Effect of Implementing Nursing Intervention Regarding Infection Control Measures on Nurses' Performance during Cardiopulmonary Resuscitation

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Abstract

Background: When a patient has abrupt cardiac arrest, cardiopulmonary resuscitation (CPR) is a quick and critical lifesaving procedure that can either prevent or delay death. **The aim of the study** was to assess how nurses' knowledge and practice of CPR were affected by the implementation of nursing intervention about infection control measures. **Subjects and Methods**: This quasi-experimental research was conducted on 105 nurses. Data regarding infection control measures on nurses' performance during CPR were collected from nurses using nurses' structured interview questionnaires and Nurses' practice observational checklist. **Results:** Initially, 76.19% of participants had low knowledge, but this dropped to 0% immediately after the intervention, with only 3.81% remaining in the low knowledge category after 6 weeks. Moderate knowledge was initially present in 14.29% of participants, decreasing to 0.95% immediately after the intervention, then increasing to 19.05% at the 6-week follow-up. High knowledge increased dramatically from 9.52% to 99.05% immediately post-intervention, with 77.14% retaining high knowledge 6 weeks later. Initially, 71.43% of participants had unsatisfactory performance, which dropped to 0% immediately after the intervention, but 23.81% reverted to unsatisfactory performance 6 weeks later. In contrast, only 28.57% initially performed satisfactorily, but this increased to 100% immediately post-intervention, with 76.19% maintaining satisfactory performance 6 weeks later. **Conclusions:** There was a clear positive correlation between the nurses' overall practice scores and their overall knowledge scores.

Keywords: Cardiopulmonary Resuscitation, Infection Control, Knowledge, Practice

Introduction

Death from cardiac arrest is among the most common causes of mortality globally. Estimates suggested that cardiac arrest occurred at a rate of 50 to 100 instances per 100,000 individuals within the broader population. Effective nursing care and a thorough understanding of cardiopulmonary resuscitation (CPR) techniques are essential **(Ahern et al., 2011; Merchant et al., 2011).**

Sudden cardiac arrest (SCA) is a common consequence of several serious illnesses. This is the cessation of regular blood flow to any region of the body, including important organs. Basic life support (BLS), advanced cardiac life support (ACLS), and post-resuscitation treatment are among the factors that affect the prognosis of patients with SCA **(Filho, Santana-Santos, Gengo, & Nogueira, 2015; Murphy et al., 2020).**

Although CPR usually cannot restart the heart, it ensures that oxygen is delivered mostly to the heart and brain. After a sudden cardiac arrest, the chance of survival drops by 10–15% for each minute that goes by without resuscitation measures being initiated **(Mustafa Aljanabi & Al-Ani, 2014)**. Respiratory and cardiac arrest patients receive CPR, a lifesaving emergency procedure, though it does not yield successful outcomes for all individuals. In statistics, the patient's prognosis is key to the effectiveness of CPR; implementing trust is essential for patients with a high likelihood of survival. Numerous studies have suggested that the training of CPR courses be implemented for professional healthcare workers, and it is well known that they are familiar with the equipment and its proper use **(Kleinman et al., 2015; Mogadasian et al., 2014; Wyckoff et al., 2022; Yuen, Reid, & Fetters, 2011).**

In cases of in-hospital cardiac arrest, nurses are the initial members of the medical team to initiate CPR, and they have the primary responsibility for management. Medical staff, particularly nurses, should be trained and knowledgeable about identifying cardiac arrest symptoms and taking prompt action to prevent delays in administering basic life support care in the process of resuscitation **(Atkins et al., 2015; Atkins et al., 2018; Soar et al., 2015)**.

The standard precautions are a set of guidelines outlining the most up-to-date and comprehensive infection control practices aimed at reducing the risk of infectious transmissions.

Its capacity to win serves as the main defence against exposure to biological fluids such as blood, mucosal membranes, secretions, and non-contact skin. Numerous international bodies, such as the World Health Organisation (WHO), the Association for Professionals in Infection Control (APIC), the Centres for Disease Control (CDC), and the European Best Practice Guidelines (EPBG), all make reference to these standards. Hand sanitisation, the use of suitable personal protective equipment (PPEs), the safe handling of potentially contaminated surfaces or equipment, environmental disinfection, linen management, and

trash disposal are all part of putting standard precautions into practice **(Haile, Engeda, & Abdo, 2017; Nasiri et al., 2019; Neo, Mills, & Edward, 2013)**.

The purpose of this study was to evaluate how the introduction of nursing interventions centred on infection control protocols affected the clinical expertise and knowledge of nurses doing cardiopulmonary resuscitation.

Materials and Methods

A quasi-experimental study involving 105 nurses employed at Tanta University Hospitals and Elmenshawy Hospital's casualty and emergency departments was conducted.

The study received approval from the Ethical Committee at Tanta University Hospitals in Tanta, Egypt. Consent forms signed by the nurses indicated that they were fully informed.

Assessment phase

The Nurses' structured interview questionnaire, consisting of parts A and B, was initially utilized at the commencement of the study. Part A gathered socio-demographic data from nurses, including details on age, sex, marital status, years of professional experience, educational level, and prior training in infection control practices during CPR procedures. Meanwhile, part B, the nurses' knowledge assessment sheet, was employed to evaluate nurses' knowledge both prior to and following the implementation of an educational program focused on infection control measures during CPR. The Tool II, nurses' practice observational checklist, was employed to evaluate nurses' practice both prior to and subsequent to the introduction of an educational program focused on hand washing and preventing the dissemination of infection during cardiopulmonary resuscitation.

Planning phase

This phase focuses on building, setting up, and evaluating various data collection instruments, as well as making managerial arrangements to conduct the study. A researcher was developing a nursing health teaching program to enhance nurses' knowledge and clinical skills. By the end of the sessions, an Arabic-language booklet was distributed.

Implementation phase

The educational program was created by researchers following a comprehensive review of relevant studies **(Alwutaib, Abdulghafour, Alfadhli, Makboul, & El-Shazly, 2012; Sreedharan, Muttappillymyalil, & Venkatramana, 2011)** and research findings on detecting, managing, and evaluating nurses' knowledge and clinical practices. Data was gathered throughout three stages of evaluation for nurses; the initial stage was conducted before implementing the program using two instruments to obtain baseline information about nurses' knowledge and practice regarding infection control assessment. Prior to the educational program's implementation, each nurse was individually observed to assess their current practices in accordance

with infection control standards. A booklet outlining the program components, informed by literature reviews **(Al-Tonbary et al., 2011; Hamid, Aziz, Anita, & Norlijah, 2010; Okechukwu & Motshedisi, 2012)** and pretest evaluation findings, was compiled in Arabic and supplemented with photographs and demonstrations to aid nurses in comprehending the material. All nurses participated in an educational program conducted in outpatient clinic unit classrooms. The program was divided into two sections: the initial component involved theoretical instruction, which spanned across four consecutive days, with each of the four daily sessions lasting one hour. The first session of the program outlined the purpose of the study, provided an overview of infection control procedures, defined key concepts, and discussed the factors contributing to the spread of infection. Subsequent sessions included standard precautions for infection control, methods for controlling infection, and a final session that facilitated revision and open discussion between researchers and the study participants. Following each session, nurses were provided with printed materials containing guidelines and were also supplemented with a knowledge booklet. Throughout the training sessions, nurses were urged to pose inquiries and offer constructive comments. A line of communication was maintained between the researchers and the nurses. The practical part comprised four one-hour sessions held on four consecutive days. Nurses were allocated to smaller groups, with a typical group size ranging from 5 to 7 individuals. The first session focused on hand washing technique, the second covered personal protective equipment (PPEs), the third involved the removal of waste products through proper infection control practices, and the fourth included demonstrations and re-demonstrations. The teaching media incorporated group discussions, PowerPoint presentations, and real-life case studies.

Evaluation phase

The evaluation of this phase took place both prior to and following six weeks of program implementation, with each nurse being assessed to gauge the programme's impact on performance via tools I and II, using a scoring system. For tool I, each correct response to multiple choice questions was awarded one point, while incorrect responses received zero points. Each short answer question received scores of 2 for a correct and complete response, 1 for a correct but incomplete answer, and 0 for an incorrect answer. The total scoring system was used to categorize patients' knowledge based on the following criteria: scores above 80% were classified as high, scores between 60% and 80% were categorized as moderate, and scores below 60% were designated as low. For tool II, a scoring system was implemented to evaluate each step of nurses' practice, with a score of (1) assigned for tasks completed and a

score of (0) assigned for tasks not completed. The nurse practice scoring system was categorized into two groups: less than 80% was classified as unsatisfactory and 80% or greater was classified as satisfactory.

Statistical analysis

Measurable investigation was finished by SPSS v26. Quantitative factors were introduced as mean and standard deviation, with correlations made between the three gatherings utilizing the ANOVA (F) test, trailed by a Tukey post hoc test. Recurrence and rate information for subjective factors were introduced, and the Chi-square test was utilized for investigation. A two-followed P value of under 0.05 was viewed as statically significant.

Results

Sociodemographic characteristics of the studied nurses were enumerated in this table. **Table 1**

Initially, 76.19% of participants had low knowledge, but this dropped to 0% immediately after the intervention, with only 3.81% remaining in the low knowledge category after 6 weeks. Moderate knowledge was initially present in 14.29% of participants, decreasing to 0.95% immediately after the intervention, then increasing to 19.05% at the 6-week follow-up. High knowledge increased dramatically from 9.52% to 99.05% immediately post-intervention, with 77.14% retaining high knowledge 6 weeks later. Total knowledge showed significant increase from pre to immediately to post 6 weeks periods of follow up (P<0.05). **Table 2**

Initially, 71.43% of participants had unsatisfactory performance, which dropped to 0% immediately after the intervention, but 23.81% reverted to unsatisfactory performance 6 weeks later. In contrast, only 28.57% initially performed satisfactorily, but this increased to 100% immediately post-intervention, with 76.19% maintaining satisfactory performance 6 weeks later. These changes were statistically significant, reflecting a strong immediate impact of the intervention, with a slight decline over time.Total practice showed significant increase from pre to immediately to post 6 weeks periods of follow up (P<0.05). **Table 3**

Prior to, during, and six weeks after the implementation of the educational program, the total knowledge and total practice scores of the nurses under study showed a significant positive connection (P0.05). There was no discernible difference in the correlation between total knowledge and total practice scores. Total knowledge and total practice scores before and just after the educational program was implemented showed statistically significant changes (P0.05). **Table 4**

There was no significant difference between socio-demographic characteristics and total knowledge scores in pre, immediately and 6 weeks after implementing of educational program except in sex through the period of immediately after of follow up showed significant difference (P<0.05). **Table 5**

Sociodemographic traits and total practice scores before, during, and six

weeks after the start of the educational program did not significantly differ from one another. **Table 6**

Table 1: distribution of the nurses studied regarding their sociodemographic characteristics

		N=105	%
Age (years)	21-<30	61	58.10
	30-<40	24	22.86
	40-<50	18	17.14
	50-60	2	1.90
Sex	Male	27	25.71
	Female	78	74.29
Marital status	Married	27	25.71
	Single	75	71.43
	Divorced	1	0.95
	Widow	2	1.90
Educational level	Diplome	13	12.38
	Technical institute	44	41.90
	Bachelor	45	42.86
	Mention Other	3	2.86
Experience (years)	(1-<5)	52	49.52
	(5-<10)	13	12.38
	(10-<15)	19	18.10
	(≥15)	21	20.0

Data is presented as frequency (%).

Table 2: distribution of the studied nurses regarding their total knowledge level about infection control during CPR

Knowledge level	Pre	Immediately	Post 6 weeks	Test of Sig.	P
Low	80(76.19%)	0(0.0%)	4(3.81%)	X^2=235.186	0.000*
Moderate	15(14.29%)	1(0.95%)	20(19.05%)		
High	10(9.52%)	104(99.05%)	81(77.14%)		
Total score	23.60±12.175	48.30±2.527	48.19±6.481	F=324.44	0.000*

Data are presented as mean ± SD or frequency (%). * Significant P value <0.05. CPR: Cardiopulmonary resuscitation, X^2: Chi-square test.

Table 3: distribution of the studied nurses regarding their total level of practice during CPR

N=105	Pre	Immediately	Post 6 weeks	Test of Sig.	P
Unsatisfactory	75(71.43%)	0(0.0%)	25(23.81%)	X^2=128.19	0.000*
Satisfactory	30(28.57%)	105(100.0%)	80(76.19%)		
Total score	14.58±5.447	25.59±0.513	23.22±5.073	F=190.04	0.000*

Data are presented as mean ± SD or frequency (%). * Significant P value <0.05. CPR: Cardiopulmonary resuscitation, X^2: Chi-square test.

Table 4: Correlation between total knowledge and total practice scores of the studied nurses about infection control during CPR

N=105	Total Knowledge score					
	Pre		Immediately		Post 6 weeks	
	r	P	r	P	r	P
Total practice score	0.303	**0.002****	0.208	**0.033***	0.071	0.470

*Significant P value <0.05. CPR: Cardiopulmonary resuscitation, r: Pearson correlation coefficient.

Table 5: Mean scores of socio-demographic characteristics of the studied nurses and their total knowledge scores about infection control during CPR

N=105		Pre	Immediately	Post 6 weeks
Age (years)	(21-<30)	23.20±11.89	47.90±2.45	47.44±7.13
	(30-<40)	23.17±12.68	49.04±2.74	49.83±4.15
	(40-<50)	26.61±12.98	49.00±1.85	48.11±6.83
	(50-60)	14.00±2.83	45.50±4.95	52.00±0.00
F1=0.81, F2=2.586, F3=1.017, P1=0.491, P2=0.057, P3=0.389				
Sex	Male	26.78±13.69	49.52±1.74	48.96±5.58
	Female	22.50±11.50	47.88±2.63	47.92±6.78
t1=2.512, t2=9.031, t3=0.514, P1=0.116, P2=0.003*, P3=0.475				
Marital status	Married	22.44±12.30	48.22±2.28	47.67±7.05
	Single	23.76±12.04	48.37±2.66	48.41±6.35
	Divorced	19.00±0.00	47.00±0.00	50.00±0.00
	Widow	35.50±20.51	47.50±2.12	46.00±8.49
F1=0.765, F2=0.18, F3=0.186, P1=0516, P2=0.911, P3=0.906				
Educational level	Diplome	23.69±13.39	48.23±1.48	46.92±7.18
	Technical institute	22.18±11.04	48.61±2.52	48.73±6.20
	Bachelor	25.24±13.13	47.87±2.76	48.11±6.68
	Post studies	19.33±9.29	50.67±0.58	47.00±6.93
F1=0.589, F2=1.573, F3=0.296, P1=0.624, P2=0.201, P3=0.828				
Years of experience	(1-<5)	23.15±12.23	47.75±2.57	47.69±6.84
	(5-<10)	25.46±11.46	49.38±1.61	46.85±8.12
	(10-<15)	21.89±12.62	48.79±2.92	50.58±2.95
	(≥15)	25.10±12.62	48.57±2.32	48.10±6.67
F1=0.348, F2=1.993, F3=1.156, P1=0.791, P2=0.121, P3=0.331				
Attendance of training program		22.31±12.51	48.41±2.55	48.75±5.58
t1=0.512, t2=0.074, t3=0.341, P1=0.476, P2=0.787, P3=0.561				

Data are presented as mean ± SD. * Significant P value <0.05. CPR: Cardiopulmonary resuscitation.

Table 6: Mean scores of socio-demographic characteristics of the studied nurses and their total practice scores about infection control during CPR

N=105		Pre	Immediately	Post 6 weeks
Age (years)	(21-<30)	14.54±5.34	25.54±0.54	22.90±5.30
	(30-<40)	13.92±5.62	25.63±0.50	23.17±5.16
	(40-<50)	15.39±5.62	25.78±0.43	24.06±4.48
	(50-60)	16.50±9.19	25.00±0.00	26.00±0.00
F1=0.328, F2=1.96, F3=0.437, P1=0.805, P2=0.125, P3=0.727				
Sex	Male	13.93±6.17	25.59±0.57	23.48±4.89
	Female	14.81±5.20	25.59±0.50	23.13±5.16
t1=0.523, t2=0.001, t3=0.096, P1=0.471, P2=0.981, P3=0.757				
Marital status	Married	15.04±5.81	25.63±0.49	23.11±5.08
	Single	14.43±5.34	25.57±0.52	23.29±5.10
	Divorced	10.00±0.00	26.00±0.00	26.00±0.00
	Widow	16.50±7.78	25.50±0.71	20.50±7.78
F1=0.395, F2=0.307, F3=0.295, P1=0.757, P2=0.821, P3=0.829				
Educational level	Diplome	15.85±5.83	25.69±0.48	25.15±3.05
	Technical institute	14.41±5.30	25.59±0.50	23.30±5.11
	Bachelor	14.44±5.71	25.53±0.55	22.40±5.52
	Post studies	13.67±2.08	26.00±0.00	26.00±0.00
F1=0.28, F2=0.993, F3=1.338, P1=0.842, P2=0.399, P3=0.266				
Years of experience	(1-<5)	14.58±5.46	25.54±0.54	22.56±5.53
	(5-<10)	14.92±5.44	25.62±0.51	24.15±4.58
	(10-<15)	13.63±5.42	25.58±0.51	23.16±5.04
	(≥15)	15.24±5.71	25.71±0.46	24.33±4.19
F1=0.305, F2=,0.592 F3=0.775, P1=0.822, P2=0.622, P3=0.511				
Attendance of training program		12.94±4.98	25.47±0.57	23.47±4.92
t1=4.324, t2=2.63, t3=0.111, P1=0.04*, P2=0.108, P3=0.741				

Data are presented as mean ± SD. * Significant P value <0.05. CPR: Cardiopulmonary resuscitation.

Discussion

All medical personnel, but especially critical care nurses, should be proficient in advanced cardiovascular life support **(Abass & Soliman, 2020)**. More than two-thirds of the nurses in the current study had not taken part in the infection control training program during cardiopulmonary resuscitation. Less than two-thirds of nurses did not participate in an infection control training program when doing cardiopulmonary resuscitation, according to **(Pellis et al., 2009)**. The results of the current study showed that the nurses' level of knowledge had significantly improved; most had insufficient knowledge before the educational training program was implemented, but all nurses had good knowledge after the program was put into place.

Also, there was significant differences were found in all questions and between all periods of follow-up. This finding was consistent with **(Chan-Yeung, 2004)** reported that lack of continuous education and training programs about infection control during CPR led to unsatisfactory level of nurse's knowledge. In contrast with **(Naser & Hadziomerovic, 2018)** reported that nearly three quarters of the studied patient have scored good knowledge before the program.

The current study's findings on knowledge retention throughout the intervention stages for infection control during CPR (True and False questions) showed that, prior to the educational program, the participating nurses provided incorrect answers to all queries, whereas after the program, their responses improved. Consistent with **(Kubica et al., 2018)**, prior to the adoption of educational standards, it was found that around three-quarters of the nurses under study had inadequate knowledge; following this, a highly significant improvement in their level of knowledge was noted.

Prior to the start of the educational program, the participating nurses in this study initially shown a lack of understanding. Most nurses showed a high degree of understanding once it was put into practice. Interestingly, six weeks after the educational session ended, more than three-quarters of them continued to possess this high level of knowledge. According to studies by **(Wang et al., 2013)**, most nurses polled knew very little about infection prevention during CPR before the instructional program was put into place. However, in the immediate aftermath of the program's execution, almost three-quarters of them showed a high degree of understanding in this area.

More than half of the participants did not wash their hands and did not wear their gloves, apron, foot protector, and mask prior to the implementation of the educational program. In contrast, six weeks after the program was implemented, all participants were washing their hands and wearing their gloves, apron, foot protector, and mask.

These findings were in line with those of **(Konstantinides et al., 2020)**, who discovered a highly significant positive link between a person's total knowledge level throughout the

research period and how often they practiced infection control during CPR.

This study found that prior to the introduction of an educational program, more than half of the participating nurses were not following hand hygiene protocols, but afterwards, the majority and all of the nurses were adhering to all steps of hand hygiene practice within 6 weeks. Studies concur with **(Perkins et al., 2015)** those enhancements in nursing knowledge following an educational program led to improved nursing practice after 6 weeks.

The current study found that over half of the nurses being studied had failed to wear gloves, face masks, nose masks, and gowns before the educational program was put in place, whereas all and the majority of them wore personal protective equipment during cardiopulmonary resuscitation six weeks after the educational program was implemented. This outcome is consistent with **(Patel et al., 2018)**, who observed a highly significant improvement in the nurses' use of personal protective equipment during CPR following their participation in the educational training program.

following the introduction of the educational program.

The research identified a significant connection between the socio-demographic traits of the participants and their overall knowledge score, consistent with the results of **(Holmberg et al., 2019)**, which revealed a substantial correlation between knowledge scores and socio-demographic traits of nurses in

The findings of this study concerning the distribution of the participating nurses based on their overall proficiency in CPR indicated that fewer than three quarters of the nurses displayed an unsatisfactory level of practice during CPR implementation, whereas more than three quarters of the nurses demonstrated a satisfactory level of practice after 6 weeks of the cardiopulmonary resuscitation educational program.

Researchers investigated the connection between the total scores for knowledge and the total scores for practice among the nurses studied in terms of their adherence to infection control procedures during cardiopulmonary resuscitation (CPR). The study found a significant positive relationship between nurses' overall scores for knowledge and practice before, immediately after, and six weeks following the implementation of an educational program. This discovery aligned with **(Bircher, Chan, & Xu, 2019)**, a statistically significant and highly positive correlation was observed between the total practice level of nurses in the study and their total knowledge level over the course of the study period

relation to infection control during CPR within the context of a program intervention. In contrast, a study led by **(Bossaert et al., 2015)** revealed that the demographic characteristics of the respondents did not significantly affect the knowledge score.

Findings from the study indicated a substantial relationship between socio-demographic factors and the

participants' overall practice score. The discovery aligned with Finn's observation, noted in reference **(Finn, Jacobs, Williams, Gates, & Perkins, 2019)**, revealed after a program centred on infection control during CPR was put into place, there was a significant correlation between total practice scores and sociodemographic traits. One of the study's drawbacks was its very small sample size, therefore, it is suggested that further research is necessary to extend the follow-up period for the CPR programs. The study's findings should be validated by conducting it on a large sample size in various hospital settings to achieve broader applicability.

Conclusions

At three different times in time - before, right after, and six weeks after the start of the training program - the study discovered a significant positive link between the nurses' overall knowledge scores and their overall practice scores. There was a notable disparity between every stage of follow-up regarding the overall extent of CPR practice.

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