

Improving Maternity Nurses' Performance Regarding Prevention and Control of Postpartum Hemorrhage

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Abstract: Nurses play a key role in the prevention and control of postpartum hemorrhage they may be first and only professional persons present when bleeding occurs, her prompt and competent action will be crucial in controlling blood loss and reducing the risk of maternal morbidity or even death Aim: This study was undertaken to evaluate the effect of an educational intervention on Improving maternity nurses' performance regarding prevention and control of postpartum hemorrhage Methods: A quasi-experimental design was utilized. Setting: The study was conducted at obstetrics and gynecology departments affiliated to Benha University Hospital and Benha Teaching hospital. Sample: total sample of 64 maternity nurses were included in the current study. Tools: Two tools were used for data collection; 1) a structured interviewing schedule to collect data about the nurses' sociodemographic characteristics and knowledge regarding postpartum hemorrhage. 2); an observation checklist to assess the procedures provided by nurses during immediate postpartum period concerned with prevention and control of post-partum hemorrhage. Results: there were highly statistically significant differences ($P < .001$) before and after educational intervention regarding total knowledge and practices mean scores of the studied nurses. There were negative statistically significant correlations ($P \leq .01$) between studied nurses, total knowledge, total practices scores and their age and years of experience. Conclusion and recommendation: The implementation of the educational intervention significantly improved nurses' knowledge and practices towards prevention and control of postpartum hemorrhage. Adequately planned in-service training programs must be conducted in order to improve nurses' knowledge, and performance regarding postpartum hemorrhage which will be reflected on improving the quality of health care.

Keywords: Educational intervention, Nurses' performance, Prevention, Control and Postpartum hemorrhage.

1. INTRODUCTION

Postpartum hemorrhage (PPH) continues to be a leading cause of maternal deaths worldwide.^[1] According to the World Health Organization (WHO), PPH is the speediest of maternal killers, this is the case in both developed and developing countries. If undetected early, PPH can be fatal even to a healthy mother within two hours.^[2] It is a life-threatening event that can occur with little warning and is often not identified until the mother has profound signs and symptoms. PPH occurs in approximately 3% of deliveries.^[3]

The world health organization defined PPH as a blood loss of 500 ml or more within 24 hours after birth, while severe PPH is defined as a blood loss of 1000 ml or more within the same timeframe.^[4] A 10% change in hematocrit between admission for delivery and postpartum or the need for erythrocyte transfusion is used to define PPH.^[5,6]

Recent definitions pay major attention to symptoms (e.g., light headedness, weakness, palpitations, restlessness, confusion, diaphoresis, air hunger and/or syncope) and signs of hypovolemia (e.g., hypotension, tachycardia, oliguria and low oxygen saturation). Most healthy women do not exhibit signs or symptoms of hemodynamic instability until blood

loss of 1200 ml.^[7] So that the nurses should be alert to the signs and symptoms of PPH and should call for help within 10 minutes of diagnosis before the signs and symptoms of hemodynamic instability.^[8]

The PPH is classified as early or late with respect to birth. The hemorrhage that occurs during the first 24 hours after delivery is called primary or early PPH. When this occurs after 24 hours of birth until six weeks it is called secondary or late PPH.^[9] The most common cause of PPH is uterine atony (impaired uterine contraction after birth), which occurs in about 80 percent of cases. Clinical risk factors associated with uterine atony, such as multiple pregnancies, polyhydramnios, increase parity, over distention of the uterus, infection, placental abnormalities, bladder distention, and prolonged labor.^[10,11,12] Other causes of PPH include retained placenta lacerations, uterine inversion or rupture, and inherited or acquired coagulation abnormalities.^[10]

The massive PPH leads to complications like hypovolemic shock, disseminated intravascular coagulopathy, hepatic dysfunction, acute respiratory distress syndrome and renal failure.^[13] PPH complications with the consequent increase in maternal deaths are associated with the lack skilled midwives and nurses, lack of resources, inability of health professionals to accurately assess blood loss, delay to decide to get help in obstetric services and delay in referral system and transportation.^[14]

The PPH is preventable in more than half of the cases.^[10] Active management of the third stage of labor (AMTSL) as one of the most effective interventions to prevent PPH should be used routinely. AMTSL includes oxytocin after delivery of the fetal anterior shoulder and controlled cord traction with the Brandt maneuver. Uterine massage after delivery of the placenta is a reasonable approach and is included in some AMTSL protocols. Delayed cord clamping one to three minutes after delivery may be considered to decrease risk of infant anemia without increasing maternal hemorrhage risk.^[15]

Moreover, PPH could be prevented or managed if the women had access to a skilled health care practitioner with the necessary back-up and support.^[16] Nurses are central to the effective prevention, early recognition and treatment of PPH. They need to be aware of the risk factors for this condition and take appropriate action when they are identified.^[17] Nurses play an important role in monitoring the woman's status, assisting with measures to control bleeding, educating the woman about her condition and providing support to the woman and her family.^[18]

There is a clear need to enhance nurses' competencies related to emergency obstetric care, particularly PPH and pregnancy induced hypertension, as well as critical infrastructure and resources to complement efforts to increase the coverage of institutional deliveries.^[19] Nursing care measures for the woman experiencing PPH focuses on stopping the bleeding, restoring fluid balance, preventing injury and promoting adequate tissue perfusion. As with any postpartum complication, be sure to provide emotional support for the woman and family, explaining all events and procedures to minimize anxiety and fear, keep the family informed of the situation, explaining laboratory tests, procedures and signs of improvement.^[4]

Significance of the study:

The PPH, the most common cause of maternal deaths worldwide, could be prevented with early recognition and more appropriate and adequate management.^[20] Each year, PPH is diagnosed in 14 million women, of them 140,000 die and 1.6 million will become anemic.^[21] In Egypt, especially in rural areas, PPH is still one of the main causes responsible for maternal morbidity and mortality. It still needs a radical solution.^[22] The percent distribution of maternal deaths due to PPH in Egypt in 2013 was 19.7%.^[23] Nurses play a key role in the prevention and control of PPH, they may be first and only professional person present when bleeding occurs, her prompt and competent action will be crucial in controlling blood loss and reducing the risk of maternal morbidity or even death.^[17]

Aim of the study:

This study was undertaken to evaluate the effect of an educational intervention on improving maternity nurses' performance regarding prevention and control of PPH.

Hypothesis:

Maternity nurses who received an educational intervention would have improved knowledge and practices toward prevention and control of PPH than before intervention.

2. SUBJECTS AND METHODS

Research design: A quasi-experimental design was utilized to fulfill the aim of this study

Setting: The study was carried out at two settings; obstetrics and gynecology departments at Benha University Hospital and Benha Teaching Hospital.

Sample: All nurses working in the above mentioned settings at the time of the data collection and agreed to participate in the study were included. The total number was 64 maternity nurses, they were divided into Benha University Hospital (46) nurses and Benha Teaching Hospital (18) nurses.

Tools of data collection: Two tools were used for data collection:

1-A structured interviewing schedule:

It was designed by the researchers after reviewing related literature.^[24,25] It was written in Arabic language in the form of closed and open-ended questions. It encompassed two major parts:

Part I: included sociodemographic data such as age, qualification, years of experience in obstetrics and gynecology department and attendance of training courses about prevention and control of PPH.

Part II: deals with nurse's knowledge about prevention and control of PPH. This part was used before and after implementation of the educational intervention program (pre/post-test format), It consisted of (4) sections;

Section (1) general knowledge regarding PPH, it consisted of (6) items (definition, causes and risk factors, signs and symptoms, types, complications and the most common causes of maternal mortality during childbirth).

Section (2) knowledge pertaining preventive measures of PPH in antenatal, intra-natal and post-natal period, it consisted of (16) items such as; (detection and correction of anaemia, proper use of analgesia and anaesthesia, avoid prolonged labour, episiotomy timing, routine examination of the placenta and membranes, perineal support, avoid fundal pressure, proper bearing down, active management of the third stage of labour, exploration of the birth canal after delivery, fundal examination and massage, empty urinary bladder, routine use of ecobolics after delivery, early breast feeding, careful observation in the fourth stage of labour etc...)

Section (3) knowledge concerning nursing and medical management of PPH, it consisted of (4) items (methods of medical management, nursing management, drugs used to control bleeding, the effect of these drugs)

Section (4) knowledge pertaining to hypovolemic shock and its nursing measures, it consisted of (4) items (definition, signs and symptoms, medical and nursing management).

Scoring system of knowledge:

In the open-ended questions the answers were classified into 3 categories (2) degrees for correct answer (1) degree for incomplete answer and (0) for incorrect or don't know answer. In the closed ended questions the answers were classified into 2 categories (1) degree for correct answer and (0) for incorrect or don't know answer. The total score of each section was calculated by summation of the scores of its items. The total score for the knowledge of maternity nurse was calculated by the addition of the total score of all sections. The mean and standard deviation was calculated. In addition, the score of total knowledge was divided into three levels, the nurse was considered to have good level if the score was $\geq 75\%$, average level if the score was $50 < 75\%$ and poor level if $< 50\%$.

II- An observation checklist:-

An observation checklist was used to assess the procedures provided by nurses during immediate postpartum period concerned with prevention and control of PPH including peripheral pulse measurement, blood pressure measurement, fundus, lochia and perineal assessment, urinary catheterization, administration of ecobolic drugs and IV fluid, uterine massage and perineal care. This checklist was adopted from **Orshan, (2008)** and **Perry and Potter, (2010)**.^[24-27]

Scoring system of practices:

The scoring system for practices ranged from 2 to 0 as follows, each statement took (2) score if done correctly, (1) score if done incorrectly and (0) if not done. The total score of practices was divided into three levels, where maternity nurses whose practice scores $\geq 75\%$, were considered on the good level, when their practice score $50 < 75\%$ they were considered on the average level, and those whose score $< 50\%$ are on poor level.

Tools validity and reliability:

Tools were reviewed by a panel of five experts in the field of obstetric and woman health nursing to test their content validity. Modifications were done accordingly based on their judgment. Reliability was done by Cronbach's Alpha coefficient test which revealed that each of the two tools consisted of relatively homogenous items as indicated by the moderate to high reliability (internal consistency) of each tool (knowledge = 0.772 and practices = 0.863).

Ethical considerations:

The present study was conducted under the approval of the Faculty of Nursing Ethical Committee, Benha University. An official permission was obtained from the directors of the pre mentioned settings. Each nurse was informed about the purpose of the study, those who agreed to complete in this study were asked to sign a consent form before starting the data collection. Confidentiality was ensured throughout the study process, and the nurses were assured that all data were used only for research purpose and their benefit. Each nurse was informed that participation is voluntary and they are free to withdraw from the study at any stage.

Pilot study:

A pilot study was carried out on 10% from the total number of sample (6) nurses to assess the tools clarity, objectivity and feasibility. as well as to estimate the time needed to fill in the questionnaire. Required modifications were done in the form of addition of some questions as (The most common cause of maternal mortality during childbirth etc.). Nurses involved in the pilot were excluded from the main study sample.

Field work:

After approval to conduct this research, official letters were used from the Dean of the Faculty of Nursing to the directors of the previously mentioned settings. The study was carried out through four phases: assessment, planning, implementation, and evaluation. These phases were carried out from beginning of June 2015 to the end of January 2016, covering along a period of eight months. The previously mentioned settings were visited by the researchers two days/week (Mondays and Thursdays) from 9.00 a.m. to 1.00 p.m.

Assessment phase: Upon securing official permissions to conduct the study, the researchers interviewed the maternity nurses, greeted each nurse, explained the purpose and procedures of the study, and asked for participation. Upon consent to participate, the nurse was interviewed to assess general characteristics, knowledge regarding PPH, as well as nurses' practices toward prevention and control of PPH. The data obtained during this phase constituted the baseline for further comparisons to evaluate the effect of the educational intervention. Average time for the completion of interviewing schedule 20-30 minutes. The number of assessed nurses/week ranged from 2-3 nurses. The time needed to fill in the checklist depends upon the time of each procedure and was filled in by the researcher during nurse's practices inside the department in the morning and afternoon shifts.

Planning phase: Based on the needs identified in the assessment phase from the maternity nurses, and in view of the related literature, the educational intervention was developed by the researchers in the form of printed Arabic booklet to satisfy the studied nurses' deficit knowledge and practices regarding PPH. Power Point presentation about PPH was prepared in simple Arabic language to suit the nurses' level of understanding. The *general objective* of the educational intervention was to improve maternity nurses' knowledge and practices regarding prevention and control of PPH.

Specific objectives: By completion of the educational intervention, each nurse will be able to:

- Discuss the significance of PPH as a major cause of maternal mortality.
- Define PPH.
- List common causes and risk factors for PPH.
- Differentiate between early and late PPH.
- Discuss the potential complications of PPH.
- Describe active management of the third stage of labor.
- Discuss preventive measures of PPH.
- Enumerate medical management of PPH.
- Describe surgical procedures for treatment of a PPH.

- State the steps necessary to care for a patient with PPH.
- Discuss the appropriate nursing interventions for the woman with PPH.
- Explain how to monitor women for the signs of shock.
- Enumerate medical management of hypovolemic shock.
- Discuss nursing management of hypovolemic shock.
- Demonstrate the nursing procedures concerned with prevention and control of PPH.

Implementation phase: Implementation of the educational intervention took (18) weeks period. The researchers visited each of the previously mentioned settings in the two shifts (morning - afternoon), two days/week alternatively. The educational intervention involved (6) scheduled sessions; 3 sessions for theoretical content and 3 for practical content and were implemented according to working circumstances, nurses' physical and mental readiness. These sessions were repeated to each subgroup of (4-5) nurses. The duration of each session lasted from half an hour to one hour including periods of discussion according to their achievement, progress and feedback. At the beginning of the first session an orientation to the educational intervention and its aims took place. Feedback was given in the beginning of each session about the previous one. Different teaching strategies were used such as lectures, group discussions, critical thinking and problem solving, concept mapping and demonstrations /re-demonstrations. Suitable teaching media were used, included an educational booklet that was distributed to all nurses in the first day of the educational intervention as well as audio-visual aids (data show presentation) and real objects used for practical sessions such as fundus and lochial examination set etc.

Evaluation phase: Immediately after implementation of the educational intervention, the post test for nurses' knowledge and practices was done by the same formats of the pre-test to assess the impact of the implemented educational intervention.

Limitation of the study:

Sometimes, the sessions were protracted due to workload, noise and other individuals' interruption that required more time than the devoted as well as more effort.

Statistical analysis:

Data analysis was performed using Statistical Package for Social Sciences (SPSS), version 20.0. Descriptive statistics were applied (e.g., mean, standard deviation, frequency and percentage). Test of significance (chi-square, Monte-Carlo and paired t test) were applied to test the study hypothesis. Correlation coefficient was calculated between knowledge, and practice scores as well as between knowledge, practice scores and sociodemographic data. A statistically significant difference was considered at $p\text{-value} \leq .05$, and a highly statistically significant difference was considered at $p\text{-value} \leq .001$, while the $p\text{-value} > .05$ indicates non-significant results.

3. RESULTS

Table (1) Represents socio-demographic characteristics of the studied nurses. It was clear that 40.6% of the nurses were aged from 30-<40 years, with a mean age 35.48 ± 6.01 years. Furthermore, 93.7% of them were working as staff nurses. Regarding nurses' educational qualification, 78.1% of them had nursing diploma. As regards years of experience, 73.4% of nurses had more than 10 years of experience in the maternity ward, with a mean 16.78 ± 5.46 years. In addition, 71.9% of nurses were working in a university hospital. Only 9.4% of nurses attended training programs about PPH.

Table (2) displays that there were highly statistically significant differences ($P < .001$) before and after implementation of the educational intervention in relation to nurses' general knowledge about PPH definition, causes and risk factors, signs and symptoms, types, complications of PPH and the most common causes of maternal mortality during childbirth.

Table (3) represents that, there were highly statistically significant differences ($P < .001$) before and after implementation of the educational intervention in relation to nurses' knowledge regarding preventive measures of PPH in antenatal, intra-natal and post-natal periods.

Table (4) reflects that, there were highly statistically significant differences ($P < .001$) before and after implementation of the educational intervention in relation to all items of nurses' knowledge pertaining to nursing and medical management of PPH and hypovolemic shock.

Table (5) shows that, there were general improvements ($P < .001$) in all items of knowledge about PPH (general knowledge about PPH, preventive measures, nursing management, hypovolemic shock and total knowledge scores) after the educational intervention as compared to before.

Fig. (1) Illustrates that, only 3.1% of the nurses had a good knowledge level before the educational intervention. However, the good knowledge level changed to be 85.9% after intervention.

Table (6) displays that, there were highly statistically significant differences ($P < .001$) before and after educational intervention in relation to nurses' practices about, peripheral pulse measurement, blood pressure measurement, fundus; lochia and perineal assessment, urinary catheterization, administration of ebolic drugs and IV fluid, uterine massage, perineal care and total practice score.

Fig. (2) demonstrates that, 82.8% of the nurses had an average level of practices before the educational intervention. However, after the educational intervention, 81.2% of them got a good level of practices.

Table (7) clarifies that, there was a positive, highly statistically significant correlation ($P \leq .01$) between nurses' total knowledge and practice scores before and after the educational intervention.

Table (8) reflects that, there were negative, highly statistically significant correlations ($P \leq .01$) between nurses' total knowledge, total practice scores and their age, as well as between nurses' total knowledge, total practice scores and their years of experience before and after the educational intervention. On the other hand, there was a positive, highly statistically significant correlation ($P \leq .01$) between nurses' total knowledge, total practice scores and their educational level.

Table (9) shows that, there was no significant correlation ($P > .05$) between nurses' total knowledge, total practice scores and their place of work throughout the study period.

Table (1): Distribution of the study subjects according to their socio-demographic characteristics. (n= 64)

Characteristics	No	%
Age		
- 20-<30	13	20.3
- 30-<40	26	40.6
- 40-<50	22	34.4
- 50+	3	4.7
Mean ± SD	35.48±6.01	
Educational qualification		
- Nursing diploma	50	78.1
- Technical institute	11	17.2
- Bachelor degree	3	4.7
Job position		
- Head nurse	4	6.3
- Staff nurse	60	93.7
Years of experience		
- < 5	5	7.8
- 5 - <10	12	18.8
- 10+	47	73.4
Mean ± SD	16.78±5.46	
Place of work		
- University hospital	46	71.9
- Teaching hospital	18	28.1
Attendance of training program about PPH		
- Yes	6	9.4
- No	58	90.6

Table (2): Distribution of the studied subjects according to their general knowledge regarding PPH before and after educational intervention (n= 64).

Items	Study period	Pre-intervention		Post-intervention		χ^2	P value
		No	%	No	%		
Definition of PPH							
-	Correct answer	15	23.4	39	60.9	39.504	<.001**
-	Incomplete answer	32	50.0	22	34.4		
-	Don't know	17	26.6	3	4.7		
Causes and risk factors of PPH							
-	Correct answer	23	35.9	45	70.3	38.485	<.001**
-	Incomplete answer	36	56.3	17	26.6		
-	Don't know	5	7.8	2	3.1		
Signs and symptoms of PPH							
-	Correct answer	17	26.6	37	57.8	29.367	<.001**
-	Incomplete answer	30	46.8	20	31.3		
-	Don't know	17	26.6	7	10.9		
Types of PPH							
-	Correct answer	10	15.6	39	60.9	35.490	<.001**
-	Incomplete answer	38	59.4	23	35.9		
-	Don't know	16	25.0	2	3.2		
Complications of PPH							
-	Correct answer	7	10.9	44	68.8	36.708	<.001**
-	Incomplete answer	44	68.8	15	23.4		
-	Don't know	13	20.3	5	7.8		
Most common causes of maternal mortality.							
-	Correct answer	13	20.3	32	50.0	35.468	<.001**
-	Incomplete answer	34	53.1	25	39.1		
-	Don't know	17	26.6	7	10.9		

** Highly statistically significant difference at $P \leq .001$

Table (3): Distribution of the studied subjects according to their knowledge regarding preventive measures of PPH before and after educational intervention (n = 64).

Items	Study period	Pre-intervention				Post-intervention				χ^2	P value
		Correct answer		Incorrec t answer		Correct answer		Incorrec t answer			
		No	%	No	%	No	%	No	%		
Prevention during antenatal period											
-	Detection and correction of anaemia.	43	67.2	21	32.8	58	90.6	6	9.4	23.557	<.001**
-	Hospital delivery with ready cross-matched blood for high risk patients	33	51.6	31	48.4	51	79.7	13	20.3	27.366	<.001**
Prevention during intra-natal period											
-	Proper use of analgesia and anaesthesia.	40	62.5	24	37.5	59	92.2	5	7.8	19.040	<.001**
-	Avoid prolonged labour	38	59.4	26	40.6	50	78.1	14	21.9	25.104	<.001**
-	Episiotomy timing	36	56.3	28	43.8	49	76.6	15	23.4	24.663	<.001**
-	Routine examination of the placenta and membranes	42	65.6	22	34.4	49	76.6	15	23.4	30.189	<.001**
-	Perineal support	40	62.5	24	37.5	56	87.5	8	12.5	25.238	<.001**
-	Avoid fundal pressure	34	53.1	30	46.9	51	79.7	13	20.3	28.489	<.001**
-	Proper bearing down	40	62.5	24	37.5	58	90.6	6	9.4	21.034	<.001**
-	Active management of the third stage of labour	41	64.1	23	35.9	59	92.2	5	7.8	29.668	<.001**
-	Exploration of the birth canal after delivery	48	75.0	16	25.0	2	3.1	62	96.9	25.772	<.001**
Prevention during immediate post-natal period											
-	Fundal examination and massage	42	65.6	22	34.4	54	84.4	10	15.6	32.626	<.001**
-	Empty urinary bladder	28	43.7	36	56.3	56	87.5	8	12.5	23.628	<.001**
-	Routine use of ecbolics after delivery.	35	54.7	29	45.3	51	79.7	13	20.3	29.689	<.001**
-	Early breast feeding	42	65.6	22	34.4	58	90.6	6	9.4	22.639	<.001**
-	Careful observation in the fourth stage of labour	40	62.5	24	37.5	60	93.7	4	6.3	27.111	<.001**

** Highly statistically significant difference at $P \leq .001$

Table (4): Distribution of the studied subjects according to their knowledge regarding nursing and medical management of PPH and hypovolemic shock before and after educational intervention (n= 64).

Items	Study period		Pre-intervention		Post-intervention		χ^2	P value
	No	%	No	%	No	%		
Methods of medical management of PPH								
- Correct answer	22	34.4	35	54.7	31.931	<.001**		
- Incomplete answer	21	32.8	25	39.1				
- Don't know	21	32.8	4	6.2				
Nursing management of PPH								
- Correct answer	15	23.4	48	75.0	42.190	<.001**		
- Incomplete answer	35	54.7	7	10.9				
- Don't know	14	21.9	9	14.1				
Drugs used to control bleeding								
- Correct answer	22	34.4	49	76.6	26.705	<.001**		
- Incomplete answer	35	54.7	13	20.3				
- Don't know	7	10.9	2	3.1				
Effect of these drugs								
- Correct answer	21	32.8	47	73.5	34.508	<.001**		
- Incomplete answer	28	43.8	10	15.6				
- Don't know	15	23.4	7	10.9				
Definition of hypovolemic shock								
- Correct answer	0	0.0	36	56.3	29.038	<.001**		
- Incomplete answer	22	34.4	21	32.8				
- Don't know	42	65.6	7	10.9				
Signs and symptoms of hypovolemic shock								
- Correct answer	22	34.4	39	60.9	55.426	<.001**		
- Incomplete answer	35	54.7	21	32.8				
- Don't know	7	10.9	4	6.3				
Medical management of hypovolemic shock								
- Correct answer	15	23.4	38	59.4	28.900	<.001**		
- Incomplete answer	35	54.7	21	32.8				
- Don't know	14	21.9	5	7.8				
Nursing management of hypovolemic shock								
- Correct answer	14	21.9	46	71.9	33.282	<.001**		
- Incomplete answer	43	67.2	16	25.0				
- Don't know	7	10.9	2	3.1				

** Highly statistically significant difference at $P \leq .001$

Table (5): Mean knowledge scores of the study subjects before and after educational intervention (n= 64)

Items	Study period	Maxi-mum score	Pre-intervention		Post-intervention		Paired (t) test	P Value
			Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD		
- Knowledge about PPH		12	6.82±2.11	9.58±1.17	14.25	<.001**		
- Preventive measures of PPH		16	10.17±1.75	13.09±1.47	23.08	<.001**		
- Nursing management of PPH		8	4.43±0.85	6.21±0.96	16.50	<.001**		
- Hypovolemic shock and nursing management		8	4.84±1.11	6.56±0.99	14.72	<.001**		
- Total knowledge		44	26.00±4.82	35.21±3.22	26.91	<.001**		

** Highly statistically significant difference at $P \leq .001$

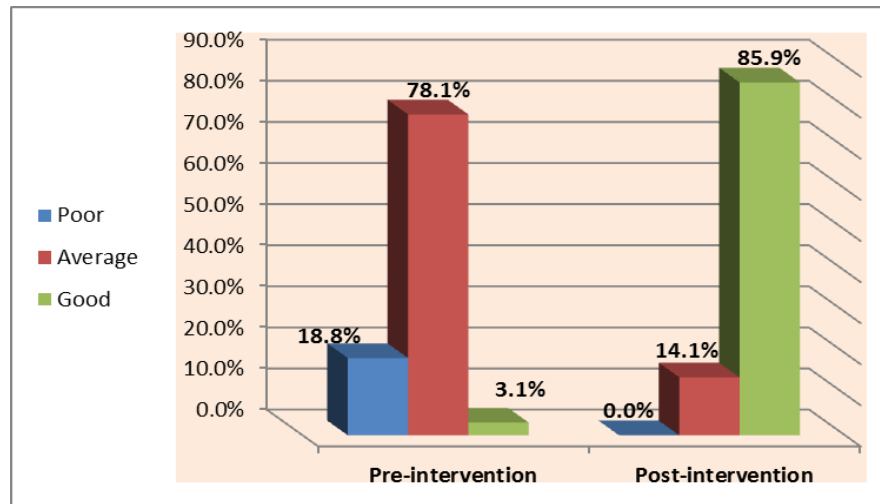


Fig. (1): Distribution of the study subjects according to their total knowledge scores before and after educational intervention (n= 64)

Table (6): Mean practice scores of the study subjects before and after educational intervention (n= 64)

Study period	Items	Maximum score	Pre-intervention	Post-intervention		P Value
			Mean ± SD	Mean ± SD	Paired (t) test	
	- Peripheral pulse measurement	16	10.62±2.03	13.09±1.39	22.18	<.001**
	- Blood pressure measurement	42	30.70±4.08	35.82±3.00	12.22	<.001**
	- Fundus, lochia and perineal assessment	32	21.65±1.90	25.93±3.02	15.08	<.001**
	- Urinary catheterization	30	18.85±3.86	22.60±2.60	13.61	<.001**
	- Administration of ecboic drugs and IV fluid	34	24.23±3.63	28.43±2.62	20.09	<.001**
	- Uterine massage	18	10.26±1.49	13.65±1.34	21.19	<.001**
	- Perineal care	14	8.84±1.31	10.79±1.52	13.96	<.001**
	- Total practices score	186	115.82±11.27	149.75±9.17	47.54	<.001**

** Highly statistically significant difference at $P \leq .001$

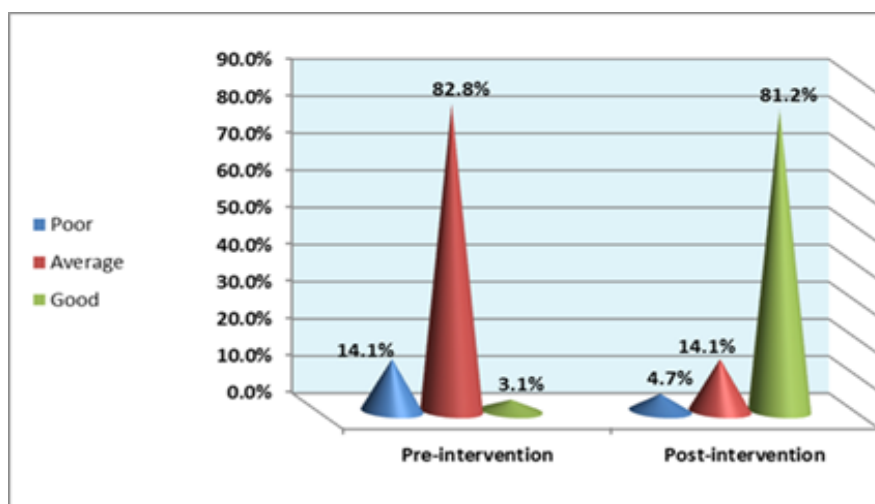


Fig. 2: Distribution of the study subjects according to their total practice scores before and after educational intervention (n= 64)

Table (7): Correlation coefficient between study subjects' total knowledge and practice scores before and after educational intervention (n= 64)

Variables		Age		Years of Experience		Educational level	
		r	P	r	P	r	P
Knowledge	Pre-intervention	-0.599	<.01**	-0.605	<.01**	0.486	<.01**
	Post-intervention	-0.595	<.01**	-0.625	<.01**	0.554	<.01**
Practice	Pre-intervention	-0.603	<.01**	-0.620	<.01**	0.387	<.01**
	Post-intervention	-0.565	<.01**	-0.587	<.01**	0.465	<.01**

**Correlation is highly statistically significant at P ≤ .01

Table (8): Correlation coefficient between study subjects' total knowledge and practice scores and their socio demographic characteristics before and after educational intervention (n = 64)

Variables		Knowledge	
		r	P
Practices	Pre-intervention	0.952	<.01**
	Post-intervention	0.888	<.01**

**Correlation is highly statistically significant at P ≤ .01

Table (9): Relationship between study subjects' total knowledge, practice scores and their place of work before and after educational intervention (n = 64)

Variables			Place of Work				MC	P		
			University Hospital		Teaching Hospital					
			No	%	No	%				
Total knowledge	Pre-intervention	Poor	7	15.2	5	27.8	0.094	>.05		
		Average	38	82.6	12	66.6				
		Good	1	2.2	1	5.6				
	Post-intervention	Average	6	13	3	16.7			0.067	>.05
		Good	40	87	15	83.3				
		Total	46	100	18	100				
Total practices	Pre-intervention	Poor	6	13	3	16.7	0.090	>.05		
		Average	38	82.7	14	77.7				
		Good	2	4.3	1	5.6				
	Post-intervention	Poor	3	6.5	0	0			0.081	>.05
		Average	6	13	3	16.7				
		Good	37	80.5	15	83.3				

MC= Monte-Carlo Test

4. DISCUSSION

Obstetric hemorrhage continues to be the leading cause of maternal mortality worldwide and accounts for an estimated 27% of direct obstetric causes of maternal deaths. Approximately three quarters of obstetric hemorrhage are due to PPH and 99.8% of these events occur in low-income countries.^[28] Several evidence recommends a strong need for educational intervention in this area. **Ruth and Kennedy (2011)**^[29] noted an increase in positive patient outcomes during treatment of PPH after staff nurses attended in-service training on the appropriate documentation and quantification of blood loss during the postpartum period. Similarly, a recent study by **Motanya (2015)**^[30] demonstrated a need for educational programs for staff nurses and the need for hospitals to develop standards for professional practice related to decreasing PPH. The author also noted that education and support are critical to any improvements that lead to positive patient outcomes.

Concerning maternity nurses' total knowledge about PPH, the present study findings revealed that, a minority of the nurses had a good knowledge level before educational intervention. However, after educational intervention the good knowledge level changed to be for the majority. The decrease of the percentage of the nurses' good knowledge level before educational intervention may be due to that most of the studied nurses were diploma graduates, working since more than 10 years ago, as well as the inadequate participation in training programs related to the research topic, where most of the nurses did not attend any training program about PPH.

The present study findings showed highly significant improvement in the nurses' knowledge regarding all items related to prevention and nursing management of PPH after the educational intervention as compared to before the intervention. The results of the present study agree with at least three other researches. *First*, **Hassan (2015)**^[31] who had studied "the effect of nursing intervention program on reduction of PPH". He pointed out that, there was highly statistically significant difference between pre and post intervention of the nurses' knowledge regarding PPH. *Second*, **Motanya, (2015)**^[30], who had studied "implementation of an evidence-based educational module on nurses' role on management of PPH" and found significant improvement in the staff nurses' knowledge and awareness of PPH after implementation of an evidence-based educational module and concluded that providing staff nurses with an educational program on the prevention and management of PPH can impact their level of knowledge and thereby increase positive patient outcomes. *Third*, **Garcia, (2013)**^[32] who had studied "mixed methods evaluation and teaching with traditional midwives' regarding nursing interventions to manage PPH", and stated that, the culturally sensitive teaching improved traditional midwives' knowledge about nursing interventions to manage PPH. This improvement of knowledge post intervention in the current study may be attributed to the ability of the maternity nurses to gain knowledge easily and they are interested to refresh and update their knowledge about PPH as well as the distribution of the written booklet to nurses to be used as an ongoing reference, was helpful in nurses' acquisition of knowledge. Finally, In-service training programs about prevention and management of PPH for nurses and midwives are recommended by the WHO to improve the quality of nursing care.^[33]

Regarding to mean practice scores of the maternity nurses, the present study revealed that there were highly statistically significant differences ($P < .001$) between pre and post intervention in relation to nurses' practices about, peripheral pulse measurement, blood pressure measurement, fundus; lochia and perineal assessment, urinary catheterization, administration of ecbolic drugs and IV fluid, uterine massage, perineal care and total practices scores.

These results are in accordance with at least four other researches. *First*, **Faiza, (2015)**^[17] who had studied "knowledge and practice of nurse midwives regarding management and prevention of PPH in three selected teaching hospitals, Khartoum State, Sudan" she recommended the continuous in-service training to update nurse midwives' knowledge and practices regarding management and prevention of PPH. *Second*, the previously mentioned **Garcia, (2013)**^[32] study, found a significant improvement in traditional midwives' practices about nursing care to manage PPH after training. *Third* **Audureau et al.(2009)**^[34] who had evaluated "the effectiveness of a multifaceted intervention on practices for prevention, diagnosis and management of PPH". They reported that, the intervention was effective at improving PPH related to preventive and diagnostic practices. *Fourth*, **El Sayed (2006)**^[35] who had studied "quality improvement of immediate postpartum nursing care" found significant improvement in nurses' practices regarding observing the general appearance, assessing the uterine fundus and uterine massage, assessing lochia and bladder elimination assessment after the training program. These findings point to the successful effect of the training program to maternity nurses as method for continuous updating and renewal of their knowledge and skills to maintain and improve their competences. Thus, there is a clear role in continuing professional development activities of nurses which have ultimate reflection on improving patient's care outcome.

Regarding the relationship between nurses' total knowledge and practice scores and their sociodemographic characteristics, the present study results revealed that, there were negative, statistically significant correlations between nurses' total knowledge and practice scores and their ages. As well nurses' total knowledge and practice scores and their years of experience through all the study periods. This means that nurses' level of knowledge and practices is better with decreased ages and years of experience. This might be due to that the older nurses delegated nursing activities to the younger nurses and have a small number of assigned patients beside some administrative roles, in addition to the fact that young age nurses have the ability to remember and retrieve information easily than older nurses. This result is compatible with **Mohammed and El-Sayed (2015); El-Bahy et al. (2013) and Abd El Fattah and Zein El Dein (2012)**.^[36,37,38] *The first*, had studied " the effect of an educational intervention regarding cord blood collection and stem cells on knowledge

and attitude of maternity nurses". They found negative statistically significant correlations between nurses total knowledge scores and their ages and years of experience at different times of assessment. *The second*, had studied the "effect of an educational program for maternity nurses about pregnancy induced hypertension on their knowledge in Port Said hospitals", they showed a statistically significant association between nurses' knowledge about pregnancy induced hypertension at the follow-up phase and their age and years of experience. *The third*, had assessed "the quality of nursing care provided immediately after birth at university hospital". They documented that, there was a negative correlation between the studied subjects' total knowledge scores and their years of experience.

Incongruent with the previous results, **Satwe et al. (2016)**,^[39] who had studied "effectiveness of planned teaching programme on knowledge regarding active management of the third stage of labour among 4th year nursing students", didn't find a significant relation between the study respondents' total knowledge scores and their demographic variables. This discrepancy between the present study and latter study might be related to the age and experience differences between the studies subjects, where the present study deals with mature registered nurses with long experience, the latter study deals with student nurses with young age and limited experience.

Moreover, the current study showed a positive, statistically significant correlation ($P \leq .01$) between nurses' total knowledge and practice scores and their educational level. In the same line, the previously mentioned **Mohammed and El-Sayed (2015)**^[36] study, pointed out that there was a statistically significant correlation between the studied nurses' total knowledge score and their educational level. As well **Rasheid and Ali (2010)**^[40] who had studied "assessment of nurse-midwives' knowledge and practices toward second stage of labor", found a significant correlation between nurses' educational level and their total practice scores. In addition, **Abd El Fattah and Zein El Dein, (2012) and Jaber and Abbas, (2011)**,^[38, 41] they reported positive statistically significant correlation between the studied subjects' knowledge score and their educational level.

As for the relationship between nurses' knowledge and practice total scores regarding PPH throughout the educational intervention, there was a positive highly statistically significant correlation ($P \leq .01$) between nurses' total knowledge and practice scores. This strong correlation between nurses' knowledge and practices is highly expectable; whereas, the effective prevention, management and control of PPH is often hindered by lack of knowledge in addition to the basic knowledge about PPH is essential for effective nursing practices. This result was supported by **Kaur et al. (2016)**,^[42] who had studied "knowledge and practices regarding antenatal assessment among obstetric nurses", they found highly significant association between obstetric nurses' knowledge and their practices regarding antenatal assessment. This finding is also in agreement with the previously mentioned **El Sayed (2006)**^[35] study, who had found highly statistically significant correlation between their participants' scores of knowledge and practices in pre and post intervention regarding immediate postpartum nursing care.

Additionally, the finding of the present study pointed out that, there was no significant correlation ($p > .05$) between the studied nurses' total knowledge, total practice scores and their place of work. This might be attributed to the insufficient contribution of nurses in in-service training programs about PPH in the both university and teaching hospitals. In this regard, **Sarani et al. (2016)**,^[43] who had studied "knowledge, attitude and practices of nurses about standard precautions in teaching hospitals", they stated that place of work did not establish a significant relationship with the knowledge and practice of the studied nurses. As well, **Mohammed (2006)**,^[44] who had conducted a "comparative study between the nursing performance for general postoperative patient at university hospital and teaching hospital at Benha City", stated that there is no difference in nurses performance about postoperative care in general surgical units between nurses in university hospital and teaching hospital. Thus, to produce proficient and knowledgeable nurse, emphasis should be made on in-service training programs and continual evaluation of nurse's performance which will help in improving the quality of nursing care.

5. CONCLUSION

Based on the results of the present study, it can be concluded that, there was a statistically significant improvement in nurses' knowledge and practice mean scores after the educational intervention. The implementation of an educational intervention significantly improved nurses' knowledge and practices towards prevention and control of PPH. Moreover, the above mentioned results proved and reinforced the study hypothesis.

6. RECOMMENDATIONS

- Adequately planned in-service training programs regarding PPH must be conducted in order to improve nurses' knowledge and practices which will be reflected on improving the quality of health care.
- Providing maternity nurses in obstetrics and gynecology departments with an instructional booklet regarding PPH to enhance their knowledge and practices.
- The nursing curriculum should be revised and updated according to recent researches regarding PPH prevention and control.
- Replication of the study on a larger sample and in different geographical areas in Egypt is recommended for generalization of findings.

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