The Effect of Simulation-Based Educational Program on Maternity Nurses' Performance regarding Obstetrical Emergencies during Pregnancy

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ABSTRACT

***Context*:** Simulation-based nursing education is an increasingly and wide-spread preferred educational approach. It offers opportunities to acquire clinical skills and decision-making through various situational experiences**.**

Aim: The research aimed to investigate the effect of simulation-based educational program on maternity nurses' performance regarding obstetrical emergencies during pregnancy.

Methods: A quasi-experimental research (one group pre/post-test) design was adopted to fulfill the research aim. This research was conducted at the Clinical Obstetrics' Skill lab of the Faculty of Nursing, Benha University. Forty nurses were recruited (all nurses working at obstetrics and gynecology emergency department of Benha University Hospital at the time of collecting data). Three tools were used for data collection; a structured self-administered questionnaire, maternity nurses' attitude assessment scale, and maternity nurses' practices observational checklist.

Results: showed a highly statistically significant improvement concerning maternity nurses' knowledge, attitude, and practices regarding obstetrical emergencies during pregnancy, immediate post-intervention, and at follow up phase compared to the pre-intervention phase ($P \leq 0.001$). There was a positive, highly statistically significant correlation between total knowledge and total attitude and total practice scores at pre-intervention, immediate post-intervention, and at follow up phases ($P \leq 0.001$).

Conclusion: The simulation-based educational program positively affected maternity nurses' performance regarding obstetrical emergencies during pregnancy. Simulation-based education regarding obstetrical emergencies during pregnancy is recommended for all nurses working at obstetrics and gynecology units.

Keywords: Simulation-based education, maternity nurses, performance, obstetrical emergencies, pregnancy

1. Introduction

One of the most important causes of maternal and neonatal mortality is the low quality of care provided for mothers and babies, which is probably a result of low levels of skills in health care providers, especially in obstetric emergencies *(Filby et al., 2016).*

Obstetrical emergencies are pregnancy-related conditions that can threaten the lives of both mother and newborn. Obstetrical emergencies can occur during pregnancy, labor, or post-delivery and tend to be unpredictable, stressful, and can cause ethical dilemmas because two lives are at stake *(Fransen et al., 2015).* Globally, every year an estimated 287,000 women die of complications during pregnancy or childbirth. There are various obstetrical emergencies of pregnancy that can threaten the wellbeing of both mother and child. The five major global causes of maternal death are severe bleeding, infections, unsafe induced abortion, hypertensive disorders of pregnancy (eclampsia), and obstructed labor, yet many of these deaths are preventable *(King & Scrutton, 2010).*

During pregnancy, obstetrical emergencies are health problems that occurred at different times during pregnancy and affected women's health, fetuses, or both. The most common causes of maternal mortality during pregnancy are maternal hemorrhage, severe preeclampsia, eclampsia, and premature rupture of membranes (PROM) *(Centers for Disease Control and Prevention, 2016).*

Maternal hemorrhage in the first trimester of pregnancy is a common complaint of women and occurs in about 25% of women who attended the emergency department. Vaginal bleeding may be caused by implantation of the embryo, gestational trophoblastic disease, or ectopic pregnancy, but the most common causes are abortion and ectopic pregnancy *(Gubbin & Gould, 2016).* Vaginal bleeding in late pregnancy is less common than in early pregnancy and can lead to severe and potentially life-threatening complications. Antepartum hemorrhage occurs in the second half of

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pregnancy, usually after 20 weeks' gestation, and complicates approximately 5% of pregnancies. The primary causes include placenta previa and placental abruption *(Silver, 2015).*

Severe preeclampsia and eclampsia can cause severe pregnancy complications and are the second leading cause of direct maternal deaths. Annually, there are 10 million women worldwide suffering from preeclampsia. About 76,000 of them die each year due to preeclampsia and related hypertensive disorders. The number of babies dying from these disorders is believed to be around 500,000 per year. In developing countries, women are seven times more likely to develop preeclampsia than women in developed countries *(Prithi et al., 2018).*

Premature rupture of membranes is associated with several potentially life-threatening maternal and perinatal complications. The overall incidence of PROM is about 5-10% of cases. It is the leading cause of premature birth and responsible for approximately 18-20% of perinatal deaths. Besides, many complications can be caused by PROM, which includes amniotic fluid infection in approximately 15–25%, postpartum infection occurs in approximately 15–20%, increased risk of cord prolapse, malpresentation, and abruption placenta. Also, severe oligohydramnios may lead to compression on the umbilical cord that causes fetal distress during labor and increases the cesarean section *(Olabi & Mousa, 2016).*

The gap between theory and clinical education can lead to low quality of health services in clinical areas. One of the most important instructions to constrain maternal and neonatal death is to promote obstetric care quality. In order to achieve this goal, nurses and gynecologists should be trained. Educations using conventional approaches do not have the requisite durability; this illustrates the need for using modern teaching methods in the education of midwifery skills. The simulation-based educational program is an active and learner-centered method that increases the ability to perform skills well by practicing and repeating *(Walker et al., 2013; WHO, 2017).*

The use of a simulation-based educational program is widely accepted and used for the education of healthcare providers. The simulation-based educational program's benefits include a learner-centered approach, safe acquisition of technical skills training, and the development of effective communication skills. The simulation-based educational program provides healthcare professionals with the opportunity to be involved in simulated patient care scenarios without harming actual patients *(Amatullah, 2018).*

Simulation-based educational programs in obstetrics are a promising method for improving safety during pregnancy and birth for women and their newborns *(Monod et al., 2014).* Simulation-based obstetrical emergency team training can improve participants' knowledge and skills and increase their ability to detect and appropriately manage relatively rare life-threatening events that can affect women during pregnancy, labor, and the postpartum period. This type of training can positively impact course participants' aptitudes and, consequently, on patients and organizations *(Nelissen et al., 2015; Mduma et al., 2015).*

Lack of skills and knowledge on how to recognize and manage obstetrical emergencies contribute to substandard institutional care and preventable maternal deaths *(Siaulys et al., 2019).* Proper knowledge about identification signs, emergency measures to be taken, and a well-equipped obstetrics unit can reduce maternal mortality by almost 35-40%. As the nurses being the primary health care providers, their preparedness for obstetrics emergencies attains paramount importance. The challenges perceived by them in managing those urgent situations demanded immediate interventions to ensure safe pregnancy and childbirth for the obstetric population *(Kim et al., 2016; Subrahmanyam et al., 2017)*

2. Significance of the study

Worldwide, obstetrical emergencies are the leading causes of maternal mortality, particularly in developing countries where literacy, poverty, lack of antenatal care, poor transport facilities, and inadequate equipment combine to magnify the problem. Moreover, other possible contributing factors may include lack of skills and training in managing obstetrical emergencies, lack of team collaboration, and ineffective communication between the health team *(Crofts et al., 2015).*

Every day around the world, approximately 830 women die from preventable causes related to pregnancy and childbirth. The maternal mortality ratio in developing countries in 2015 is 239 per 100 000 live births versus 12 per 100 000 live births in developed countries. Between 2016 and 2030, as part of the Sustainable Development Goals, the target is to reduce the global maternal mortality ratio to less than 70 per 100 000 live births *(WHO, 2016).* In Egypt, the maternal mortality ratio was 33 deaths/100,000 live births *(The world factbook, 2015).*

Clinical experience in the obstetrics emergency department at Benha University Hospital suggested that obstetrical emergencies represent a different health problem for pregnant women and their fetuses. Therefore, this study was conducted to investigate the effect of simulation-based educational program on nurses' performance regarding obstetrical emergencies during pregnancy.

3. Aim of the study

The aim was to investigate the effect of simulation-based educational program on maternity nurses' performance regarding obstetrical emergencies during pregnancy. This aim was achieved through the following objectives:

- Assessing maternity nurses' knowledge, attitude, and practices regarding obstetrical emergencies during pregnancy.
- Designing and implementing a simulation-based educational program framework for maternity nurses regarding obstetrical emergencies during pregnancy.
- Evaluating the effect of simulation-based educational program on maternity nurses' performance regarding obstetrical emergencies during pregnancy.

3.1. The research hypothesis

The researchers hypothesized that; maternity nurses who receive simulation-based educational program would have higher knowledge, practices, and positive attitude scores at post-test and follow up phases than pretest.

4. Subjects and Methods

4.1. Research design

A quasi-experimental design was utilized to fulfill the aim of this research. The one-group, pretest/post-test design specified that: An observation (called a pretest) assessed before the intervention was introduced to maternity nurses, the intervention subsequently introduced, and finally, a second observation (called a post-test) was applied at different times. The differences between the pretest and post-test observations were used to estimate the effect of the intervention.

4.2. Research Setting

This research was conducted at the Faculty of Nursing's clinical obstetrics skill lab, Benha University. The faculty started in the academic year 1993/1994 with 51 female students. The first bachelor's degree was graduated in 1997. The faculty consists of six different departments: Medical and Surgical Nursing, Community Health Nursing, Nursing Administration, Obstetrics and Women' Health Nursing, Psychiatric and Mental Health, and Pediatric Nursing

4.3. Subjects

A convenient sample of 40 nurses was recruited (all nurses working at obstetrics and gynecology emergency department of Benha University Hospital at the time of collecting data).

4.4. Tools of data collection

The following tools were designed and used after reviewing related literature

4.4.1. A Structured Self-Administered Questionnaire

The researcher designed it after reviewing the related literature *Bias et al., (2016); Abdelhakm and Said, (2017); Dettinger et al., (2018)* and included the following parts:
Part 1 included the personal characteristics of studied nurses. It consisted of age, educational qualification, current job, years of experience, and attendance of training courses.

Part 2 including assessment of maternity nurses' knowledge regarding obstetrical emergencies. The researchers designed the maternal knowledge questionnaire after reviewing related literature in the Arabic language. The 36- multiple-choice questions designed to measure maternal knowledge regarding obstetrical emergencies. Each question has four options (one right answer, two wrong answers, and I do not know). The concepts included for developing the tools were; Maternity nurses' general knowledge regarding obstetrical emergencies (9 questions), knowledge regarding the preparation of the emergency tray (3 questions), cardiopulmonary resuscitation of the pregnant woman (4 questions), preeclampsia, and eclampsia during pregnancy (9 questions), bleeding during pregnancy (6 questions) and regarding premature ruptures of membranes (5 questions).
Scoring system

Each question was assigned a score of 2, given for correct answer, and a score (1) was given when the answer was incorrect, and a score (0) was given when the answer did not know. This score is for MCQs, for the essay questions, the complete, correct answer was given two scores, one score for the incomplete correct answer, and zero for the wrong answer or did not know. The total score earned by maternity nurses reflects their knowledge regarding obstetrical emergencies. A possible total knowledge score ranged from 0-72 and classified as the following; good when the total knowledge score was >75% to 100% (54-72), average when the total knowledge score was 60-<75% (44-53), and poor when the total knowledge score was <60% (0-43).

4.4.2. Maternity Nurses' Attitude Assessment Scale

It was adapted from *Adenekan et al. (2016)* and translated into the Arabic language. The ten items questionnaire to assess nurses' attitudes toward obstetrical emergencies. It consisted of such statements as prenatal care is effective in preventing obstetric complications; emergency obstetrical care is very effective in improving maternal health; emergency obstetrical care is very effective in reducing maternal mortality. Besides, emergency training is necessary for all health workers; obstetrical emergencies' plans need to be regularly updated, and obstetrical emergencies occur at a different time during pregnancy.
Scoring system

The items were judged according to a three-point Likert scale continuum from agree (2), neutral (1), and disagree (zero). Summing up the scores of the items, then the overall score gave the total attitude score. Nurses' total attitude score was ranged from (0-20) and graded as the following; Positive attitude when the total score was ≥ 75% (15-20) and negative attitude when the total score was <75% (0-14).

4.4.3. Maternity Nurses' Practice Observational Checklist

The researcher designed it after reviewing related literature *Magowan et al., (2014); Royal College of Obstetricians and Gynaecologists guidelines (2016); Gabbe et al. (2016)* to assess nurses' practices while providing care for women with obstetrical emergencies during pregnancy. It included six procedures; preparation of the emergency tray (15 items), woman resuscitation (24 items), nursing management of preeclampsia (17 items), nursing management of eclampsia (17 items), nursing management of bleeding (18 items), and nursing management of premature rupture of membrane (11 items)
Scoring system

Each item of the procedure was assigned a score (2) if done thoroughly, a score (1) if done incompletely, and a score (zero) if not done. The total score was calculated by the addition of the total score of all procedures. A subtotal score

was summed for each subsection. A possible total score ranged from (0-204) and classified as the following; the unsatisfactory level of practices when the total score was < 75% (0-152) and satisfactory level of practices when the total score was ≥ 75% (153-204).

4.5. Procedures

The research was executed according to the following steps: Written official approval to conduct this research was obtained from the dean of faculty of nursing to the director of Benha University hospital and then delivered to the director of the Obstetrics and Gynecology Emergencies Department in order to obtain their agreement to conduct the study after explaining its purpose.

Five experts revised the tools' content validity, including three obstetrics and woman health nursing professors and two obstetrics and gynecological medicine professors. Minor modifications were required in formulating sentences. The reliability was done by Cronbach's Alpha coefficient test, which revealed that the knowledge assessment questionnaire's internal consistency was 0.81, the internal consistency of practice checklists was 0.86, and the internal consistency of the attitude assessment scale was 0.79.

Ethical considerations: The nurses informed the purpose and benefits of research at the beginning of the interview and throughout the research phases. Written consent was obtained from each nurse before starting data collection. The nurses were ensured that the data would remain confidential and used for research purposes only. The nurses' right to autonomy and freedom from harm was ensured. The nurses were also given an unconditional right of withdrawal at any time.

The pilot study was carried out on ten percent of the total sample (4 nurses) to test the research tools' clarity and applicability and estimated the time required to fill in the tools. Since no modifications have been made, the primary sample included nurses in the pilot.

Fieldwork: Official permissions were taken to carry out the research. Implementation of the research was carried out at Clinical Obstetrics' Skill lab of Faculty of Nursing, Benha University. Data were collected through the beginning of December 2019 and completed at the end of May 2020, covering six months.

This research was conducted through five sequential phases:

The preparatory phase was the first phase of the research. A review of current and past national and international relevant literature related to obstetrical emergencies was carried out using local and international textbooks, journals, periodicals, and computer searches to develop the research tools and contents.

Interviewing and assessment phase: At the beginning of the interview, the researchers greeted the nurses, introduced themselves, explained the purpose of the research, and provided the nurses with all information about the research (purpose, duration, and activities) to gain confidence and cooperation, and then obtained the informed written consent to participate in the research. Data were collected by the researchers through the distribution of a structured self-administered questionnaire (the tool I) and attitude questionnaire (tool II) to collect nurses' demographic characteristics and to assess nurses' knowledge and attitude regarding obstetrical emergencies. The average time required for completion of the questionnaires was around (30-45 minutes). Then the researcher used the observational checklists (tool III) to assess nurses' practices regarding obstetrical emergencies.

Planning phase: The researchers prepare the Clinical Obstetrics' Skill lab with essential needed supplies as Gaumard's NOELLE maternal birthing simulator with a pregnant uterus, emergency tray, emergency drugs, oxygen source, flow meter, humidifier, the mask of oxygen, suction device, cannula, sterile syringes, gloves, alcohol swab, dressing, Y-type blood administration set, IV lines, IV fluids, foley' catheter, sphygmomanometer, thermometer, airway, mouth gag, reflex hammer, antiseptic solution, warm water, kidney basin, vaginal speculum, towels, and mackintosh, for all simulations to enable the performance of preparation of the emergency tray, woman resuscitation, nursing management of preeclampsia and eclampsia, nursing management of bleeding, and nursing management of premature rupture of membranes. Besides, a digital monitor displaying dynamic, vital signs was readily to evaluate women's condition and assess fetal wellbeing.

Implementation phase: Implementation of the simulation-based educational program was carried out at the pre-mentioned setting and took eight weeks. Nurses were divided into eight groups according to working circumstances and nurses' physical and mental readiness. Each group included five nurses. The overall sessions were six sessions for each group; divided into three theoretical sessions with a duration ranged from 45-60 minutes for each, and three practical sessions and the duration of each practice session was ranged from 90-120 minutes, included periods of discussion according to nurses' achievement, progress, and feedback.

The training of each group took three days over one week. Each day included one theoretical session and one practical session that is repeated for each group separately. Different teaching methods were used for theoretical sessions, such as modified lecture, group discussion, and brainstorming. Suitable teaching media were included real objects, simulator, PowerPoint presentation, and a designed booklet (that distributed to nurses on the first day of the training). Simulation-based training was used for practical sessions.

The sessions were conducted in the following order:

The first day included: The first theoretical session (At the beginning of the first session, an orientation to the simulation-based educational program and its aims took place). The researchers provided nurses with general knowledge about obstetrical emergencies, knowledge about the emergency tray preparation, and knowledge regarding cardiopulmonary resuscitation of the pregnant woman. First practical session (included specific procedures as preparation of the emergency tray and the procedures of woman resuscitation).

The second day included a second theoretical session. The researchers provided nurses with knowledge about preeclampsia and eclampsia during pregnancy—second practical session (the researchers practically applied the management of preeclampsia and eclampsia).

The third day included the third theoretical session (the researchers provided nurses with knowledge about bleeding during pregnancy and premature rupture of membranes). Third practical session (the researchers practically applied the management of bleeding during pregnancy and premature rupture of membranes)

Each session started with feedback and re-demonstration of the previous session and the introduction to the new session's objectives. At the end of each session, the researcher informed the nurses about the next session's objectives and allowed them to ask questions and provided a period of discussion.

Evaluation phase: Immediately after applying the simulation, the researchers used the same previous (pretest) tools (a tool I, II and III) as (Posttest) tools to evaluate the effect of simulation-based educational program on maternity nurses' knowledge, attitude and practices regarding obstetrical emergencies during pregnancy. After eight weeks, the researchers used the same previously mentioned tools (Posttest) to follow up on the effect of simulation on nurses' knowledge, attitude, and practices regarding obstetrical emergencies during pregnancy.

4.6. Limitation of the study

Sometimes the educational and training sessions were postponed as some nurses were busy during data collection.

4.7. Data analysis

Data entry and statistical analysis were done using the Statistical Package for Social Science (SPSS version 22). Descriptive statistics included frequencies and percentages, means, and standard deviations. Inferential statistics as the Chi-square test was used to test the study hypothesis. The correlation coefficient was used to investigate the relationship between scores of knowledge, attitude, and practices. For all of the statistical tests done, p-value > 0.05 indicated no statistically significant difference, p-value ≤0.05 indicated a statistically significant difference, and p-value P ≤ 0.001 indicated a highly statistically significant difference.

5. Results

Table 1 clarifies that 62.5% of the studied nurses were in the age group of <30 years with a mean age of 30.15±8.21 years old. 57.5% of the studied nurses had technical nursing education. Concerning the current job, 90.0% of the studied nurses were assigned as a staff nurse as well as, 55.0% had >10 years of experience with mean 8.68±3.97 years. Moreover, 80.0% of the studied nurses did not attend any training courses about obstetrical emergencies.

Table 2 illustrates a highly statistically significant improvement concerning all nurses' subtotal knowledge immediate post-intervention and at follow up phase compared to the pre-intervention phase ($p \leq 0.001$).

Figure 1 shows that 17.5% of studied nurses had good knowledge regarding obstetrical emergencies pre-intervention. While 72.5% of the studied nurses had good knowledge of obstetrical emergencies, immediate post-intervention declined to 65.0% of nurses' level of knowledge at the follow-up phase.

Table 3 shows a highly statistically significant improvement concerning nurses' attitudes regarding obstetrical emergencies during immediate pregnancy post-intervention and at the follow-up phase compared to the pre-intervention phase ($p \leq 0.001$).

Figure 2 shows that 27.5% of the studied nurses had a positive attitude regarding obstetrical emergencies pre-intervention. While 90.0% of the studied nurses had a positive attitude, immediate post-intervention declined to 87.5% of nurses' level of attitude at the follow-up phase.

Table 4 clarifies a highly statistically significant improvement concerning nurses' practices regarding obstetrical emergencies during pregnancy, immediate post-intervention, and a follow-up phase compared to the pre-intervention phase ($p \leq 0.001$).

Figure 3 shows that 7.5% of the studied nurses had satisfactory practice regarding obstetrical emergencies pre-intervention. While 87.5% of the studied nurses had satisfactory practice, immediate post-intervention decline to 80.0% of nurses' level of practice at the follow-up phase.

Table 5 shows a positive, highly statistically significant correlation between total attitude and total practice with total knowledge scores at pre-intervention, immediate post-intervention, and follow-up phases ($p \leq 0.001$).

Table 6 shows a positive, highly statistically significant correlation between total practice scores and total attitude scores at pre-intervention, immediate post-intervention, and follow-up phases ($p \leq 0.001$).

Table (1): Frequency and percentage distribution of the studied nurses according to their characteristics (no.=40).

Variables	No.	%
Age (years)		
< 30 years	25	62.5
30-39 years	8	20.0
40-49 years	5	12.5
> 50 years	2	5.0
Mean ±SD	30.15±8.21	
Educational qualification		
Secondary nursing education	13	32.5
Technical nursing education	23	57.5
Bachelor of nursing	4	10.0
Current job		
Staff nurse	36	90.0
Supervisor	4	10.0
Years of experience		
<5 years	8	20.0
5-10 years	10	25.0
>10 years	22	55.0
Mean ±SD	8.68±3.97	
Attend training courses		
Yes	8	20.0
No	32	80.0
Site of training (n = 8)		
Outside the hospital	2	25.0
At hospital	6	75.0

Table (2): Comparison of the studied nurses' knowledge throughout the program phases (no.=40).

Knowledge elements	Pre-intervention		Post-intervention: Immediate post-intervention		Post-intervention: Follow up After (8 weeks)		$X^2 1^*$	p-value	$X^2 2$	p-value	$X^2 3$	p-value
	No.	%	No.	%	No.	%						
General knowledge about obstetrical emergencies												
Correct answer	4	10.0	28	70.0	24	60.0						
Incorrect answer	5	12.5	9	22.5	13	32.5	42.2	0.000	1.03	0.59	40.9	0.000
Do not know the answer	31	77.5	3	7.5	3	7.5						
knowledge about Preparation of the emergency tray												
Correct answer	3	7.5	26	65.0	24	60.0						
Incorrect answer	11	27.5	10	25.0	11	27.5	34.4	0.000	0.23	0.88	30.5	0.000
Do not know the answer	26	65.0	4	10.0	5	12.5						
knowledge about cardiopulmonary resuscitation												
Correct answer	4	10.0	28	70.0	25	62.5						
Incorrect answer	7	17.5	8	20.0	12	30.0	37.0	0.000	1.11	0.57	37.6	0.000
Do not know the answer	29	72.5	4	10.0	3	7.5						
knowledge about preeclampsia and eclampsia												
Correct answer	7	17.5	28	70.0	26	65.0						
Incorrect answer	8	20.0	9	22.5	10	25.0	29.9	0.000	0.27	0.87	26.3	0.000
Do not know the answer	25	62.5	3	7.5	4	10.0						
knowledge about bleeding during pregnancy												
Correct answer	9	22.5	30	75.0	25	62.5						
Incorrect answer	6	15.0	8	20.0	13	32.5	31.1	0.000	1.46	0.43	20.7	0.000
Do not know the answer	25	62.5	2	5.0	2	5.0						
knowledge about Premature rupture of membranes												
Correct answer	4	10.0	29	72.5	26	65.0						
Incorrect answer	13	32.5	9	22.5	13	32.5	37.3	0.000	1.22	0.54	36.3	0.000
Do not know the answer	23	57.5	2	5.0	1	2.5						
Total knowledge score												
Correct answer	7	17.5	29	27.5	26	65.0						
Incorrect answer	8	20.0	8	20.0	11	27.5	30.7	0.000	0.63	0.72	28.6	0.000
Do not know the answer	25	62.5	3	7.5	3	7.5						

**$X^2 1$ between pre and post-program, $X^2 2$ between post and follow-up program, $X^2 3$ between pre and follow-up program.*

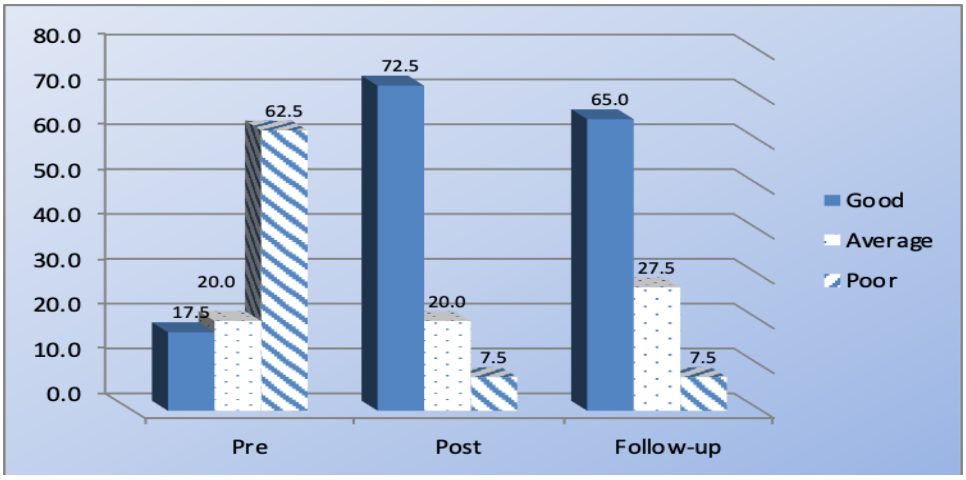

Figure (1): Percentage distribution of studied nurses regarding their total knowledge score through the program phases (n.=40)

6. Discussion

Obstetrical emergencies are defined as pregnancy-related conditions that threaten the lives of both mother and infant. The majority of obstetrical emergencies occur during pregnancy, delivery, and early in the postnatal period and cannot be predicted by antenatal screening. Also, obstetrical emergencies are considered stressful situations that require immediate identification and management by the medical team to ensure the best possible clinical outcomes *(Amatullah, 2018).*

The current research aimed to investigate the effect of simulation-based educational program on maternity nurses' performance regarding obstetrical emergencies during pregnancy. The findings of this research significantly support the research hypothesis, which confirms the importance of utilizing the simulation for improving nurses' performance regarding obstetrical emergencies during pregnancy.

Personal characteristics can play a significant role in determining pregnant women's exact features that may affect their pregnancy complaints. Regarding the personal characteristics of the studied nurses, the present research results revealed that less than two-thirds of the studied nurses were in the age group of <30 years with a mean age of 30.15±8.21 years old, and more than half of them were technical nurses. Concerning the current job, the majority of the studied nurses were assigned as staff nurses as well as, more than half of the studied nurses had >10 years of experience with mean 8.68±3.97 years. Moreover, more than three-quarters of the studied nurses did not attend any training courses about obstetrical emergencies. From the researchers' point of view, the young age of nurses and their average education may be a reason for their lack of knowledge, attitude, and practical experience towards managing obstetrical emergencies during pregnancy.

The findings of the current research agreed with *Subrahmanyam et al. (2017),* who studied "obstetric emergency preparedness among staff nurses working in obstetric care units," and reported that participants' mean age was 30.79±5.13 years. The results also agreed with *Bongban et al. (2016),* who studied "Emergency obstetrics knowledge and practical skills retention among hospital and clinic staff following advanced life support obstetrical training in Cameroon." They found that 60% of nurses had 1-10 years of experience with an average work experience of 10.5 years. This finding contradicts *Verma et al. (2016),* who studied "Obstetric emergencies: Preparedness among nurses for safe motherhood," and pointed that the majority of nurses (92%) had total working experience of fewer than two years.

Regarding studied nurses' knowledge, the findings of the current emergencies a highly statistically significant improvement concerning all items of nurses' subtotal knowledge immediately post-intervention and after eight weeks of application of simulation compared to pre-intervention**.** This result might be due to the positive effect of the simulation-based training and the well-organized learning sessions. The study's topic was considered vital and sensitive to their work in such a critical unit, so nurses were very interested and satisfied during the learning sessions. Moreover, they had a booklet followed in care with women to minimize the complications that might affect the woman and newborn.

There was a slight decrease in the total nurses' knowledge scores after eight weeks of simulation application but still higher than pre-intervention. This finding might be due to the absence of continuous follow-up. So, nurses did not retain all the necessary knowledge learned, so periodical training should be conducted from time to time to maintain their knowledge.

The results of the current research agreed with *Kim and Shin (2016). They* studied "Effects of nursing process-based simulation for maternal child emergency nursing care on knowledge, attitude, and skills in clinical nurses, " and found that nurses trained by simulation-based training were more likely to have improved knowledge about maternal emergency nursing care than the control group.

Table (3): Comparison of the studied nurses' attitude throughout the program phases (no.=40).

Attitude statements	Pre-intervention		Post-intervention: Immediate post-intervention		Post-intervention: Follow up After (8 weeks)		X^2 1*	p-value	X^2 2	p-value	X^2 3	p-value
	No.	%	No.	%	No.	%						
Prenatal care is effective in preventing obstetric complications												
Disagree	17	42.5	0	0.0	0	0.0						
Neutral	13	32.5	8	20.0	10	25.0	29.7	0.000	0.28	0.59	27.3	0.000
Agree	10	25.0	32	80.0	30	75.0						
Emergency obstetrical care is very effective in improving maternal health												
Disagree	12	30.0	2	5.0	1	2.5						
Neutral	12	30.0	5	12.5	5	12.5	15.9	0.000	0.34	0.84	18.6	0.000
Agree	16	40.0	33	82.5	34	85.0						
Emergency obstetrical care is very effective in reducing maternal mortality												
Disagree	19	47.5	0	0.0	0	0.0						
Neutral	10	25.0	5	12.5	7	17.5	33.1	0.000	0.39	0.53	30.5	0.000
Agree	11	27.5	35	87.5	33	82.5						
Emergency training is necessary for all health worker												
Disagree	18	45.0	0	0.0	0	0.0						
Neutral	13	32.5	4	10.0	5	12.5	38.9	0.000	0.12	0.72	36.9	0.000
Agree	9	22.5	36	90.0	35	87.5						
Obstetrical emergencies' plans need to be regularly updated												
Disagree	16	40.0	2	5.0	1	2.5						
Neutral	16	40.0	6	15.0	8	20.0	29.8	0.000	0.63	0.72	29.4	0.000
Agree	8	20.0	32	80.0	31	77.5						
Obstetrical emergencies occur at a different time during pregnancy												
Disagree	28	70.0	0	0.0	0	0.0						
Neutral	7	17.5	4	10.0	6	15.0	52.2	0.000	0.45	0.49	49.6	0.000
Agree	5	12.5	36	90.0	34	85.0						
Simulation of Obstetrics emergency should frequently occur in the hospital												
Disagree	24	60.0	0	0.0	0	0.0						
Neutral	8	20.0	5	12.5	4	10.0	41.6	0.000	0.12	0.72	43.1	0.000
Agree	8	20.0	35	87.5	36	90.0						
Emergency drills should be conducted in the hospital												
Disagree	21	52.5	2	5.0	0	0.0						
Neutral	13	32.5	3	7.5	6	15.0	42.4	0.000	3.01	0.22	43.1	0.000
Agree	6	15.0	35	87.5	34	85.0						
Emergency disaster is unlikely to happen in our hospital												
Disagree	14	35.0	0	0.0	0	0.0						
Neutral	8	20.0	3	7.5	5	12.5	22.8	0.000	0.55	0.45	20.1	0.000
Agree	18	45.0	37	92.5	35	87.5						
Women who have had PROM were more likely to experience it in future pregnancies.												
Disagree	26	65.0	0	0.0	0	0.0						
Neutral	9	22.5	5	12.5	3	7.5	49.6	0.000	0.55	0.45	53.3	0.000
Agree	5	12.5	35	87.5	37	92.5						
Total attitude score												
Disagree	18	45.0	1	2.5	1	2.5						
Neutral	11	27.5	5	12.5	6	15.0	29.2	0.000	0.10	0.94	27.6	0.000
Agree	11	27.5	34	85.0	33	82.0						

**$X^2$1 between pre and post-program, $X^2$2 between post and follow-up program, $X^2$3 between pre and follow-up program.*

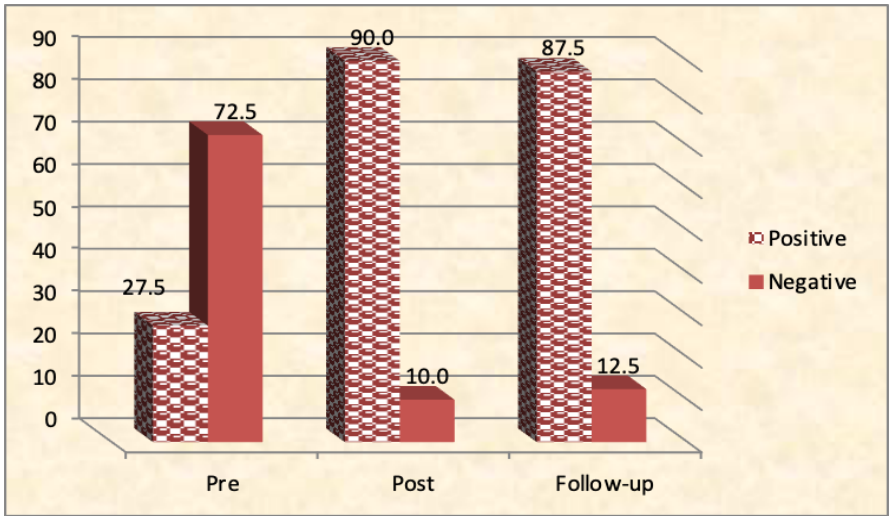

Figure (2): Percentage distribution of studied nurses regarding their total attitude score through the program phases (n.=40)

Table (4): Comparison of the studied nurses' practice throughout the program phases (no.=40).

Practice Items	Pre-intervention		Post-intervention: Immediate post-intervention		Post-intervention: Follow up After (8 weeks)		X^2 1*	p-value	X^2 2	p-value	X^2 3	p-value
	No.	%	No.	%	No.	%						
Preparation of emergency tray												
Not done	9	22.5	1	2.5	2	5.0						
Incompletely done	26	65.0	7	17.5	8	20.0	37.04	0.000	0.46	0.79	31.8	0.000
Completely done	5	12.5	32	80.0	30	75.0						
Woman resuscitation												
Not done	14	35.0	0	0.0	1	2.5						
Incompletely done	23	57.5	5	12.5	7	17.5	52.5	0.000	1.26	0.48	43.8	0.000
Completely done	3	7.5	35	87.5	32	80.0						
Management of Preeclampsia												
Not done	6	15.0	2	5.0	2	5.0						
Incompletely done	27	67.5	3	7.5	6	15.0	39.8	0.000	1.13	0.56	31.3	0.000
Completely done	7	17.5	35	87.5	32	80.0						
Management of Eclampsia												
Not done	6	15.0	2	5.0	3	7.5						
Incompletely done	31	77.5	8	20.0	6	15.0	37.6	0.000	0.50	0.77	40.9	0.000
Completely done	3	7.5	30	75.0	31	77.5						
Management of Bleeding												
Not done	7	17.5	0	0.0	0	0.0						
Incompletely done	31	77.5	4	10.0	7	17.5	58.2	0.000	0.94	0.33	49.6	0.000
Completely done	2	5.0	36	90.0	33	82.5						
Management of Premature rupture of membranes												
Not done	9	22.5	1	2.5	1	2.5						
Incompletely done	27	67.5	4	10.0	7	17.5	48.1	0.000	0.95	0.62	39.9	0.000
Completely done	4	10.0	35	87.5	32	80.0						
Total practices score												
Not done	7	17.5	1	2.5	2	5.0						
Incompletely done	30	75.0	5	12.5	7	17.5	84.3	0.000	0.80	0.66	40.1	0.000
Completely done	3	7.5	34	85.0	31	77.5						

**$X^2$1 between pre and post-program, $X^2$2 between post and follow-up program, $X^2$3 between pre and follow-up program.*

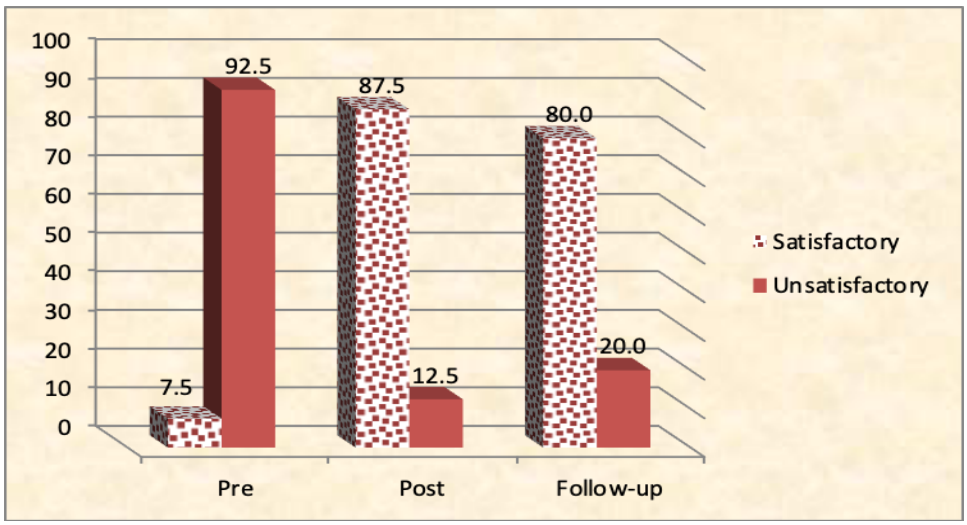

Figure (3): Percentage distribution of studied nurses regarding their total practices score through the program phases (n.=40).

Table (5): Correlation between total knowledge, attitude, and practices through program phases.

Variables	Total knowledge					
	Pre-intervention		Immediate post-intervention		Follow up after (8 weeks)	
	r	p-value	r	p-value	r	p-value
Total attitude	0.928	0.000	0.870	0.000	0.816	0.000
Total practices	0.730	0.000	0.894	0.000	0.831	0.000

Table (6): Correlation between total attitude and practices through program phases

Variables	Total practices					
	Pre-intervention		Immediate post-intervention		Follow up after (8 weeks)	
	r	p-value	r	p-value	r	p-value
Total attitude	0.786	0.000	0.989	0.000	0.956	0.000

Regarding nurses' knowledge about the emergency tray preparation, the present research shows a highly statistically significant improvement in total nurses' knowledge immediately post-intervention and after eight weeks of simulation compared to pre-intervention. The result was similar to *Ibrahim (2016),* who studied "Effect of nursing care standards on nurses' performance regarding caring for patients with cardiac arrhythmias." The results revealed that more than half of the studied nurses had unsatisfactory knowledge regarding the emergency tray arrangement before the implementation of nursing care standards, where the majority of them had adequate knowledge after implementation of nursing care standards ($p<0.001$).

Concerning nurses' knowledge about preeclampsia and eclampsia, the present research results illustrate a highly statistically significant improvement in total nurses' knowledge immediately post-intervention, and after eight weeks of application of simulation compared to pre-intervention. This improvement in the nurses' knowledge might be due to nurses' active participation and good communication in the learning sessions with the researchers who helped them acquire knowledge. Besides, the booklet played a vital role in helping nurses to acquire knowledge and used it as a future reference.

These results correspond to *Sheikh et al. (2016),* who studied "Health care provider knowledge and routine management of preeclampsia in Pakistan." They found several gaps in knowledge regarding etiology, diagnosis, and preeclampsia treatment among health care providers in Sindh. The findings suggested that a lack of knowledge regarding preeclampsia management was due to fewer refresher training and written guidelines for preeclampsia management. It may also refer to the presentation of fewer pre-eclamptic patients at first and secondary level health care facilities. They also suggested including management of preeclampsia in regular training of health care providers and provided management protocols at all health facilities.

Regarding nurses' knowledge about women's resuscitation, the present research post-intervention results show a highly statistically significant improvement in total nurses' knowledge immediately post-intervention, and after eight weeks of application of simulation compared to pre-intervention. This result might be due to the learning sessions' effect and nurses' interest in its content to acquire knowledge and improve their performance.

These findings were in agreement with *Abd-Allah et al. (2017),* who investigate "The effect of educational program on cardiopulmonary resuscitation on nursing student's performance," and mentioned that educational program was positively improved knowledge of the studied nursing student. This result was also supported by *Mohamed et al. (2018),* who study "Maternity nurses' performance regarding cardiopulmonary resuscitation during pregnancy: Simulation-based intervention," and found a highly statistical difference between knowledge scores of maternity nurses' at pre and post-intervention.

As regards nurses' attitude score regarding obstetrical emergencies during pregnancy, the result of the present research shows a highly statistically significant improvement concerning all items of nurses' attitude immediately post-intervention and after eight weeks of application of simulation compared to the pre-intervention phase. The difference in the health attitude score of studied nurses, as reported, can be linked to the positive effect of learning sessions that raise the nurses' awareness of the size and importance of the problem with their improved practice. This result was consistent with *Joho et al. (2018),* who studied "The effectiveness of simulation-based training for life-saving skills to improve nurses' knowledge, skills, and attitude on caring mothers and newborns: A quasi-experimental study." The results clarified that nurse students gain knowledge, skills, and change of attitude on caring for women with postpartum hemorrhage, severe preeclampsia, and eclampsia and how to resuscitate babies who failed to cry and breathe soon after being delivered.

Concerning nurses' practices score regarding obstetrical emergencies during pregnancy, the result of the present research revealed that there was a highly statistically significant improvement concerning all items of nurses' practices immediately post-intervention and after eight weeks of application of simulation compared to pre-intervention**.** This finding might be due to nurses' active participation in hands-on training, commitment, and interest in the subject and excellent communication between nurses and researchers, which helped acquire proper practice regarding obstetrical emergencies. These findings were in agreement with *Amatullah (2018),* who studied "Using Interprofessional Simulation-based training to improve management of obstetric emergencies: A systematic review," and pointed out that there were improvements in staff skills, patient safety, and quality of care regarding obstetric emergencies after the training.

The results were also matched with *Chen et al. (2017),* who conducted a study to determine the impact of an interactive, situated, and simulated (ISST) learning workshop. They focused on the clinical competence of novice nurse practitioners. One group received ISST training, and the other did not. At the end of the study period, the ISST group demonstrated superior nursing competency, reported lower stress levels, and showed increased confidence in clinical skills.

Concerning nurses' practices regarding emergency tray preparation, the present research results show a highly statistically significant difference in nurses' practices regarding emergency tray preparation immediately post-intervention and at the follow-up phase compared to the pre-intervention phase. These findings may be because simulation allows the learner to experience uncommon scenarios and receive feedback. Besides, simulation gives a chance for learners to apply procedure without any fear or distress. This result was matched with *AbdElmordi, (2016),* who reported that 5.6% of nurses have a competent practice before implementing the instructional package. Meanwhile, 63.9% of them have competent practice immediately after implementing the instructional package, and 52.8% of them have competent practice at the follow-up phase regarding emergency tray preparation.

Concerning nurses' practices about woman resuscitation, the result of the present research shows a highly statistically significant difference regarding nurses' practice of woman resuscitation immediate post-intervention and at the follow-up phase compared to the pre-intervention phase. This result might be due to the nurses' reflected sense with this critical procedure that could save many women's lives in the emergency departments they worked.

This result agreed with *Mohamed et al. (2018)*. Their study findings proved that most of the studied maternity nurses had unsatisfactory practice regarding the implementation of cardiopulmonary resuscitation during pregnancy at pre the program phase, which has been sharply increased post-intervention immediately. Also, *Ahmed et al. (2017),* who studied "Impact of a pregnant advanced cardiopulmonary resuscitation training program on maternity nurses' knowledge, attitude, and practice in Beni-Suef City," and found that after implementation of the learning package, nurses' practice score reported a high score of satisfactory practice compared to before implementation of the learning package that showed unsatisfactory practice.

Regarding nurses' practice regarding preeclampsia and eclampsia, the present research results showed a highly statistically significant difference concerning nurses' practices regarding preeclampsia and eclampsia immediate post-intervention follow-up phase compared to the pre-intervention phase. This result might be due to the simulation program's comprehensiveness and clarity to include all emergency obstetrics cases during pregnancy. The result was in agreement with *Raney (2018),* who studied "Simulation-based nurse mentoring to promote preeclampsia care," demonstrating improvement in nurses' ability to take histories, diagnose preeclampsia, and undertake management steps of antihypertensive administration, Foley's catheter insertion, and intravenous line catheter application. Simulation-based training increased the use of clinical skills by nurses in simulated severe preeclampsia and eclampsia cases.

As well, *Tabatabaeian et al. (2018),* who compared the effects of simulation-based training, blended, and lecture on the simulated performance of midwives in preeclampsia and eclampsia, and concluded that the performance of preeclampsia and eclampsia management in the simulation education group is more effective and beneficial than that of the blended and lecture groups.

Concerning nurses' practices regarding the management of bleeding and premature rupture of membranes, the present research results show highly statistically significant differences regarding nurses' practices regarding the management of bleeding and premature rupture of the immediate membrane post the follow-up phase compared to pre-intervention. This result might be due to the hand-on-training in a safe, simulated, well-equipped environment. This result was following *Abdelhakm and Said (2017)*, who found that 77.5% of studied nurses reported complete, correct practices regarding bleeding after management protocol.

The present research showed that less than one-tenth of the studied nurses had satisfactory practice regarding obstetrical emergencies pre-intervention. At the same time, the majority had satisfactory practice post-intervention. This result is incongruent with *Abdelhakm and Said (2017),* who studied "Developing nursing management protocol for maternity nurses regarding emergency obstetric care." This study was conducted in the Obstetrics and Gynaecology Emergencies Department at Benha University Hospital, including 40 nurses, and found that about three-quarters of the studied nurses had unsatisfactory practices toward emergency obstetrics care before the intervention. Meanwhile, after the intervention, most of them had satisfactory practices.

The present research results showed a positive, highly statistically significant correlation between total attitude score and total practice score with total knowledge scores pre-intervention, immediate post-intervention, and at follow-up phases. As well, there was a positive, highly statistically significant correlation between total practice scores and total attitude scores pre-intervention, immediate post-intervention, and follow up phases. This finding clarifies the relationships between the three learning domains and emphasizes the importance of integrating them all in the nurses training programs.

This result was supported by *Abdelhakm and Said (2017),* who found a statistically significant correlation between total scores of nurses' knowledge and practices before and after the application of the nursing management protocol. The result agreed with *Williams et al. (2015),* who studied "Relationship among knowledge acquisition, motivation to change, and self-efficacy," and found a significant relationship between knowledge and intent to change practice. Also*, Attia (2012)* found a highly statistically significant correlation between total nurses' performance and total nurses' knowledge.

7. Conclusion

The simulation-based educational program had a positive effect on the improvement of maternity nurses' performance regarding obstetrical emergencies during pregnancy. Also, a positive, highly statistically significant correlation between total knowledge and total attitude and total practice scores at pre-intervention, immediate post-intervention, and at follow up phases was observed. Moreover, there was a positive, highly statistically significant correlation between total practice scores and total attitude scores at pre-intervention, immediate post-intervention, and follow up phases. Therefore, the research hypotheses are accepted.

8. Recommendations

Based on the findings of the current research, the following recommendations are suggested:

- Simulation-based educational programs regarding obstetrical emergencies during pregnancy are recommended for all nurses working at obstetrics and gynecology units.
- Development of a national program, including periodical workshops regarding the management of obstetrical emergencies during pregnancy in Egypt for maternity nurses in maternity health services.
- Applying periodic training courses for nurses to enhance their practical skills regarding obstetrical emergencies.
- Integration of simulation-based training into the curriculum of nursing colleges.
- Further research is crucial to conduct an extensive study on larger probability sample sizes and different settings to improve maternity nurses' performance regarding obstetrical emergencies during pregnancy.

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