English-language publications, with few incorporating studies in other languages such as Spanish, Portuguese, and German.[14-22] This language restriction could limit the inclusivity and comprehensiveness of findings. Additionally, many reviews focus primarily on nursing education or combine multiple disciplines, often without a formal control group, relying instead on pre- and post-test comparisons.

The studies reviewed generally support the efficacy of clinical simulation in enhancing healthcare education, particularly in skill acquisition and self-confidence, with outcomes comparable to traditional clinical placements. However, the evidence remains constrained by small sample sizes, a lack of high-quality randomized control trials, and the absence of standardized qualitative measurement tools.

The main thrust of this study is to describe the profile of Philippine studies on clinical simulation in healthcare professional education and assess the methodological quality of these studies. By analyzing the status of clinical simulation in the Philippines, we will be able to identify strengths and areas for improvement in the curricula of healthcare education in the Philippines as well as in the teaching and learning methods. These findings can serve as a guide for curricular revisions to enhance health science education with improved resource allocation. This will ultimately improve patient safety and patient outcomes. This study will also lay the groundwork for the identification of research gaps in clinical simulation in the Philippines to guide future research initiatives. The significance of this study lies in its potential to inform policy and practice, contributing to the advancement of healthcare education and the optimization of clinical training programs in the Philippines.

METHODS

Study Design/Duration/Setting

We conducted a scoping review of studies on clinical simulation in medical and allied medical education among Filipinos. The scoping review followed recommendations and was reported according to the PRISMA scoping review reporting guidelines.[23-25] The study protocol was exempted by the University of the Philippines Manila ethics board (REB No.2024-0582-EXEMPT) and is available from the author upon request.

The study was conducted from August 13 to September 2, 2024 primarily online by extracting data from electronic copies of published articles.

Data Collection and Processing

We used the Population-Concept-Context framework to identify inclusion criteria that guided our search strategy and eligibility assessment criteria.[26]

Inclusion/Exclusion Criteria

The following were used for inclusion criteria: (Population), Filipino healthcare professionals and students/trainees; (Exposure), clinical simulation modalities including full scenario runs using manikins or cadavers or models, with or without prebrief and debrief, skills labs using task trainers, and other methods (e.g., standardized patients, computer-based learning); (Comparator), any traditional learning tool or no comparator; (Outcomes), knowledge, skills, and attitudes, whether quantitative or qualitative, and (Study design), any study design, including case report/series, observational, experimental. Exclusion criteria were commentaries/corres-

pondence letters/abstracts without full texts, and those studies involved in patient education.

Search Strategies

We searched the following electronic databases (PubMed, Scopus, Herdin) (from inception to May 17, 2024) and CENTRAL (from inception to June 15, 2024) and secondary sources [handsearching relevant journals (Acta Medica Philippina, Philippine Journal of Health Research and Development, Philippine Journal of Science)]. Search strategies based on the search terms for the concept of 'simulation' and 'Philippines" were chosen to have a broader reach since simulation in healthcare is still a relatively new field in the Philippine setting (Appendix B). After merging search results from the databases, duplicate records were removed using Rayyan software and a list of unique records was generated.

Screening and Eligibility Assessment

Two reviewers independently screened the deduplicated list of titles and abstracts from the merged database records for potentially relevant articles using Rayyan software. Full texts of potentially relevant articles were retrieved and assessed for eligibility by two independent reviewers. Studies that fulfilled inclusion criteria were included in the review while excluded studies were listed with reasons for exclusion. Flow of studies was documented in a PRISMA flow diagram.

Data Extraction

A data collection form was piloted using the 1st two studies before being finalized. Two reviewers independently extracted the following data from included studies: publishing and author information; study characteristics including details on the simulation modality, field of healthcare, and outcomes; and the quality of the clinical simulation study using the Modified Medical Education Research Study Quality Instrument (MMERSQI). Any disagreements were discussed or resolved by a third reviewer.

Data Analysis

We used descriptive statistics (means and standard deviations or medians and interquartile range for continuous variables; frequency distribution for categorical variables) to analyze collected data. Individual domain and total

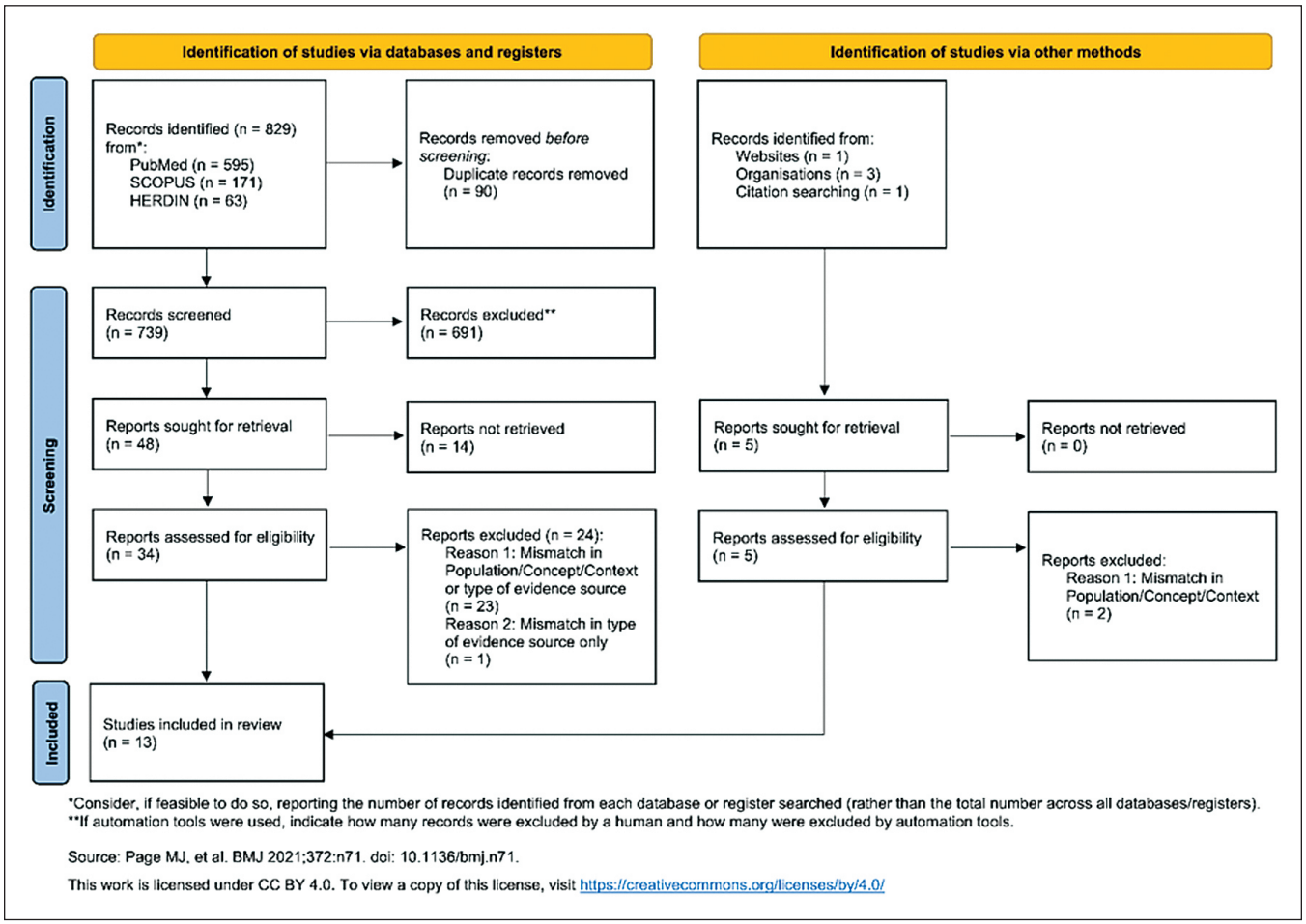

Figure 1. PRISMA flow chart.

MMERSQI scores were obtained. Median (IQR) scores % of studies that fulfilled each item were computed and described. Summary figures and tables were generated using Microsoft Excel.

RESULTS

Out of 829 unique database records and five secondary sources, we sought the full text reports of 53 potentially relevant records (Figure 1). We only retrieved 39 full text reports for eligibility assessment and included 13 studies in this review. We provided lists of 14 records without full text (Appendix C) and 26 excluded studies (Appendix D).

Characteristics of Included Studies

We included 13 studies whose details are in Table 1.

Studies were published from 1992 to 2024 (median 2019), with the highest number of studies in the current decade (k = 7) (2020s) despite this decade spanning only four years to date. There is a notable gap between 1994 and 2009 (15-year gap), and 2009 and 2017 (18-year gap) during which no studies were published. A little over half of the studies (7/13) were published in various international journals. The median number of authors was 5, range (2, 25) with international publications having a higher median number (k = 9) than local publications (3). Majority of main authors were faculty/consultants (k = 9) (Figure 2).

Most of the authors were affiliated with hospitals (k = 10) while the rest were from medical or nursing schools. The general health field was medicine in the majority (k = 10), nursing had two studies, and one had mixed fields (medicine, nursing, and allied health). For main authorship, surgical specialties

Table 1. Characteristics of Included Studies (k = 13)

No.	Study ID	Study design	Sample Size	Type of participants	Purpose of study	Study Setting	Type of simulation technique	Level of Fidelity	Outcomes
1	Berdida 2023 [27]	Observational	14	Youtube videos by nursing students	Research	Home	Task trainers	Low	Low-cost material usage (frequency and pattern)
2	Carrillo 2017 [28]	Experimental	160	Medical students	Education	Medical school	Task trainers	Medium	Skills, Perceptions
3	Chan 2018 [29]	Observational	18	Practitioners and resident trainees	Assessment	Hospital	Task trainers	Medium	Perceptions, Skills
4	Escueta 2023 [30]	Observational	7	Resident trainees	Education	Hospital	Task trainers	Low	Skills
5	Gardner 2022 [31]	Observational	24	Resident trainees	Assessment	Hospital	Manikins	Medium	Skills, Attitudes, Knowledge
6	Grullo 2017 [32]	Observational	10	Consultants and resident trainees	Education, research	Medical school	Cadavers	High	Perceptions, Open-ended question on the suitability of Thiel-soft embalmed cadavers in the training for endoscopic sinus surgery
7	Lim-Navarro 2024 [33]	Experimental	50	Resident trainees	Education	Hospital	Visually enhanced models	Low	Knowledge, Perceptions
8	Loyola 2020 [34]	Observational	312	Medical students	Education	Medical school	Standardized patient	Low	Perceptions, Attitudes
9	McCaw 2023 [35]	Experimental	49	Nursing students	Education	Nursing school and home	Task trainers, Manikins, Computer-based	Low	Skills, Knowledge
10	Menna 2024 [36]	Observational	168	Practitioners and resident trainees	Research	Unspecified facility	Virtual reality, task trainers, mobile application	High	Perceptions, Attitudes
11	Santana 1992 [37]	Experimental	641	Hospital workers	Education	Hospital	Standardized patient	Medium	Knowledge, Attitudes, Perceptions
12	Sotto 1994 [38]	Observational	8	Resident trainees	Education, assessment	Unspecified facility	Task trainers	Medium	Skills
13	Sotto 2009 [39]	Experimental	40	Medical students	Education	Hospital	Virtual reality	Medium	Skills
Total			1501						

(Otorhinolaryngology, Orthopedics, Obstetrics-Gynecology, Neurosurgery, Surgery) were more highly represented (k = 8) than non-cutting specialties (Anesthesiology, Medicine) (k = 5) (Figure 3). Most were single-center studies (k = 11), with two out of five international collaboration studies having 11 and 18 centers, respectively.[36,37]

Eleven studies were conducted in Metro Manila while two were in Cavite and Davao Oriental (Figure 4). The study setting was facility-based in 6 studies (hospital, 4; medical school, 2), only one study was in-situ (hospital), another was home-based, and one was hybrid.[27,35,39] The median sample size was 40, ranging from 7, wherein the participants were orthopedic surgery trainees who performed suturing for microvascular surgery, and 641 where a pre- and post-test survey was conducted among health workers in 18 Metro Manila hospitals.[30,37] Studies were quantitative only in seven studies and both quantitative and qualitative in 6 studies. The study design was observational in eight studies, mostly cross-sectional, while only five were experimental (two were RCTs). Majority of studies were analytic (k = 8). The most

Table 2. Summary of Included Studies (k = 13)

Characteristic	No. of Studies
Year published	
1990s	2
2000s	1
2010s	3
2020s	7
Type of journal	
International	7
Local	6
Main author designation	
Faculty	9
Resident physician trainees	3
Not stated	1
Affiliated institution of main author	
Hospital	10
Medical school	2
Nursing school	1
Specialty of main author	
Surgical/cutting	8
Non-surgical/non-cutting/ general (Anesthesia, Medicine, medical or nursing school)	5
No. of centers	
Single	11
Multiple	2
Region where study conducted	
National Capital Region (Manila, Quezon City)	11
Region IVA (Cavite)	1
Region XI (Davao Oriental)	1
Study setting	
Facility-based: Hospital	5
Facility-based: Medical school	3
Home	1
In situ: Hospital	1
Hybrid: Facility-based and Home	1
Not stated	2
Type of data	
Quantitative	7
Both Quantitative and Qualitative	6

Characteristic	No. of Studies
Study design	
Experimental	5
RCT	2
Non-RCT	2
Before-and-after study	1
Observational	8
Cross-sectional	7
Before-and-after study	1
Type of study	
Descriptive	5
Analytic	8
General field of study	
Medicine	10
Nursing	2
Mixed (Medicine, Nursing, Allied health)	1
Purpose of study	
Education	7
Research	2
Assessment	1
Education and Assessment	1
Education and Research	1
Assessment and Research	1
Simulation technique	
Task trainers	5
Standardized patients	2
Manikins	1
Cadavers	1
Visually enhanced models	1
Virtual reality	1
Hybrid techniques (task trainers, manikins, computer-based; task trainers, virtual reality, mobile app)	2
Level of fidelity	
High	2
Medium	6
Low	5
Desired competencies	
Technical	9
Core	1
Both Technical and Core	3

Characteristic	No. of Studies
Components of full-simulation technique studies (k = 4)	
Prebriefing + Scenario	2
Scenario + Debriefing	1
Prebriefing + Scenario + Debriefing	1
Sample size [Median 40 (7, 641)]	
<50	8
50 to 199	3
200 to 399	1
>400	1
Types of participants	
Resident physician trainees	4
Mixed: Physician practitioners/ consultants + trainees	3
Medical students	3
Nursing students	1
Healthcare workers	1
Youtube videos	1
Level of education of participants	
Curricular: Postgraduate	7
Curricular: Graduate	3
Curricular: Undergraduate	2
Continuing Professional Education	1
Main study outcome measure	
Skills	6
Perceptions	4
Knowledge	2
Usage pattern of low-cost simulators	1
Not stated	1
Type of funding	
Academic	4
Government	1
Government and Commercial	1
None	2
Not stated	5

common source of funding was academic in four studies, with no mention of funding source in five studies.

The most common participants were resident physician trainees (k = 4), physician practitioners/consultants and trainees (k = 3) and medical students (k = 3); one study included YouTube videos uploaded by nursing students.[30] The level of education was mainly curricular (postgraduate, 7; graduate, 3; undergraduate, 2) with only one study for continuing professional education.[37] Most studies were in the field of Medicine (10), with the main purpose on education (k = 7). The most common simulation technique was task trainers (k = 5) followed by standardized patients (k = 2) and hybrid techniques (k = 2). Majority were either medium-fidelity (k = 6) or low-fidelity (k = 5), only two were high-fidelity. One study involved hybrid neurosurgical simulators (physical model and augmented reality) while another used Thiel soft-embalmed cadavers as a training model for endoscopic sinus surgery.[32,36]

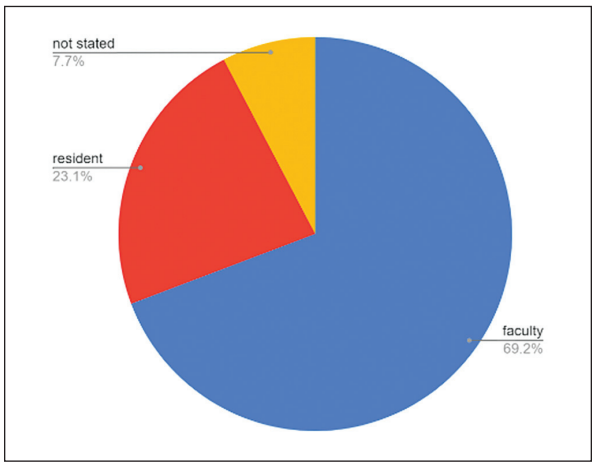

Figure 2. Distribution of studies by type of main author.

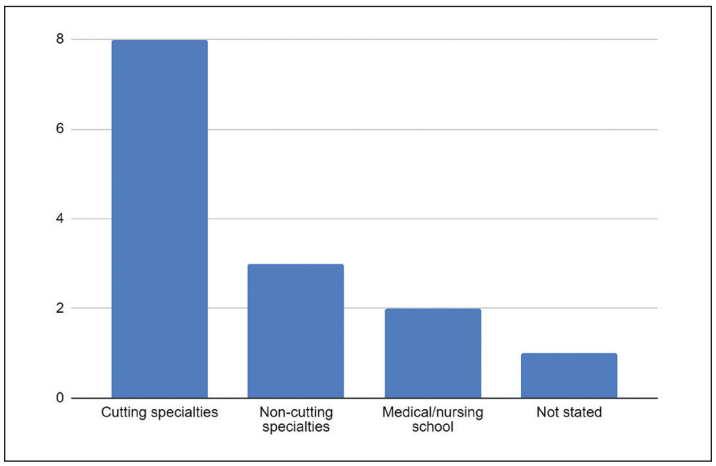

Figure 3. Distribution of studies by type of specialty of main author.

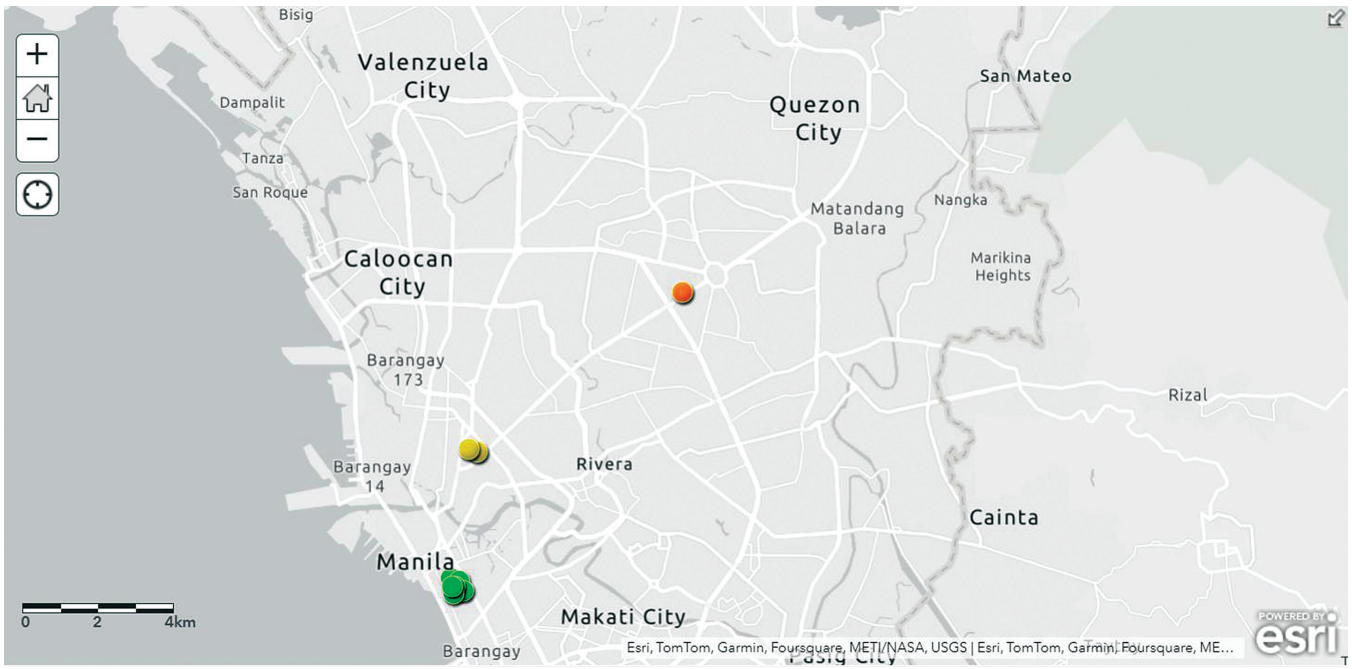

Figure 4. Geographic distribution of Metro Manila-based studies.

Green pin (k = 6) (Carrillo 2017; Chan 2018; Grullo 2017; Lim-Navarro 2024; Loyola 2020; Sotto 2009)
Yellow pin (k = 2) (Berdida 2023; Sotto 1994)
Orange pin (k =1) (Gardner 2022)

Note: Not in map: 6 hospitals in Metro Manila (Santana 1992); Dasmarinas, Cavite (Escueta 2023); Mati, Davao Oriental (McCaw 2023); Not stated (Menna 2024)

Table 3. Summary of MMERSQI Scores

Study Title	Total Score	Item 1: Study Design		Item 2: Sampling		Item 3: Setting		Item 4: Type of Data		Item 5: Validity of Evaluation Instrument		Item 6: Data Analysis		Item 7: Outcomes	
Total possible points	100	23		10		8		11		15		17		16	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%
Berdida 2023	50	7	30.4	4	40	5	62.5	4	36.4	10	66.7	13	76.5	7	43.8
Carrillo 2017	51	10	43.5	4	40	5	62.5	11	100	0	0	13	76.5	8	50
Chan 2018	51	7	30.4	7	70	5	62.5	11	100	0	0	13	76.5	8	50
Escueta 2023	51	7	30.4	7	70	5	62.5	11	100	0	0	13	76.5	8	50
Gardner 2022	66	9	39.1	10	100	5	62.5	11	100	10	66.7	13	76.5	8	50
Grullo 2017	43	7	30.4	7	70	5	62.5	4	36.4	0	0	13	76.5	7	43.8
Lim-Navarro 2024	52	9	39.1	10	100	5	62.5	6	54.5	0	0	13	76.5	9	56.3
Loyola 2020	40	7	30.4	4	40	5	62.5	4	36.4	0	0	13	76.5	7	43.8
McCaw 2023	56	9	39.1	5	50	5	62.5	11	100	5	33.3	13	76.5	8	50
Menna 2024	40	7	30.4	4	40	5	62.5	4	36.4	0	0	13	76.5	7	43.8
Santana 1992	65	23	100	4	40	8	100	8	72.7	0	0	13	76.5	9	56.3
Sotto 1994	56	7	30.4	7	70	5	62.5	11	100	5	33.3	13	76.5	8	50
Sotto 2009	77	16	69.6	4	40	5	62.5	11	100	15	100	13	76.5	13	81.3
Median (Range)	51	7	30.4	5	50	5	62.5	11	100	0	0	13	76.5	8	50

Desired competencies were mostly technical (k = 9) with skills training being the main study outcome measure in six studies. Out of four full-simulation studies, only one included all three steps (prebriefing, scenario, and debriefing) while two included 1st 2 steps, and one, the last 2 steps.[34]

The median total MMERSQI score was 51 points, ranging from 40 [36,34] to 77.[37] Eight studies had scores between 41 to 60 points, indicating moderate methodological quality (Table 3). The item "type of data" had the highest median percentage score of 100% (range 36.4, 100). The items fulfilled by at least 50% of studies were study setting (62.5%; 62.5, 100), sampling (50%; 40, 100), and outcomes (50%; 43.8, 81.3). The item on validity of measurement tool was not fulfilled by eight studies (median percentage score, 0%).

DISCUSSION

Summary of Main Findings

We included 13 studies mostly published in the 2020s (7), by faculty as main author (9), with hospital affiliation (10), single-center (11), setting in NCR (11), analytic (8). Most were in the medical field (10), for educational purposes (7), with a median sample size of 40, including mostly postgraduate level participants (7), using task trainers (5), low- to medium-fidelity (11), and with desired competencies being mainly technical (9) and mostly for skills outcome (6). There was moderate methodological quality [median MMERSQI score, 51 (range, 40, 77)] with the 'type of data' item being highly reported and 'validity of instrument tool' item poorly reported.

This review provides a bird's eye view of the trends, characteristics, and methodological quality of studies related to simulation-based education within medical and allied health fields in the Philippines. Our findings underscore both advancements and gaps in the literature from 1992 to 2024, with a notable concentration of research emerging in the most recent decade. This increased output in the 2020s, despite the brevity of the period, suggests a growing interest and investment in simulation as a pedagogical tool.

Publication Trends and Research Gaps

Our findings show a notable increase in published studies during the 2020s, despite the decade only being partially completed. This recent surge contrasts sharply with the significant gaps between 1994-2009 and 2009-2017, during which no studies were published. This trend differs from past systematic reviews, which often highlight a more continuous growth in research activity or focus on specific periods without noting such significant gaps.[14,18] These gaps in our review might suggest shifts in research focus or funding availability over time, a nuance not always captured in systematic reviews that aggregate findings without detailed temporal analysis.

Study Characteristics, Authorship, and Participants

The predominance of studies published in international journals and conducted in hospital settings highlights the global interest in simulation-based education, particularly in medical fields. The higher median number of authors in international publications compared to local ones may indicate collaborative efforts and resource pooling in more extensive, multicentric studies. It is notable that majority of studies were authored by faculty or consultants, with a smaller representation of resident trainees. This distribution could

point to a need for more inclusion of trainees in research, potentially enriching study perspectives and outcomes. Majority of the studies included post-graduate level participants, highlighting a potential gap in the use of simulation in the early years of medical and allied medical education. In contrast, previous systematic reviews included mostly students in nursing[16,19-22] and mixed allied professions.[14,17,18]

Study Design and Methodology

Our review found that most studies (8 out of 13) were observational, primarily cross-sectional, with only five being experimental (two of which were RCTs). This is consistent with findings from past systematic reviews. For instance, a predominance of observational studies and a scarcity of RCTs in the literature on clinical simulation were noted.[14,18] The lack of RCTs could be attributed to the high costs and potential ethical concerns associated with controlled trials in educational settings, particularly regarding student evaluations. Implementing a crossover design after an initial phase might be a viable solution to mitigate these issues and increase the feasibility of RCTs.

Simulation Techniques and Fidelity

In terms of simulation techniques, our review identified a variety of methods, with task trainers being the most common (k = 5), followed by standardized patients and hybrid techniques. This aligns with the findings of Alrashidi et al. and Nascimento et al., which also highlighted the prevalence of lower-fidelity simulations in their reviews.[16,19] Our review noted that only two studies utilized high-fidelity simulations, which are generally more resource-intensive and time-consuming. Past systematic reviews, including those by Bogossian et al. and Oliveira Silva et al., have similarly indicated that high-fidelity simulations are less common, likely due to the significant resources required to set up and maintain simulation centers. The limited use of full simulation in our review further supports this observation, emphasizing the need for more accessible and less resource-demanding simulation options.[17,20] It is also notable that none of the 13 studies included in this scoping review were done in an actual simulation center, suggesting the need to conduct such studies. As of this writing, there are already four clinical healthcare simulation centers in the Philippines in the medical and nursing fields.

Quality Assessment

The moderate methodological quality (median MMERSQI score, 51 points) with high score for type of data but low score for validity of instrument is similar to that found in three previous systematic reviews.[14,17,19] This gap underscores a critical area for improvement, as the methodologic rigor of a study is paramount in ensuring that the reader can draw reliable conclusions about the simulation's effectiveness. In particular, the validity of measurement tools is essential for ensuring the accuracy and reliability of study findings, a highly valid tool for measuring outcomes means that the findings closely represent the truth. Al Asmri et al. recommended that the methodological quality of these studies should be improved by employing randomization, blinding outcome assessment, and sufficient sample size with mixed ethnicity, while incorporating clinical variation and range of difficulties in simulation.[14] Bogossian et al. recommended to improve reporting of completion rates of intended intervention or control exposures, and losses to follow up as well as to conduct studies that measure level 4 outcomes (improvements in patient outcomes and/or organizational change).[17]

Geographic Distribution

Regarding the geographic focus of studies, our review highlighted a concentration of research in Metro Manila, with limited representation from other regions in the Philippines. This follows the trend of increased density of academic and healthcare institutions in and around the capital city, Manila.[40,41] In addition, the local focus in our review complements the more global perspective observed in past systematic reviews where the Philippines was not included.[16,22] This fulfills this gap for country- and region-specific research to better understand local educational needs and practices.

Limitations/Potential Biases of this Review

We limited our search to the electronic databases and did not search other grey literature; thus, we may have missed studies that were not indexed in the major databases. We also did not include allied medical professions in the search terms such as dentistry, nursing, pharmacy, physical therapy, and occupational therapy. Future updates should attempt to include grey literature and use more search terms to have a broader capture of the healthcare professional fields. We were also unable to retrieve the full texts of 14 studies (N = 296, comprising 1/5 of the total population in 13 included studies, N = 1501) that were unpublished course work and were kept on file in the respective universities of the authors. This reflects a lack of publication impetus in this field of study and potential of unpublished research results to impact the findings of our scooping review. In addition, the wide heterogeneity of characteristics of included studies preclude us from pursuing a more focused systematic review on a specific topic/simulation technique. This shows the infancy of simulation-based techniques in healthcare professional education. Future research should be conducted on ongoing curricular courses in medical and allied medical fields or extra-curricular workshop courses for practitioners.

CONCLUSION

In summary, while there has been significant progress in simulation-based education research, there are clear areas for improvement. The observed gaps in study design, methodological rigor, and fidelity of simulation techniques highlight

opportunities for advancing the field. Future research should aim to address these gaps, particularly by increasing the use of RCTs, enhancing the validity of measurement tools, and incorporating comprehensive simulation components. These steps will be crucial for advancing evidence-based practices and optimizing simulation-based education across various health disciplines.

Recommendations and Future Research Directions

Since our review is a scoping study rather than a systematic review, we did not evaluate the efficacy of clinical simulation interventions or their treatment effects. Future research should aim to conduct well-designed randomized controlled trials with adequate sample sizes and methodological rigor to assess the efficacy of these interventions. More high-quality RCTs would provide a clearer picture of the effectiveness of various simulation techniques and their impact on healthcare education outcomes. Moreover, the observed gaps in high-fidelity simulations and the focus on observational studies highlight a need for increased investment in simulation resources and innovative study designs. Addressing these gaps could enhance the quality of evidence and support the development of more effective and accessible simulation-based educational tools.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

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APPENDICES

Appendix A. Summary of relevant systematic reviews on clinical simulation in healthcare education

Study ID (Author, Year)	No. of included studies	Participants/Countries	Intervention/Exposure	Comparator	Outcomes
1. Alonso-Peña & Alvarez, 2023	42	Health science students from USA, United Kingdom, Argentina	Role-playing, simulation (computer simulation, virtual reality, simulation with anatomical models)	None	Knowledge, Perception, Qualitative (leadership and communication, teamwork, critical thinking, reflective learning, making of decisions, trust, and clinical skill)
2. Alrashidi et al., 2023	15	Nursing students from Jordan, USA, Iran, Norway, Australia, and Singapore	Clinical simulation	None	Qualitative (self-confidence, ability to work in teams)
3. Oliveira Silva et al., 2022	62	Nursing students from Brazil, Canada, China, Iran, Jordan, Norway, Oman, Saudi Arabia, Singapore, South Korea, Turkey, United Kingdom, United States	Simulation-based experiments of any nature	Conventional teaching strategies or no intervention on comparator	Stress, anxiety, and self-confidence (primary outcomes) and learningverified by assessing knowledge, skills, and performance (secondary outcomes)

33. Lim-Navarro L, Aguinaldo JKS. Using an anatomic model to teach female stress incontinence to gynecologic residents-in-training: A prospective cohort study. Philippine Journal of Obstetrics and Gynecology. 2024 Jan;48(1):42–54. Doi: 10.4103/pjog.pjog_79_23.
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Strengths	Limitations	Study Conclusion/ Recommendations	Methodological Assessment Tool	Methodological Assessment Findings
Included a search for articles written in English or Spanish	Most studies were done locally with small sample size, and used convenience sampling. Studies utilized mixed methodology. Learning was assessed through repeated measurements (pre/post-test).	Clinical simulation as teaching methodology is mainly implemented in English-speaking countries. Evidence indicates that it is useful for providing training on general competency in multidisciplinary groups.	None	N/A
Appropriate critiquing tools were used to evaluate each study. This review used thematic analysis to identify major themes occurring in the individual studies.	Use of pre-and post-test evaluations instead of comparisons with a control group. Lack of grey literature. Majority of the studies originated from Western countries. Significant sources of bias present in many of the studies. The effect was assessed by very few studies	The findings suggest that the self-confidence of student nurses is significantly improved following attendance in clinical simulation.	Critical Appraisal Skills Programme	Findings were not discussed
Conducted grey literature search in Google Scholar, the databases PQDT Open (ProQuest) and the Brazilian Digital Library of Theses and Dissertations (BDTD).	Limited studies addressing the effect of simulation on stress in comparison with conventional teaching strategies. Multiple studies have high risk of bias.	Simulation has a positive effect on anxiety and self-confidence compared to traditional teaching strategies. Recommendation: Results are inconclusive for stress due to limited available studies.	RoB2 for experimental studies and ROBINS-I for quasi-experimental studies	Ten experimental studies (30%) had a high risk of bias. Among quasi-experimental studies, 9 (28%) were identified to have high risk of bias while 4 (12.5%) had critical risk of bias.

Scoping Clinical Simulation

Appendix A. Summary of relevant systematic reviews on clinical simulation in healthcare education *(continued)*

Study ID (Author, Year)	No. of included studies	Participants/Countries	Intervention/Exposure	Comparator	Outcomes	Strengths	Limitations	Study Conclusion/ Recommendations	Methodological Assessment Tool	Methodological Assessment Findings
4. Qin et al., 2021	10	Nursing students from Norway, United States	Clinical simulation using standardized patients	Standard practice compared with the usual, control training, an alternative intervention, or conduct a pre–post comparison	Culture competence, cultural awareness, transcultural self-efficacy, or intercultural development	Focused on cultural competence	Publication bias. No search for grey literature. Inclusion of articles written in English narrowed global perspective of findings to only United States and Norway.	It cannot be concluded that simulation using standardized patients is the most effective learning intervention for increasing students' cultural competence. Recommendations: Need for rigorous RCTs on clinical simulation that utilize more objective measurements for cultural competence rather than self-report instruments.	Joanna Briggs Institute Critical Appraisal Checklist for Randomized Controlled Trials and Quasi-Experimental Studies	The scores of the 10 studies, based on the Joanna Briggs Institute Critical Appraisal Checklist for Randomized Controlled Trials and Quasi-Experimental Studies ranged from 44.4% to 100%.
5. Nascimento et al., 2020	5	Nursing students from Jordan, United States	Clinical simulation	Different teaching and learning strategies	Development of clinical competence for CPR	Did not limit studies to those written in English but included articles published in Spanish and Portuguese. Used two different instruments (Joanna Briggs Institute and MERSQI) to assess the quality of methodology used.	High occurrence of quasi-experimental studies; difficult in comparing the results of the experimental and quasi-experimental studies.	Simulation is an effective teaching and learning strategy to develop competence in CPR.	Joanna Briggs Institute Critical Appraisal Checklist for Randomized Controlled Trials and Quasi-Experimental Studies, and Medical Education Research Study Quality Instrument	The quasi-experimental studies met most of the JBI quality assessment requirements, with only two studies not meeting the criterion for the use of multiple measurements of results. The experimental studies met most of the criteria, although the blinding in the allocation, treatment groups, and evaluation domains was unclear. The MERSQI scores of the studies ranged from 11.0 to 14.5, indicating moderate methodological quality.
6. Al Asmri et al., 2021	12	Medical students/clinical students from Belgium, Canada, Germany, Spain, United Kingdom, United States, and New Zealand	Technology-enhanced simulation	Standard learning	Acquisition of clinical skills for digital rectal exam, acquisition of knowledge; learner satisfaction, confidence, anxiety and comfort levels.	Comprehensive review on the acquisition of skill and knowledge on digital rectal exam. Did not apply language restriction in literature search; found articles written in German and Spanish.	Limited literature on use of technology-enhanced simulation for teaching DRE. Low quality of the published papers.	Teaching DRE with high fidelity (e.g., TAs) improves student skill acquisition and reduces student anxiety compared with other teaching approaches.	Modified MERSQI	Six out of twelve studies scored more than 50% of the overall MMERSQI score, with an average of 8.2 out of 18.
7. Bogossian et al., 2019	10	Pre-licensure students in all health-related discipline from Australia, Israel, United States, and United Kingdom	simulation-based education	Traditional clinical placement	Reaction, learning, and behavior/transfer	Included regional clinical trials database. Evaluated studies using JBI Level of Evidence.	Heterogenous studies in terms of ratio and duration of simulation programs and evaluation outcomes.	There is conditional support for substitution of clinical practice with simulation-based education. Outcomes are similar when simulation replaces clinical practice.	MERSQI	The 10 primary studies had an average MERSQI score of 13.5 (9.0 - 16.5), indicating moderate to high quality.
8. Stunden et al., 2015	8	First year nursing students from Australia, United Kingdom, and United States	Simulation	No comparator, skills lab session, or clinical placement	Reduce anxiety prior to objective structured clinical assessment	Focused on the use of simulation to prepare students for objective structured clinical assessments.	Focused only in a specific group of students (first year nursing students); limited articles to English.	Students who have been exposed to simulation scenarios prior to the OSCA are able to cope better during the OSCA and when placed in the clinical setting. Recommendation: To implement well-organized simulation scenarios into the nursing curricula for first year nursing students' clinical units to help reduce their anxiety levels prior to OSCA.	None	N/A
9. Harder, 2010	23	Health care students (country not specified)	High-fidelity simulation	None	Clinical skills performance, confidence, perceived competence score	Described the type of studies conducted in the specific practice discipline; Focused only on high-fidelity simulation.	Limited examined data from 2003 to 2007; No active search of grey literature.	There are very limited studies that objectively evaluate the outcomes of simulation use. Recommendations: to develop measurement tools designed specifically for high-simulation use instead of pretest and posttest scores, and OSCE scores to evaluate outcomes.	None	N/A

Appendix B. Search strategy for systematic review proper

1. PubMed
595 hits (17 May 2024)
“simulat*” - 912,927 hits
"philippin*" OR "phillippin*" OR "phillipin*" OR "filipin*" OR "fillipin*" OR "fillippin*" - 31,970 hits
“simulat*” AND ["philippin*" OR "phillippin*" OR "phillipin*" OR "filipin*" OR "fillipin*" OR "fillippin*"] - 595 hits

2. Scopus
171 hits (17 May 2024)
Abstract, title, keywords: ‘Simulation’
AND
Affiliation: Philippines

Filter: Limited to Medicine

3. Herdin
‘Simulation’ - 56 hits (17 May 2024)
‘Simulator’ - 7 hits (17 May 2024)

4. COCHRANE Central
10 hits (15 June 2024)
“Simulation” OR MeSH descriptor: [Simulation Training] OR "simulation-based training" OR "simulation-based education" - 16571
AND
Philippin* OR Filipin* - 1637

5. Secondary sources: 5

Appendix C. List of No Full texts (k =14)

	Study ID	No. of participants
1	Acuna 2017	N/A
2	Dungog n.d.	N/A
3	Quiling 2003	25
4	Abarquez 2010	54
5	Cruz 2000	45
6	Domingo 2015	N/A
7	Flores 2016	N/A
8	“Bedside cardiac auscultation: Heart and lung sound simulation.” 2003	N/A
9	Abaya 2016	35
10	“The Extent of Implementation and Level of Importance of Clinical Simulation of the CSA-B Nursing Program.” 2019	N/A
11	Caumban 2000	26
12	Rosel 2012	10
13	Ando 2022	68
14	Baltazar 2019	33
Total N		296

Appendix D. List of Excluded Studies (k =26)

	Study ID	Reason for Exclusion
1	Lacuata 2022	Did not involve any student or trainee in healthcare profession
2	Garcia 2023	Commentary paper
3	Ferrara 2020	Not on clinical simulation; Not conducted in the Philippines
4	Javier 2002	Did not involve any student or trainee in healthcare profession
5	Dos Santos 2023	Not conducted in the Philippines
6	Kotani 2012	Did not involve any student or trainee in healthcare profession; Not conducted in the Philippines
7	Murad 2009	Did not involve any student or trainee in healthcare profession; Not conducted in the Philippines; Commentary paper
8	Ascuitto 2008	Did not involve any student or trainee in healthcare profession; Not conducted in the Philippines
9	Velarde 2023	Did not involve any student or trainee in healthcare profession; Review paper
10	Nippita 2018	Not conducted in the Philippines
11	Oravetz 2019	Not conducted in the Philippines
12	Annoh 2023	Not conducted in the Philippines
13	Tan 2013	Not conducted in the Philippines
14	Peabody 2019	Not on clinical simulation; Not conducted in the Philippines
15	Noste 2023	Not conducted in the Philippines
16	Gardner 2021	Not on clinical simulation; Commentary paper
17	Nuevo 2018	Not conducted in the Philippines; Review paper
18	Capule 2010	Did not involve any student or trainee in healthcare profession; Not on clinical simulation; Perspective paper
19	Crisostomo 2022	Did not involve any student or trainee in healthcare profession; Not on clinical simulation; Not conducted in the Philippines
20	Gui 2013	Did not involve any student or trainee in healthcare profession; Not on clinical simulation; Not conducted in the Philippines
21	Navarro 2019	Not on clinical simulation
22	Shilkofski 2017	Not on clinical simulation; Not conducted in the Philippines; Review paper
23	Kho 2019	Did not involve any student or trainee in healthcare profession; Not on clinical simulation; Not conducted in the Philippines
24	Hopkins 2011	Did not involve any student or trainee in healthcare profession; Not on clinical simulation; Not conducted in the Philippines
25	Bagares 2022	Did not involve any student or trainee in healthcare profession
26	Almazan 2021	Not on clinical simulation