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Effectiveness of Simulation Based Teaching on Knowledge and Skill Regarding Cardiopulmonary Resuscitation of Pregnant Women among Nursing Personnel

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Abstract: ***Background: Cardiac arrest in pregnancy is an uncommon but the most challenging clinical scenarios. Nurses are often the first responders in cardiopulmonary arrest of pregnant women in hospital. Hence appropriate training and preparation of nurse is much needed. Objective: The study was intended to determine the effectiveness of simulation based teaching on the knowledge and skill of nurses regarding cardiopulmonary resuscitation of pregnant women. Methodology: A pre-experimental study design was undertaken for a period of 6 weeks in a tertiary care center. Fifty subjects were selected using simple random sampling technique. The data collection tools were demographic profile of the nursing personnel, self-administered questionnaire and observational checklist which were prepared by the researcher and validated by experts. A pretest was conducted to assess the knowledge and skill of the subjects regarding cardiopulmonary resuscitation of pregnant women using self-administered questionnaire and observational checklist respectively. Subsequently, the researcher provided simulation based teaching. Thereafter a posttest was conducted in a similar manner to pretest. Descriptive and inferential statistics were used to analyze the findings of the study. Results: This study revealed that the mean age of the nursing personnel was 30.6 ± 6.8 years. The majority of them had General Nursing and Midwifery (84%) as their educational qualification. The mean years of experience were 6.1 ± 4.9 years. There was a statistically significant (p<0.001) increase in knowledge and skill regarding cardiopulmonary resuscitation (CPR) of pregnant women among nursing personnel after simulation based teaching.Conclusion: This study identified that simulation based teaching was effective. The investigator strongly recommends to use the simulation based teaching to train the nurses on CPR of pregnant women. CPR of pregnant women should be incorporated in the routine CPR training program.***

Keywords: Cardiopulmonary arrest, Cardiopulmonary Resuscitation (CPR), pregnant women, simulation based teaching.

1. Introduction

"Save one life you're a hero.
Save a hundred lives and you're a nurse."

- Anonymous

Cardiopulmonary arrest during pregnancy presents a unique clinical scenario which endangers more than one life: the mother and the fetus. According to RCOG, Maternal collapse is defined as acritical event involving the cardio pulmonary systems and/or brain, leading to a reduced or absent conscious level (and potentially death), at any stage in pregnancy till six weeks after delivery[1]. Globally, 800 maternal deaths occur every day. The prevalence of cardiopulmonary arrest in pregnant women ranges from1/20,000 to 1/50,000 ongoing pregnancies [2].Historically, survival was described as poor, and resuscitation futile, because "the causes of cardiac arrest are fatal".

According to Jeejeebhoy et al, the leading causes for maternal cardiac arrest are described, as an alphabetical etiology running from A to H [A, B, C, D, E, F, G, H] such as Anesthesia complications, Bleeding or DIC due to uterine atony, placenta abruption, placenta previa, Cardiac disease (Myocardial Infarction or dissection or cardiomyopathy), Drugs, Embolism, Fever or sepsis, General non-obstetric causes [H and T's], Hypertension or preeclampsia or eclampsia or HELLP syndrome [3]. Most features of resuscitating a pregnant woman are similar toregular adult resuscitation, few aspects and considerations are distinctively different. The most obvious difference is that there are dyadic patients, the mother and the fetus.The pregnant uterus especially of more than 20 weeks of gestation or gravid uterus palpated above the umbilicus, compresses the inferior vena cava, impeding venous return and thereby reducing stroke volume and cardiac output. Two people are required to carry out the rescue efforts, with one of them aiding to move the uterus to the left (LUD- Lateral Uterine Displacement) to reduce the pressure on the blood vessels (aortocaval compression) which is often not addressed with due importance.The standard CAB's of CPR should also include "D" for delivery, beyond 20 weeks of gestation, when the initial resuscitation is either potentially or actually unsuccessful [4].

Resuscitation of the pregnant woman involves multispecialty and complex care decisions. This would include the obstetrical team,the anesthesia teamin addition theneonatal team, moreover equipment for a perimortem caesarean delivery and neonatal resuscitation [5].

Nurses are often the first responders in cardiopulmonary arrest and they should be able to begin basic emergency care

immediately. Basic emergency care is imperative. Rapid mobilization of expert resuscitation teams in addition to Basic Life Support (BLS) performed competently until the arrival of these teams bestow the woman the best chance for return of spontaneous circulation (ROSC).Preparation of nurses to manage this grave situation is absolutely necessary in current scenario.Practice of resuscitation skills is best achieved through regular effective training. Simulation based training can be the method to develop health professionals' knowledge, skills, and attitudes, whilst protecting patients from unnecessary endangerment [6]. Hence, the investigator aspired to develop a simulation based teaching on cardiopulmonary resuscitation of pregnant women and intended to determine the effectiveness of simulation based teaching.

2. Objectives

1) To assess knowledge and skill regarding CPR of pregnant women among nursing personnel before and after simulation based teaching.
2) To compare knowledge and skill regarding CPR of pregnant women among nursing personnel before and after simulation based teaching.
3) To find relationship between knowledge and skill regarding CPR of pregnant women among nursing personnel with the selected demographic variables.

3. Hypotheses

H_1: There is a significant difference in knowledge and skill regardingCPR of pregnant women among nursing personnel before and after simulation based teaching.

H_2: There is a significant relationship between knowledge and skill regardingCPR of pregnant women among nursing personnel and selected demographic variables.

4. Methods

A pre-experimental design (One-group Pretest - Posttest) was used to assess the effectiveness of simulation based teaching on knowledge and skill regarding CPR of pregnant women among nursing personnel in the wards of Obstetrics and Gynecological Department, Tertiary Care Center, Vellore for a period of 6 weeks. Fifty subjects were selected using simple random sampling techniqueby a computer generated random numbers. The data collection tools were demographic profile of the nursing personnel, self-administered questionnaire and observational checklist which were prepared by the researcher and validated by experts. Content Validity Index (CVI) for self-administered questionnaire for assessment of knowledge and observational checklist for assessment of skill regarding CPR of pregnant women was 0.98 and 0.975 respectively. The reliability and consistency of the instrument was determined by test and retest method. Intraclass Correlation Coefficient (ICC) of self-administered questionnaire for assessment of knowledge regarding CPR of pregnant women was 0.67 (95% CI: 0.18, 0.87), which showed a substantial agreement between the test and retest.

4.1 Data Collection Instruments and Scoring Procedure

The data collectioninstrument had the following parts,

Part 1: Demographic profile of the nursing personnel
This consists of demographic data of subjects, which includes age, educational qualification, years of experience in wards of Obstetrics and Gynecological Department, current area of work, classes attended on ALSO (Advanced Life Support in Obstetrics), number of classes attended on CPR (Cardiopulmonary Resuscitation). This was collected at the initial interaction between the investigator and the nursing personnel.

Part 2: Self-administered questionnaire for assessment of knowledge regarding CPR of pregnant women prepared by the investigator
Knowledge among nursing personnel was assessed using a self-administered questionnaire on selected aspects of CPR of pregnant women prepared by the investigator based on Advanced Life Support in Obstetrics (ALSO) guidelines by American Academy of Family Physicians (AAFP) and American Heart Association (AHA) guidelines. The participants were allowed 30 minutes to complete the questionnaire which consisted of 20 single choice questions. Each correct answer a score of 1 was given and for incorrect answer a score of 0 was given. The maximum total score was 20.

Part 3: Observational checklist for assessment of skill regarding CPR of pregnant women prepared by the investigator
Skill among nursing personnel was assessed using observational checklist regarding CPR of pregnant women prepared by the investigator based on Advanced Life Support in Obstetrics (ALSO) guidelines by American Academy of Family Physicians (AAFP) and American Heart Association (AHA) guidelines. The subjects were allowed 10 minutes to perform the skill individually in sequential steps.The observational checklist consisted of 30 items. The correct performance, according to the sequence was rated 'yes' and a score of 1 was given. When the performance was not according to the correct sequence, the item was rated 'no' and a score of 0 was given. The maximum total score was 30.

4.2 Data Collection Procedures

Figure 1: Steps in data collection

5. Data Analysis and Results

The collected data were analyzed using Statistical Package for Social Sciences (SPSS) version 17.0 for windows.

Section A: Demographic variables.

Table 1: Distribution of nursing personnel based on demographic variables (N=50)

Demographic Variables	Mean ± SD / n (%)	
Age[a]	30.6 ± 6.8	
Educational qualification[b]		
GNM	42	(84)
B.Sc Nursing	8(16)	
Years of experience in wards of Obstetrics and Gynaecological Department[a]	6.1 ± 4.9	
Current area of work[b]		
Wards	26	(52)
Labour Room	24	(48)
Classes attended on ALSO (Advanced Life Support in Obstetrics)[b]		
Yes	0	(0)
No	50 (100)	
No. of Classes attended on CPR)[b]		
1	12	(24)
2	13	(26)
>2	25	(50)

a: mean ±SD, b: n(%)

Table 1 highlights the demographic variables of the nursing personnel. It was found thatthe mean age of the nursing personnel was 30.6 ± 6.8 years. Majority of them 42 (84%)had GNM (General Nursing and Midwifery) as their educational qualification. The mean years of experience in wards of Obstetrics andGynecological Department were 6.1 ± 4.9 years. Most of the nursing personnel 26(52%) were from wards. None of them had attended class on ALSO (Advanced LifeSupport in Obstetrics). Half of them 25 (50%) had attended more than 2 classes on CPR.

Section B: Pretest and Posttest Score.

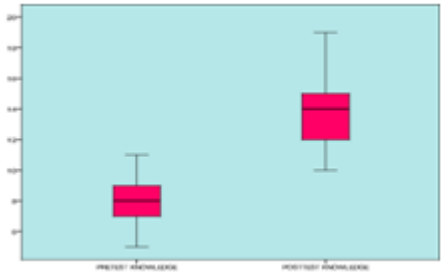


Figure 2: The assessment score of knowledge regarding CPR ofpregnant women among nursing personnel before and after simulation based teaching (Pretest Knowledge and Posttest Knowledge Score) (N=50)

Figure 2 the box plot depicts that the median and distribution of pretest knowledge score was lower than posttest knowledge score.

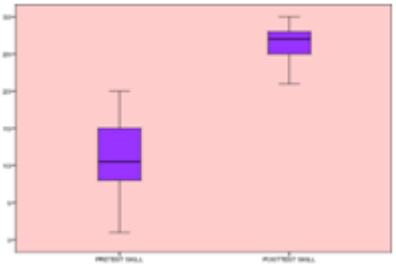


Figure 3: The assessment score of skill regarding CPR ofpregnant women among nursing personnel before and after simulation based teaching (Pretest Skill and Posttest Skill Score) (N=50)

Figure 3 the box plot depicts that the median and distribution of pretest skill score was lower than posttest skill score.

Section C: The comparison of mean difference between pretest and posttest score.

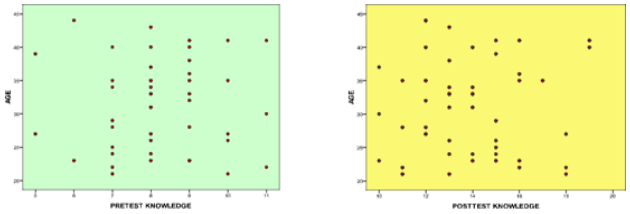
Table 2: Comparison of mean difference between pretest and posttest score in knowledge and skill regarding CPR of pregnant women among nursing personnel before and after simulation based teaching (N=50)

Variable	Pretest		Posttest		tstatistic	p-value
	Mean	SD	Mean	SD		
Knowledge	8.14	1.40	13.90	2.30	17.065	<0.001***
Skill	10.62	4.50	26.50	2.20	25.092	<0.001***

*** p< 0.001 statistically significant

Table 2 depicts that there was a statistically significant increase in knowledge and skill regarding CPR of pregnant women among nursing personnel before and after simulation based teaching (p<0.001).

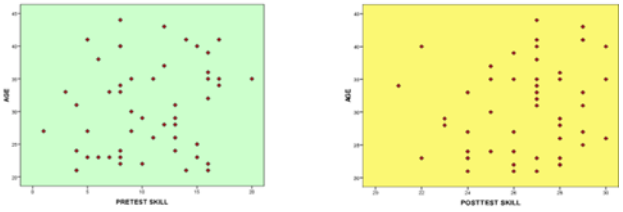
Section D: The relationship between the knowledge and skill with selected demographic variables.



4 (a) 4 (b)

Figure 4: Correlation between age and knowledge (N=50)

Figure 4.a reveals that there was no correlation between age and pretest knowledge, with the Pearson's correlation coefficient, r = 0.064 (p = 0.658).
Figure 4.b reveals that there was no correlation between age and posttest knowledge, with the Pearson's correlation coefficient, r = 0.025 (p = 0.863).

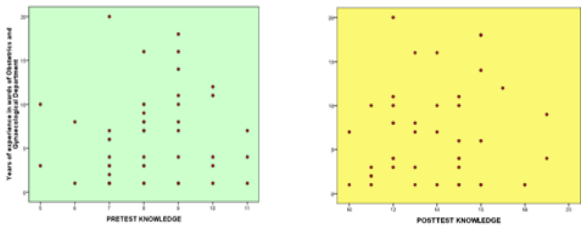


5 (a) 5 (b)

Figure 5: Correlation between age and skill (N=50)

Figure 5.a reveals that there was very weak positive correlation between age and pretest skill, but statistically not significant with the Pearson's correlation coefficient, r = 0.163 (p = 0.257).

Figure 5.b reveals that there was very weak positive correlation between age and posttest skill, but statistically not significant with the Pearson's correlation coefficient, r = 0.204 (p = 0.156).

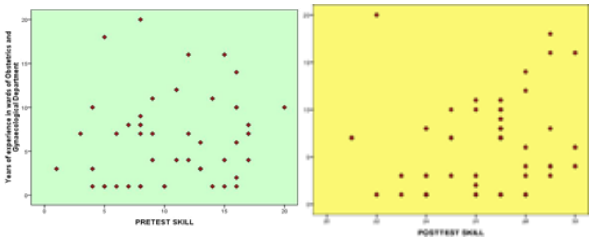


6 (a) 6 (b)

Figure 6: Correlation between years of experience in wards of Obstetrics and Gynecological Department and knowledge (N=50)

Figure 6.a reveals that there was no correlation between the years of experience in wards of Obstetrics and Gynecological Department and pretest knowledge, with the Pearson's correlation coefficient, r = 0.098 (p = 0.500).

Figure 6.b reveals that there was no correlation between the years of experience in wards of Obstetrics and Gynecological Department and posttest knowledge, with the Pearson's correlation coefficient, r = -0.063 (p = 0.662).



7 (a) 7 (b)

Figure 7: Correlation between years of experience in wards of Obstetrics and Gynecological Department and skill (N=50)

Figure 7.a reveals that there was very weak positive correlation between the years of experience in wards of Obstetrics and Gynecological Department and pretest skill, but statistically not significant with the Pearson's correlation coefficient, r = 0.116 (p = 0.423).

Figure 7.b reveals that there was very weak positive correlation between the years of experience in wards of Obstetrics and Gynecological Department and posttest skill, but statistically not significant with the Pearson's correlation coefficient, r = 0.179 (p = 0.213).

6. Discussion

Analyses of the results of the present study have shown that the median and distribution of pretest knowledge score was lower than posttest knowledge score. The investigator suspects this finding might be due to lack of educational training program regarding CPR of pregnant women. A study by Cohen et al, have assessed the knowledge regarding CPR of pregnant women. The study concluded that, health care providers have inadequate knowledge on CPR of pregnant women, especially regarding left uterine displacement and perimortem caesarean delivery during cardiac arrest [7].In the current study, the distribution of pretest skill score was lower than posttest skill score.This might be due to the lack of emphasis on the nursing curriculum about CPR of pregnant women to the nursing student. In current routine CPR trainingprogram importance on CPR of pregnant women might be insufficient.A similar study done was found to support the present study finding. A majority of the maternity nurses had unsatisfactory practice regarding implementation of CPR during pregnancy at preprogram phase, which has been strongly increased immediately after post intervention[8].

The investigator used paired t-test to determine the effectiveness of simulation based teaching on knowledge and skill regarding CPR of pregnant women among nursing personnel. Remarkably, there was statistically significant increase in knowledge and skill regarding CPR of pregnant women among nursing personnel after simulation based teaching ($p<0.001$).These findings may be due to the use of simulation based teaching which gave the nurses' the opportunity to experience rare clinical scenarios, receive immediate feedback, and most importantly correct mistakes.This finding was highly supported by Cant & Cooper, 2009; Laschinger, et al., 2008; Norman, 2012; Weaver, 2011. Simulation was considered an effective learning tool and in many studies it was proved to have an impact on knowledge acquisition, skill performance, and confidence levels[9][10].The more recent research assessed the impact of CPR training program among nurses found that there was statistically significant increase in mean knowledge level and overall performance before and after the formal certified CPR training program (P=0.000) [11].Thus, the present study findings supported the first research hypothesis (H_1) to a strong extent. This signifies that the simulation based teaching was effective.

Pearson correlation coefficient test was used to identify the relationship between knowledge, skill and selected demographic variables. The investigator found that there was very weak positive correlation between the age of the nursing personnel and skill both in pretest and posttest but statistically insignificant. These finding are in accordance with Parajulee and Selvarajthat there was no significant association between the total scores and age (p = 0.823)[12]. In Nepal, a study to investigate nurses'knowledge regarding CPR in a tertiary care teaching hospital, the study findings reported thatthere was no significant relation between the total knowledge score and age of the respondent[13].

The present study indicated that there was very weak positive correlation between the years of experience of the nursing personnel in wards of Obstetrics and Gynecological Department and skill (pretest and posttest) but statistically insignificant. A study done by Parajulee and Selvaraj that there was no significant association between the total scores and the duration of experience (p = 0.239)[12].These findings are in disagreement with findings of the study done

by Mohamed et al revealed that there was a statistically significant relation between the years of experience of the nursing personnel working in maternity department and knowledge on CPR of pregnant women [8].

7. Implications of the study

This study indicates the importance of simulation based teaching regarding CPR of pregnant women. Simulation is one of the best methods to teach CPR of pregnant women for health care personnel.

7.1 For Practice

Along with regular CPR training there should be training exclusively for CPR in pregnant women as a special circumstance.It is the responsibility of the nurses to take care of the most vulnerable people at their lowest point of life. It is important for every nurse in the health care field to perform early identification of maternal cardiac arrest and to provide prompt CPR to save two lives which are at risk. This may ultimately help to reduce the maternal and neonatal mortality and morbidity rates in hospital.

7.2 For Education

The nurse educators in clinical and in academic field ought to embrace this method with more confidence in order to provide supportive learning environments.A nursing book should be written on CPR of pregnant women with rationale for every step. It should be made available for nursing students.CPR of pregnant women should be incorporated in nursing curriculum for final year nursing students under the Obstetrics and Gynecological subject. This will help to develop competent young nurses. Simulation based training should be implemented as the method of teaching in nursing programs.

7.3 For Administration

CPR of pregnant women should be included in regular CPR training programs organized by the Nurse administrators for all the nurses irrespective of their working area.A simple manual of guidelines of advanced CPR for pregnant women should be made available. Periodical assessment and evaluation of all the nursing personnel on their knowledge and skill related to CPR of pregnant women should be made mandatory to renew their CPR certification. Every critical area in hospital should be equipped with emergency perimortem caesarean section kit and nurses should be trained for assisting the obstetrician for emergency perimortem caesarean section.

7.4 For Nursing Research

More studies should be conducted using longitudinal research methodology and using different time intervals for assessing the retention of actual knowledge and skill regarding CPR of pregnant women among health care personnel. Further research is needed to assess the long-term effects of suchsimulation based teaching. Various studies can be done to identify the satisfaction, attitude, critical thinking, decision making and self-confidence of the nursing personnel.

8. Conclusion

This study showed that application of simulation based teaching had enhanced nurses' knowledge and skill regarding CPR of pregnant women. A well-known quote by Anton Chekhov, "Knowledge is of no value unless we put it into practice". Hence the investigator strongly recommend all the nurse educators, nurse leaders and nurse administrators to use the simulation based teaching to train the nurses on CPR of pregnant women.

9. Conflicts of Interest

There is no conflict of interest.

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