ORIGINAL RESEARCH ARTICLE

Effectiveness of simulation-based paediatric cardiopulmonary resuscitation training program among nursing students in Saudi Arabia

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Abstract

The main objective of this study was to adopt a simulation-based advanced cardiac life support training program to assess nursing students' level of knowledge and practice regarding paediatric advanced cardiac life support and to identify the major knowledge and practice gaps. The methods used in this study were pre-experimental, one group pre and post-test investigation. This study was conducted between September 2022 and November 2022, at the University College of Farasan in the Kingdom of Saudi Arabia. Quantitative data were obtained using the "Cardio Pulmonary Resuscitation Knowledge Questionnaire", "Students' Satisfaction and Self-Confidence Scale," and the "CPR Skill Checklist," which were applied to 75 participants in focus groups. Before the simulation-based CPR training, the students' mean pre-test Paediatric CPR knowledge score was 6.5±2.3 out of 42.0. After the simulation, the mean post-test CPR knowledge score (38.1±2.9) considerably improved (p 0.05). The mean post-test CPR skills score (44.7±1.2) was also considerably higher than the mean pre-test CPR skills score (11.4±2.8) at (p 0.05). Additionally, after the simulation training, students' happiness and confidence levels (61.9±2.2) greatly increased. Themes from the qualitative data showed that the simulation was viewed as an engaging and effective teaching tool by the students. Two themes emerged from the study: "Worries before simulation" and "Satisfaction after simulation". Simulation-based paediatric cardio Pulmonary resuscitation training program has raised nursing students' level of expertise in knowledge, performance, and self-efficacy. Additionally, strong satisfaction and self-confidence levels were discovered following the simulation training. *(Afr J Reprod Health 2024; 28 [1]: 39-52).*

Keywords: Cardio pulmonary resuscitation; simulation training; paediatric; self efficacy; nursing students

Résumé

L'objectif principal de cette étude était d'adopter un programme de formation avancé en réanimation cardiaque basé sur la simulation pour évaluer le niveau de connaissances et de pratique des étudiants en soins infirmiers en matière de réanimation cardiaque avancée en pédiatrie et pour identifier les principales lacunes en matière de connaissances et de pratique. Les méthodes utilisées dans cette étude étaient des enquêtes pré-expérimentales, pré- et post-test sur un groupe. Cette étude a été menée entre septembre 2022 et novembre 2022, au Collège universitaire de Farasan, au Royaume d'Arabie saoudite. Des données quantitatives ont été obtenues à l'aide du « Questionnaire de connaissances sur la réanimation cardio-pulmonaire », de l'« Échelle de satisfaction et de confiance en soi des étudiants » et de la « Liste de contrôle des compétences en RCR », qui ont été appliquées à 75 participants dans des groupes de discussion. Avant la formation en RCR basée sur la simulation, le score moyen des étudiants en matière de connaissances en RCR pédiatrique avant le test était de 6,5 ± 2,3 sur 42,0. Après la simulation, le score moyen de connaissances en RCR post-test (38,1 ± 2,9) s'est considérablement amélioré (p = 0,05). Le score moyen des compétences en RCR après le test (44,7 ± 1,2) était également considérablement plus élevé que le score moyen des compétences en RCR avant le test (11,4 ± 2,8) à (p 0,05). De plus, après la formation par simulation, les niveaux de bonheur et de confiance des étudiants (61,9 ± 2,2) ont considérablement augmenté. Les thèmes issus des données qualitatives ont montré que la simulation était considérée comme un outil pédagogique engageant et efficace par les étudiants. Deux thématiques sont ressorties de l'étude : « Les soucis avant la simulation » et « La satisfaction après la simulation ». Le programme de formation en réanimation cardio-pulmonaire pédiatrique basé sur la simulation a élevé le niveau d'expertise des étudiants en soins infirmiers en termes de connaissances, de performance et d'auto-efficacité. De plus, de forts niveaux de satisfaction et de confiance en soi ont été découverts à la suite de la formation par simulation. *(Afr J Reprod Health 2024; 28 [1]: 39-52).*

Mots-clés: Réanimation cardio-pulmonaire ; formation par simulation; pédiatrique; auto-efficacité ; étudiants en soins infirmiers

Introduction

Managing acute paediatric circumstances can be challenging. Healthcare providers have additional responsibilities when caring for severely ill children because of the anatomical and physiological differences between children and adults. Training opportunities are necessary for paediatric healthcare professionals for them to treat children who are critically unwell or going through cardiac arrest. Trainees generally have limited opportunities to practice their skills on real patients because paediatric resuscitation episodes are very uncommon. As a result, they often leave their training with insufficient procedural competency and resuscitation knowledge in the treatment of seriously ill children[1].

Experts from the International Nursing Association for Clinical Simulation and Learning (INACSL), American Association for Colleges of Nursing (AACN), National League for Nursing (NLN), Society for Simulation in Healthcare (SSH), Boards of Nursing, and National Council of State Boards of Nursing have developed guidelines that support the use of simulation in nursing education (NCSBN)[2,29].

Learners' cognitive, technical, and behavioural abilities are enhanced via simulation[3]. Simulation offers targeted learning opportunities in an organized, clinically similar atmosphere for safe and successful learning[3]. Nursing students can practice their nursing techniques in a lab setting where they can apply the theoretical knowledge, they have learned without endangering the safety of real patients[4]. For nursing students, high fidelity simulation (HFS) is regarded as a cutting-edge teaching strategy. Nursing students' clinical skills and understanding are improved by HFS-based learning activities[5] and they can obtain clinical competency through simulation, make up for lost clinical time, and get through obstacles based on their culture or religion[6].

Sixty-eight nursing students participated in a pre-experimental study in Saudi Arabia that used a pre-test and post-test design and sought to determine the impact of simulation-based practice on nursing students' attitudes, levels of confidence, and learning outcomes. Study results showed that students' confidence, decision-making abilities, and ability to recognize and forecast changes in patients' states had all improved. Most students reported that they learned evaluation skills better and improved their critical thinking when it came to their information[7].

Simulation integration improves active learning, confidence, and happiness in clinical courses like adult health, critical care, maternity and child health, mental health, and community health nursing[8]. Simulation-based training improves clinical competence, self efficacy, and communication abilities in nursing courses[9]. Consistent simulation exercise boosts nursing students' self-assurance, which helps them perform well in practical assessments and develops their competency. In essence, simulation makes nurses more knowledgeable[10].

The study found that including simulation in the paediatric students' rotation was beneficial in terms of both preparing them for the encounter and rapidly broadening their total exposure to clinical settings. Additionally, simulations give paediatric nursing students the chance to practice clinical scenarios that they might not have encountered in the real world, like caring for seriously ill children, giving dangerous medications, and interacting and communicating with families in delicate circumstances[11].

Simulation is still a relatively new concept in the Arab world a great deal of empirical study is much needed. The efficacy of this teaching-learning pedagogy will be determined by empirical evidence on the results of the simulation in terms of student satisfaction, confidence, critical thinking, knowledge, and performance[29]. The statistical relationship between specific student characteristics and their simulation-based results will aid in the improvement and adaptation of simulation implementation standards for the Arab world. Based on these empirical motivations, the current study aimed to assess the effectiveness of a simulation-based paediatric cardiopulmonary resuscitation training program on knowledge, practice, and self-efficacy among undergraduate nursing students.

The objectives of this study are: 1) to assess the nursing students' knowledge and practice regarding Paediatric Advanced Cardiac Life Support; 2) to develop and implement a simulation-based training program for nursing students' regarding Paediatric Advanced Cardiac Life Support; 3) to compare the effectiveness of a simulation-based training program on Paediatric Advanced Cardiac Life Support among nursing students' performance and

self-efficacy; and 4) to determine the relationship between the Knowledge, practice, and self-efficacy scores with selected demographic variables such as age, educational level, prior knowledge of paediatric advanced cardiac life support, and having undergone any training for advanced basic cardiac life support.

Methods

Study design and setting

A Quantitative pre-experimental one-group pre and post-test design was carried out in Farasan Island, Kingdom of Saudi Arabia between September 2022 and November 2022.

Sampling size and sampling technique

Using non-probability purposive sampling, 75 people were chosen as the sample size for this study. The participants were third year nursing students majoring in Obstetrics and Paediatrics. The population of Farasan island is about 20000 which is part of Jazan province. Out of this 25% of the population were younger and adults, and only a small percentage were pursuing a bachelor's degree in nursing. Therefore, for this study, a smaller sample of 75 third-year students was chosen.

Instrument

Several experts examined the data instrument and found it to be trustworthy. The questionnaire followed American Academy of Paediatrics guidelines and was broken into five sections.

- Sociodemographic data like age, educational level, prior knowledge of paediatric advanced cardiac life support, and undergone any training for advanced or basic cardiac life support were all included in Part 1 of the demographic data.
- Students' understanding of advanced basic cardiac life support is covered in Part II. It contains 42 questions to test the student's understanding of basic life support procedures, including cardiopulmonary resuscitation (CPR) in general, CPR indications, CPR processes and techniques, and CPR effectiveness. Options on the questionnaire are Yes, No, and Don't Know. Correct responses received one mark, while incorrect ones received zero.
- Part III: An observational checklist was used to evaluate how well the students had practiced advanced cardiac life support. There are 23 elements in total, consisting of steps in CPR intervention. The one who completes all the elements in the checklist earns two marks, completing it partially earns one mark, and failing to do so earns no points. The total score is 46.
- Part IV: 5-point Likert scale on modified self-efficacy tool to analyse nurses' levels of confidence in performing Advanced cardiac life support skills. 16 items are formulated on a 5-point Likert scale (Very confident – 5 to Least Confident -1). To evaluate one's self-efficacy in CPR, 16 questions in total with four subcategories (Recognition, Debriefing, Responding, and Reporting) were developed and the total score was 80.
- Section V: After a simulation-based instruction program, student satisfaction and self-confidence with advanced cardiac life support were evaluated using a 5-point rating scale (Strongly Agree – 5, Agree - 4, True sometimes -3, Disagree -2, and Strongly disagree -1). A total of 13 questions were developed and the total marks were 65.
- Implementation of paediatric advanced cardiac life support simulation training.

Data collection procedure

The purpose of the study was communicated to every nursing student who participated in the data collection procedure. Three assessment rounds were used to acquire the data. Before the simulation training program, a pre-testing phase was completed. After classifying the sample which includes (10) nursing students, the implementation phase involved simulation application-based learning throughout five sessions over five weeks, each lasting between 30 - 45 minutes duration. All 75 students participated and underwent Paediatric advanced cardiac life support simulation training. Two weeks after implementing the simulation-based learning activity, the post-test phase was conducted using the same pre-test questionnaire. After the post-test assessment, the handouts on paediatric advanced cardiac life support were distributed to all the students.

Statistical analysis

Data were analysed with SPSS version 22.0 software. The study evaluated proportions and frequencies using descriptive statistics. Chi-square tests were employed to evaluate the association between the demographic variables in the study. The difference between pre-and post-test scores on advanced cardiac life support was determined by using a paired t-test. The knowledge, practice, and self-efficacy variables were correlated using the Karl Pearson correlation and coefficient test.

Ethical consideration

The study received official ethical approval from Jazan University's Scientific Research Ethics Committee, as well as authorization from the Dean of Farasan University College. Each participant gave his or her agreement to contribute to the study. Ethics committee decision date: 07.04.2022 Decision number: Reference No.: REC-43/09/206.

Results

The demographic data reveals that 56.0% of the student nurses were between the ages of 20 and 21 years and that 61.0% of them were pursuing Baccalaureate degrees at the sixth level, which is similar to third-year students in other countries. The majority (96.0%) of them lacked prior experience in pediatric cardiopulmonary resuscitation, and 97.0% of them had never participated in an advanced or basic cardiac life support training program.

Table 1 - Frequency and Percentage-wise distribution of knowledge on paediatric advanced cardiac life support shows that more or less 85.0% of them correctly answered the questions about cardiopulmonary resuscitation (CPR) in the post-test, compared to less than 50.0% in the pre-test. In the pre-test, roughly 40.0% of them responded correctly to the question about the universal compression-to-ventilation ratio, however in the post-test, everyone responded properly. In the post-test about the chest compression technique, over 90.0% of them correctly identified the proper depth of cardiac compression. Only about 30.0% of the pre-test respondents answered. All of them correctly used the hand technique for CPR on infants and children, compared to 50.0% in the pre-test. In the post-test, a high majority of students correctly answered the questions about opening the airway and the location to check the pulse for circulation, compared to the pre-test results of 42.7% and 14.7%, respectively. In the post-test, about 98.0% of them properly answered the questions about how to perform CPR while opening the airway and checking the patient's breathing; in the pre-test, only around 25.0% of them responded. In the post-test on the indications, methods, and effectiveness of cardiopulmonary resuscitation, more or less 90.0% of the participants responded correctly, compared to about 40.0% in the pre-test.

Table 2 shows the frequency and percentage-wise distribution of practice on paediatric advanced cardiac life support. In the post-test, about 90.0% of the students performed correctly on the majority of practice questions, compared to a very low percentage in the pre-test. It demonstrates that a high level of post-assessment practice was discovered followed by simulation training.

Table 3 shows the Frequency and Percentage-wise distribution of the Self-Efficacy Scale on Paediatric Advanced Life Support. More or less 85.0% are very confident in the post-test for the various aspects of the Recognition category. Only 72.0% of them are highly confident in the post-test in the aspect of demonstrating correct measurement, interpretation, and documentation of vital signs. Whereas in the pre-test only 15.0% had very high confidence in these aspects of recognition. In Debriefing and recording nearly 85.0% of them had high confidence in the aspects of performing debriefing or problem-solving after the event (84.0%), demonstrating staying calm and focusing on required tasks (86.7%), and performing re-assessment or re-evaluation (81.3%) respectively. Whereas in the pre-test, only 5.0% of them had high confidence in these items. In responding and rescuing, in the post-test more or less 90.0% of them had very high confidence in all aspects, whereas only 5.0% of them had high confidence in the pre-test. On all the components of the reporting shows, nearly 85.0% of them had high confidence in post-intervention whereas in pre-intervention only 7.0%.

Following the implementation of the simulation activity, the frequency and percentage-wise distribution of students' satisfaction and self-confidence on paediatric advanced life support reveals that more or less 95.0% of them are extremely satisfied and have also increased their self-confidence in the aforementioned aspects.

Table 1: Distribution of knowledge on paediatric advanced cardiac life support (N = 75)

S. No	Part I - Importance of cardiopulmonary resuscitation (CPR) in clinical practice	Yes		No		Don't Know	
		Pre-test n (%)	Post-test n (%)	Pre-test n (%)	Post-test n (%)	Pre-Test n (%)	Post- Test n (%)
1	Awareness of the importance of CPR in clinical practice *	56 (74.7)	75 (100)	16 (21.3)	0	3 (4)	0
2	Knowledge about the correct CPR procedure is mandatory for all healthcare professionals. *	24 (32)	73 (97.3)	32 (42.7)	2 (2.7)	19 (25.3)	0
3	CPR is a basic emergency need for the betterment of children and their health status *	31 (41.3)	74 (98.7)	42 (56)	0	2 (2.7)	1 (1.3)
4	Participate in CPR awareness programs and have lifesaving experience *	42 (56)	75 (100)	10 (13.3)	0	23 (30.7)	0
5	CPR procedures are arduous, unethical, incorrect, and purely inhuman	21 (28)	0	37 (49.3)	73 (97.3)	17 (22.7)	2 (2.7)
6	Rather than being beneficial, it is more harmful to the patients	34 (45.3)	0	29 (38.7)	75 (100)	12 (16)	0
7	Conducting CPR is simply a waste of manpower and time	26 (34.7)	0	19 (25.3)	72 (96)	30 (40)	3 (4)
8	Teaching and mastering CPR intervention should be made mandatory for all medical undergraduates *	39 (52)	75 (100)	14 (18.7)	0	22 (29.3)	0

S. No	Part II - Goal and Accuracy of Paediatric cardiopulmonary resuscitation (CPR) intervention	Yes		No		Don't Know	
		Pre-test n (%)	Post-test n (%)	Pre-test n (%)	Post-test n (%)	Pre-Test n (%)	Post- Test n (%)
1	The purpose of cardiopulmonary resuscitation (CPR): *						
	Restart the heart	33 (44)	65 (86.7)	25 (33.3)	2 (2.7)	17 (22.7)	8 (10.7)
	Restore oxygenated blood to the brain	31 (41.3)	68 (90.7)	20 (26.7)	1 (1.3)	24 (32)	6 (8)
	Prevent permanent brain damage	27 (36)	61 (81.3)	26 (34.7)	7 (9.3)	22 (29.3)	7 (9.3)
	Delay tissue death	32 (42.7)	67 (89.3)	18 (24)	2 (2.7)	25 (33.3)	6 (8)
	Maintain cardiac output to keep vital organs alive	35 (46.7)	70 (93.3)	20 (26.7)	0	20 (26.7)	5 (6.7)
	Responsive to defibrillation attempts	25 (33.3)	71 (94.7)	35 (46.7)	1 (1.3)	15 (20)	3 (4)
	Circulate oxygenated blood	21 (28)	62 (82.7)	31 (41.3)	9 (12)	23 (30.7)	4 (5.3)
2	The current order of updated CPR intervention is - Chest compressions, Airway, Breathing (CAB) *	12 (16)	69 (92)	49 (65.3)	0	14 (18.7)	6 (8)
3	The recommended universal compression-to-ventilation ratio is * 30:2 for children and infants if only a single rescuer	29 (38.7)	75 (100)	38 (50.7)	0	8 (10.7)	0
	15:2 in children and infants if at least 2 rescuers	32 (42.7)	75 (100)	29 (38.7)	0	14 (18.7)	0

	3:1 in new-borns unless a cardiac cause is known	17 (22.7)	54 (72)	46 (61.3)	14 (18.7)	12 (16)	7 (9.3)
4	In chest compression technique:						
	Depth in children is about 5 cm (2 inches)	21 (28)	65 (86.7)	35 (46.7)	4 (5.3)	19 (25.3)	6 (8)
	In infants, it is 4 cm (1.5 inches)	19 (25.3)	68 (90.7)	29 (38.7)	5 (6.7)	27 (36)	2 (2.7)
	In children to use one hand compression for CPR	36 (48)	74 (98.7)	33 (44)	1 (1.3)	6 (8)	0
	For infants two fingers (index and middle fingers or two thumb technique)	34 (45.3)	75 (100)	21 (28)	0	20 (26.7)	0
5	Opening the airway by head tilt and chin lift manoeuvre for both infants and children by using shoulder roll. *	32 (42.7)	73 (97.3)	18 (24)	0	25 (33.3)	2 (2.7)
6	For infants – Brachial pulse to be used and for children – carotid and femoral pulse can be used	11 (14.7)	71 (94.7)	42 (56)	3 (4)	22 (29.3)	1 (1.3)
7	Check the breathing by looking, feeling, and hearing the airway.	16 (21.3)	73 (97.3)	45 (60)	0	14 (18.7)	2 (2.7)
	Open the airway by mouth-to-mouth respiration, pinch the nose, take a normal breath, place lips over mouth, blow until the chest rises, take about 1 second, allow the chest to fall, and repeat for 2 rescue breaths. For infants use both nose and mouth if possible.	22 (29.3)	74 (98.7)	38 (50.7)	1 (1.3)	15 (20)	0

S. No	**Part III - Indications, Methods, and Effectiveness of Cardiopulmonary Resuscitation**	**Yes**		**No**		**Don't Know**	
		Pre-test n (%)	**Post-test n (%)**	**Pre-test n (%)**	**Post-test n (%)**	**Pre-Test n (%)**	**Post- Test n (%)**
1	CPR is an emergency procedure that is attempted to return to life in cardiac arrest. *	36 (48)	75 (100)	15 (20)	0	24 (32)	0
2	CPR is always attempted inside the hospital not outside.	32 (42.7)	3 (4)	28 (37.3)	67 (89.3)	15 (20)	5 (6.7)
3	CPR is only effective if performed within 6–7 minutes of the stoppage of blood flow to vital organs. *	26 (34.7)	72 (96)	35 (46.7)	1 (1.3)	14 (18.7)	2 (2.7)
4	Artificial respirations are more appropriate than CPR in cases of respiratory arrest). *	22 (29.3)	61 (81.3)	43 (57.3)	8 (10.7)	10 (13.3)	6 (8)
5	On average, 85–90% of people who receive CPR can survive if conducted by experienced personnel. *	39 (52)	70 (93.3)	24 (32)	2 (2.7)	12 (16)	3 (4)
6	The brain may sustain damage after blood flow has been stopped for about 4 minutes and irreversible damage after about 7 minutes. *	19 (25.3)	59 (78.7)	39 (52)	9 (12)	17 (22.7)	7 (9.3)
7	People with no connection to the victim are more likely to perform CPR than a member of their family. *	38 (50.7)	63 (84)	27 (36)	9 (12)	10 (13.3)	3 (4)
8	If blood flow ceases for >10 hours, virtually all cells will die. *	36 (48)	69 (92)	18 (24)	2 (2.7)	21 (28)	4 (5.3)
9	CPR is generally continued until the person returns to spontaneous circulation or is declared dead. *	41 (54.7)	74 (98.7)	13 (17.3)	0	21 (28)	1 (1.3)

10	A defibrillator is to restore a viable or "perfusing" heart rhythm. *	33 (44)	64 (85.3)	16 (21.3)	7 (9.3)	26 (34.7)	4 (5.3)
11	Compression-only CPR is recommended outside the hospital by the lay public. *	43 (57.3)	73 (97.3)	13 (17.3)	0	19 (25.3)	2 (2.7)
12	The survival rate is very high if immediate CPR is followed by defibrillation within 3–5 minutes. *	39 (52)	70 (93.3)	15 (20)	3 (4)	21 (28)	2 (2.7)
13	Compression-only CPR is less effective in children than in adults. *	26 (34.7)	60 (80)	32 (42.7)	2 (2.7)	17 (22.7)	13 (17.3)
14	Remain calm while conducting CPR rather than frightened. *	46 (61.3)	74 (98.7)	8 (10.7)	0	21 (28)	1 (1.3)
15	CPR is highly effective in resuscitating a person who is not breathing and has no circulation. *	43 (57.3)	62 (82.7)	21 (28)	11 (14.7)	11 (14.7)	2 (2.7)

CPR: Cardiopulmonary resuscitation

Table 2: Distribution of simulation practice on paediatric advanced cardiac life support (n = 75)

S. No	Steps of Procedure	Performed correctly (2)		Performed incorrectly (1)		Not performed (0)	
		Pre-test n (%)	Post-test n (%)	Pre-test n (%)	Post-test n (%)	Pre-test n (%)	Post-test n (%)
1	Hand washing	52 (69.3)	73 (97.3)	9 (12)	2 (2.7)	14 (19.7)	0
2	Wearing gloves	43 (57.3)	71 (94.7)	19 (25.3)	3 (4)	13 (17.3)	1 (1.3)
3	Preparing equipment	39 (52)	68 (90.7)	27 (36)	7 (9.3)	9 (12)	0
4	Keeping privacy	32 (42.7)	62 (82.7)	30 (40)	9 (12)	13 (17.3)	4 (5.3)
5	Assess the patient's condition	29 (38.7)	71 (94.7)	34 (45.3)	4 (5.3)	12 (16)	0
6	Checking the time of the arrest	16 (21.3)	67 (89.3)	36 (48)	4 (5.3)	23 (30.7)	4 (5.3)
7	Assessing the child's consciousness by taping him on the shoulder and shouting" Are you all right"	31 (41.3)	75 (100)	39 (52)	0	5 (6.7)	0
8	Checking for responsiveness	34 (45.3)	73 (97.3)	33 (44)	2 (2.7)	8 (10.7)	0
9	Assess airway, breathing, and circulation	12 (16)	71 (94.7)	29 (38.7)	3 (4)	34 (45.3)	1 (1.3)
10	Palpating the carotid artery or brachial artery for 10 seconds	24 (32)	69 (92)	27 (26)	4 (5.3)	24 (32)	2 (2.7)
11	Ensuring adequate space between the back of the bed and the wall	17 (22.7)	54 (72)	41 (54.7)	9 (12)	17 (22.7)	12 (16)
12	Ensuring a clear airway	19 (25.3)	71 (94.7)	35 (46.7)	0	21 (28)	4 (5.3)
13	Giving 30 chest compressions	7 (9.3)	73 (97.3)	37 (49.3)	2 (2.7)	32 (42.7)	0
14	Opening the airway	23 (30.7)	74 (98.7)	31 (41.3)	1 (1.3)	21 (28)	0
15	Delivering breathing and maintaining intubation	14 (19.7)	66 (88)	35 (46.7)	5 (6.7)	26 (34.7)	4 (5.3)
16	Monitoring the child's condition (airway, breathing, circulation, blood pressure, and urine output)	11 (14.7)	64 (85.3)	39 (52)	8 (10.7)	25 (33.3)	3 (4)
17	Establishing intravenous access	12 (16)	71 (94.7)	29 (38.7)	3 (4)	34 (45.3)	1 (1.3)
18	Checking arterial blood gases	9 (12)	61 (81.3)	30 (40)	11 (14.7)	36 (48)	3 (4)
19	Checking complete blood count and biochemistry values	7 (9.3)	58 (77.3)	37 (49.3)	9 (12)	32 (42.7)	8 (10.7)
20	Monitoring a child's cardiac rhythm and recording ECG	16 (21.3)	62 (82.7)	35 (46.7)	13 (17.3)	24 (32)	0
21	Assessing the child's level of consciousness.	25 (33.3)	71 (94.7)	34 (45.3)	3 (4)	16 (21.3)	1 (1.3)
22	Hand washing	22 (29.3)	75 (100)	32 (42.7)	0	21 (28)	0
23	Documentation	17 (22.7)	70 (93.3)	19 (25.3)	5 (6.7)	39 (52)	0

ECG: electro-cardio graph

Table 3: Distribution of self-efficacy scale on paediatric advanced life support (N = 75)

Item	1		2		3		4		5	
	Least confident				Neutral				Very Confident	
	Pre-test n (%)	Post-test n (%)	Pre-test n (%)	Post-test n (%)	Pre-test n (%)	Post-test n (%)	Pre-test n (%)	Post-test n (%)	Pre-test n (%)	Post-test n (%)
Recognition										
1. Demonstrates correct measurement, interpretation, and documentation of vital signs	29 (38.7)	0	19 (25.3)	0	16 (21.3)	4 (5.3)	11 (14.7)	17 (22.7)	0	54 (72)
2. Initiates relevant patient monitoring (Electrocardiogram, pulse oximeter)	19 (25.3)	0	24 (32)	4 (5.3)	12 (16)	5 (6.7)	9 (12)	7 (9.3)	11 (14.7)	59 (78.7)
3. Recognizes signs and symptoms of a critical event	30 (40)	0	22 (29.3)	0	17 (22.7)	5 (6.7)	6 (8)	9 (12)	0	61 (81.3)
4. Demonstrates a focused assessment following the ABC principles	19 (25.3)	0	14 (18.7)	0	10 (13.3)	3 (4)	15 (20)	3 (4)	17 (22.7)	69 (92)
Debriefing and recording										
5. Performs debriefing or problem-solving after the event	29 (38.7)	0	21 (28)	2 (2.7)	11 (14.7)	4 (5.3)	9 (12)	6 (8)	5 (6.7)	63 (84)
6. Completes quality improvement documentation	29 (38.7)	2 (2.7)	19 (25.3)	4 (5.3)	16 (21.3)	9 (12)	4 (5.3)	8 (10.7)	7 (9.3)	52 (69.3)
7. Demonstrates staying calm and focusing on required tasks	31 (41.3)	0	18 (24)	0	15 (20)	2 (2.7)	6 (8)	8 (10.7)	5 (6.7)	65 (86.7)
8. Performs re-assessment or re-evaluation	47 (62.7)	0	11 (14.7)	3 (4)	12 (16)	2 (2.7)	5 (6.7)	10 (13.3)	0	61 (81.3)
Responding and rescuing										
9. Performs CPR according to the resuscitation algorithm	26 (34.7)	0	19 (25.3)	0	15 (20)	0	9 (12)	2 (2.7)	6 (8)	73 (97.3)
10. Demonstrates effective chest compressions	28 (37.3)	0	20 (26.7)	0	14 (18.7)	0	9 (12)	3 (4)	4 (5.3)	72 (96)
11. Demonstrates effective bag valve mask ventilation	39 (52)	0	18 (24)	3 (4)	8 (10.7)	5 (6.7)	7 (9.3)	5 (6.7)	3 (4)	62 (82.7)
12. Explains clinical findings and critical lab values	33 (44)	0	15 (20)	0	13 (17.3)	6 (8)	9 (12)	6 (8)	5 (6.7)	63 (84)
Reporting										
13. Provides information to a resuscitation team member	45 (60)	0	23 (30.7)	4 (5.3)	6 (8)	3 (4)	1 (1.3)	9 (12)	0	59 (78.7)
14. Utilizes resources and external experts	36 (48)	0	11 (14.7)	0	16 (21.3)	1 (1.3)	5 (6.7)	7 (9.3)	7 (9.3)	67 (89.3)
15. Appropriate communication according to the hospital's policy	33 (44)	0	18 (24)	5 (6.7)	9 (12)	2 (2.7)	11 (14.7)	8 (10.7)	4 (5.3)	60 (80)
16. Understand when to call for help	28 (37.3)	0	16 (21.3)	0	12 (16)	3 (4)	8 (10.7)	3 (4)	9 (12)	69 (92)

CPR: cardiopulmonary resuscitation; SD: standard deviation; SE: standard error. *p<.001 level of significance

Table 4: Distribution of Mean, SD, and paired 't' test of students' knowledge, practice, self-efficacy, and self-confidence on simulation training of paediatric advanced life support (N = 75)

S. No	Variables	N	Minimum score		Maximum score		Pre-test	Post-test	SE Mean		Paired Differences 95% Confidence The interval of the Difference		'T' Test
			Pre-test	Post-test	Pre-test	Post-test	Mean (SD)	Mean (SD)	Pre-test	Post-test	Upper	Lower	
	Knowledge on CPR												
1	General questions on CPR	75	1	5	3	8	1.77 (.65)	6.64 (.95)	.08	.11	-5.16	-4.57	32.74
2	Accuracy of CPR	75	1	15	5	19	2.40(.90)	17.45 (1.02)	.11	.12	-15.36	-14.75	97.69
3	Effectiveness of CPR	75	1	12	4	15	2.29 (.77)	13.96 (.95)	.09	.11	-11.95	-11.38	81.17
	Skill on CPR	75	7	42	18	46	11.41 (2.82)	44.65 (1.19)	.33	.14	-34.01	-32.47	86.18
4	Practice skills in CPR												
	Self-efficacy on CPR	75	4	16	9	20	7.25 (1.43)	18.67 (1.14)	.17	.13	-11.83	-10.99	54.64
5	Recognition												
6	Debriefing and recording	75	4	16	10	20	7.33 (1.46)	18.85 (.91)	.16	.11	-11.97	-11.07	50.68
7	Responding & rescuing	75	4	16	9	20	7.15 (1.53)	18.56 (1.07)	.18	.12	-11.80	-11.02	58.37
8	Reporting	75	4	18	10	20	7.29 (.70)	18.88 (.70)	.18	.08	-11.94	-11.24	65.78
9	**Satisfaction and Self-confidence after simulation of CPR**	75	56		65			61.88 (2.24)	.26				

This proves that all areas of educational objectives can be improved by simulation activities. Therefore, simulation exercises were more effective today in all clinical teaching themes.

The distribution of the students' knowledge, practice, self-efficacy, and self-confidence on the simulation training for paediatric advanced life support is shown in Table 4. This reveals that the student's overall knowledge mean score was low on the pre-test; it was 6.5 (2.3), out of 42. (Maximum score) and it dramatically increased to 38.1 (2.9) at the post-test. Results shows that employing ACLS simulation as a teaching approach greatly increases students' knowledge. The mean score of ACLS knowledge in the post-test was substantially higher than the pre-test, according to a paired t-test (t -70.5, p<.001). Out of 46 possible maximum scores, the practice of paediatric advanced cardiac life support demonstrates that the mean score was 44.7 (1.2), revealing the fully adopted practice of ACLS in comparison to the pre-test practice mean score (11.4 (2.8)). In comparison to the pre-test, a paired t-test in the post-test was substantially higher (t-86.2, p<.001) and it also demonstrates how well ACLS simulation training was. When compared to the post-test mean score (75.1(3.8)), the area-wise mean self-efficacy score further reveals that the overall self-efficacy score was low at the pre-test (29.0 (6.0)), out of 80 (the maximum score). The mean ACLS score in the post-test was substantially higher than in the pre-test, according to a paired t-test (t-57.4, p< .001).

Table 5: Association between the pre-test knowledge, practice, and self-efficacy scores of paediatric advanced cardiac life support

S. No	Variables	Nursing Students	Knowledge	Practice	Self-Efficacy	*p-value*
		Mean (SD)	χ^2 value	χ^2 value	χ^2 value	
1	Age in years	20.65 (0.88)	2.05	0.89	0.38	.485
2	Level of Education	5.87 (0.62)	3.19	1.54	0.74	.652
3	Previous knowledge about paediatric CPR	0.4 (0.20)	1.99	1.59	0.14	.593
4	Attended any training program on Basic Life Support	0.3 (0.16)	0.87	1.06	0.48	.068

*p>.05 level of significance

Following the execution of simulation training, the mean score (61.9±2.2) out of 65 (the maximum score) in the area of satisfaction and self-confidence after the simulation of CPR was highly significant. Thus, it can be concluded that following their post-simulation training, pupils are extremely satisfied and have more confidence (Table 4).

Karl Pearson's Correlation Coefficient (r), which was used to determine the relationship between post-test knowledge, practice, and self-efficacy of paediatric advanced cardiac life support, reveals that a highly positive relationship in paediatric advanced cardiac life support was found between knowledge and practice (r=0.66) at p<.54, practice and self-efficacy (r=0.71) at p< .43, and knowledge and self-efficacy (r=0.97) at p< .05.

When the pre-test knowledge, practice, and self-efficacy scores of nursing students were compared to the aforementioned demographic characteristics, no significant correlation was identified. The research hypothesis was disproved based on how the results were interpreted, which shows that the difference in mean score with these demographic characteristics was only due to chance and not a real difference (Table 5).

Discussion

This simulation-based study showed an improvement in paediatric CPR performance, abilities, and knowledge with satisfactory retention at 15 to 30 days, notably regarding chest compression steps. This study further found that after participating in simulation exercises, nursing students in all clinical courses reported better levels of satisfaction and self-confidence. Paediatric nursing and obstetrical nursing students reported better levels of satisfaction and self-assurance with instructional methods. They also endorsed the use of simulation to enable students to practice paediatric ACLS in emergencies and do so in a stress-free, secure environment. The study shows that nursing

students have perceived satisfaction and self-confidence as internal effects of their simulation experience and it was also supported by the study's findings[12-14].

These recent research findings are corroborated by a study[15], which found that when students can see and practice the content, they can retain up to 75.0% of it, but they can only retain 10.0% of what they hear. Additionally, several studies in a variety of professions, including nursing, demonstrated that simulation has a beneficial impact on knowledge acquisition[16-18]. The findings of this study, therefore suggest that the simulation should be used responsibly and as a teaching tool to improve the standard of nursing students' educational experiences.

Simulated learning improves knowledge[19,28] when compared to lectures. Students exposed to HFS have considerably higher post-test knowledge and performance levels than students exposed to videos[20]. Utilizing HFS technology in a risk-free and secure lab environment is advantageous and effective for learning acquisition. Students from the fourth year (sixth and seventh level) performed better on the post-test in terms of paediatric ACLS knowledge than their counterparts from the third year. (Fifth level). The concept of the chronological effect, which suggests[21] that older kids perform better academically, may help to explain this. In the fourth year (eighth level), chronological age can have an impact on academic performance; however, in my study, pre-test results revealed low knowledge at both levels.

Through a favourable association between the satisfaction scores, simulation design, and educational methods, the present study demonstrated focused and consistent connectivity in designing, carrying out, and evaluating paediatric ACLS simulation scenarios. Innovative instructional techniques, such as simulation, are essential for engaging students in active learning and, ultimately, for bridging the gap between theory and practice[22]. According to systematic research that examined the impact of high-fidelity patient simulation (HFPS) on nursing students' learning outcomes, HFPS increased the students' knowledge and competence. The authors suggested that HFPS be taken into consideration as a teaching strategy that will enhance nursing students' competence and claimed that involving nursing students in simulation could enhance their capacity to provide safe nursing care even in patients with unstable and rapidly changing clinical conditions, thereby boosting their confidence[23].

Pre-briefing was used in this study to introduce a variety of learning possibilities, including videos, Blackboard forums, case studies, and flipped lessons. The variety of learning experiences was facilitated by exposure to high-fidelity and standardized patients. With simulation, there are several ways to learn a concept[24]. The study concluded that simulation-based instruction helps nursing students learn in a variety of ways, and the authors suggested including simulation in pre-licensure nursing programs[25]. The paediatric ACLS Educational techniques and simulation design employed in the nursing curriculum, as stated in the aforementioned study, increased nursing students' confidence and satisfaction. The study's author is a major proponent of including simulation in the nursing curriculum.

Patient-centered care, teamwork and cooperation, evidence-based practice, quality improvement, patient safety, and informatics are the six competencies of Quality and safety education for nurses (QSEN), which aim to raise the standard of patient care among nursing students[26]. In the laboratory rather than in a clinical setting, it is much easier to acquire the information, abilities, and attitudes required for these QSEN competencies[27]. The researcher of the current study therefore strongly advises the need for a standardized template, specifically the National League for Nursing-Jeffries Simulation Framework (NLN-JSF), as a guide to plan, implement, and evaluate simulation experiences that fully encompass all aspects of the simulation design.

Limitations

This study used a non-probability convenient sample technique, which limited the generalizability of the study findings. Furthermore, using a sample of students drawn from just one university of the nursing facility.

Conclusion

After the simulation, students' Paediatric ACLS knowledge, practice, and self-efficacy scores significantly improved. These results lead us to believe that simulation training can have a

favourable impact on students' learning, practice, and self-confidence. Thus, consistent and structured simulation scenarios that completely cover all aspects of simulation design are required.

Recommendations and conclusion

To boost student satisfaction and self-confidence, the authors advise using repeated simulation experiences in all nursing clinical courses. Simulations should include pre-briefing and de-briefing, two important tactics that improve students' learning. To create an effective learner-centered simulation scenario, routine assessment is necessary. When creating the simulation scenarios, domains of educational taxonomies should be considered by the course objectives. It is important to evaluate each simulation to ensure process improvements. As a result of this study, it is strongly advised that undergraduate nursing programs use the National League for Nursing-Jeffries Simulation Framework (NLN-JSF) to incorporate simulation into their curricula.

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Conflicts of interest

The author declares no conflicts of interest.

Contribution of authors

Dr. Santhi Muttipoll Dharmarajlu, Ph.D. – Constructing concepts, Design, the definition of intellectual content, Literature search manuscript, Data acquisition, Data analysis, Statistical analysis, Manuscript preparation, Guarantor.

Dr. Hamad Ghaleb Dailah, Ph.D. - Statistical analysis, Manuscript preparation, Manuscript editing, Manuscript review

Dr. Anuratha M D, Ph.D - Constructing an idea or hypothesis for research, manuscript planning methodology to reach the conclusion, Literature Review, critical review

Data availability

The statistical data that support the findings of this study are available from the corresponding authors upon reasonable request.

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