

Impact of Skill Development Training in the Management of Postpartum Hemorrhage

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Abstract

Background: Postpartum hemorrhage (PPH) is blood loss of 500 ml or more following birth of the baby. This study aimed to determine the impact of skills development training in the management of postpartum hemorrhage. **Methods:** It was an observational before-and-after study that was conducted in Paropakar Maternity and women's Hospital. Training regarding management of PPH was given to 65 doctors from July to September 2020. Pre and post-training analysis of the trainees was done. Utilization of the skills that participants gained during training, and the changes in maternal morbidity and mortality related to PPH in the year prior to the training (year 2019) and after the training (year 2022) were recorded. A Chi square test was done to evaluate the p-value and value of <0.05 was considered significant. Odds ratio was calculated. Krickpatrick four level model was used to evaluate the impact of training. **Results:** There was a vast improvement in pre and post-training scores (29.5% vs 72.5%). A significant reduction in the rate of blood transfusion (41% vs 17.2% $p=0.0001$, OR= 0.29), ICU admission (7% vs 1.7%, $p=0.0001$, OR=0.20) and peripartum hysterectomy (1.3 vs 0.04%, $p=0.03$, OR=0.28) was found. Similarly, condom tamponade placement, bimanual compression and application of compression suture increased post-training (67 vs 167, 56 vs 108 and 5 vs 12). Most importantly, maternal mortality due to postpartum hemorrhage dropped from 75% to 0%. **Conclusion:** The skill development training for health care workers was associated with a reduction in morbidity and mortality in patients with postpartum hemorrhage.

Keywords: Impact, Maternal Mortality, Maternal Morbidity, Postpartum Hemorrhage Management, Skill Training.

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INTRODUCTION

Postpartum hemorrhage is defined as blood loss of more than 500ml or more from the genital tract within 24 hours of the birth of a baby. It can be minor (500ml - 1000ml) as well as major (>1000ml). Major PPH can be further divided into moderate (1000-2000ml) or severe (>2000ml) [1, 2]. PPH occurring within 24 hours of delivery is said to be primary and after 24 hours to 12 weeks postpartum is said to be secondary PPH [3].

The incidence of PPH varies widely, depending on the criteria used to diagnose it. Sites utilizing quantitative blood loss may report a higher PPH rate than sites using estimated blood loss. The incidence of PPH using estimated blood loss has been reported to be 1 to 3 percent of deliveries. Various population-based studies

have stated the incidence of PPH ranging from 1- 32% [4-10].

Postpartum hemorrhage is the leading cause of maternal mortality in low-resource countries and the primary cause of nearly one-fourth of all maternal deaths worldwide, most of which results from PPH that could be averted by timely and appropriate management [11]. Postpartum Hemorrhage (PPH) remains a leading direct cause of maternal deaths in Nepal that is responsible for 25% of maternal mortality ratio [12].

This study aimed to evaluate the skills regarding the management of PPH among doctors, to assess the knowledge, skills, and confidence levels of trainee doctors, and to measure the changes in the incidence of maternal morbidity (severity of blood loss,

blood transfusion, ICU admission) and mortality associated with PPH.

METHODS

This was an observational before-and-after study conducted at Paropakar Maternity and Women's Hospital, which is the only tertiary care hospital for women in Nepal, with more than 22000 deliveries every year. After obtaining ethical clearance from the Institutional Review Board of the hospital, training was provided to 65 doctors (5 registrars, 20 senior residents, 30 junior residents, and 10 volunteers) over a period of 3 months from July 2020 to September 2020 as the guideline of Intensive Care in Obstetric Emergency (ICOE) designed by the Obstetrical and Gynecological Society of Malaysia (OGSM). The written consent was obtained from all the participants. The participants were divided into 6 batches of 10-12 doctors and training was conducted weekly or biweekly (one batch at a time). There were three training stations:

Station 1 (Estimation of Blood Loss and Uterotonics):

Gauze piece, pads, kidney tray, and Mackintosh sheet along with food coloring were used to create the scenario of PPH and case-based questions were kept to calculate the shock index. Oxytocin, carboprost, methergine, misoprostol and tranexamic acid were displayed and PowerPoint slides were used. Fig 1 (A), 1(B)

Station 2: (Compression Sutures, Bimanual Compression, and Aortic Compression):

Low-cost handmade uterine models were used for the hands-on training on various types of compression sutures, while the pelvic birthing model was used for bimanual and aortic compression. Fig 1(C), 1(D)

Station 3 (Uterine Balloon Tamponade):

Mama U was used for the hands-on training on condom tamponade and uterine balloon tamponade. Flex was used to show various types of uterine tamponade. Fig 1(E)



Fig. 1: (A) = Estimation of blood loss



Fig. 1: (B) = Uterotonics



Fig. 1: (C) = Uterus model



Fig. 1: (D) = Birthing model



Fig. 1: (E) = Mama U

Each batch of 10-12 participants was again divided into 3 groups that were rotated in these 3 stations every 40 minutes (10-minute demonstration with 30 minutes of hands-on practice). 3 different types of presentation were done for all 3 stations (station 1: PowerPoint, station 2: oral and demonstration, station 3: flip chart and demonstration). Pre and post-test evaluation was done as per the checklist of ICOE. Each step of the checklist was given 1 mark. There was no negative marking. At the end of the training, the participants were given a form to fill out that consisted of a questionnaire (whether they found the training fruitful and whether they thought the training had enhanced their knowledge and skills) to assess the

trainees' reaction and feedback towards the training. Detailed data of all the patients who had PPH in the pre-training year (2019) and post-training year (2021) were collected on January 2022 and the pre-formed performance was filled out. The amount of blood loss, and management (uterotonics, bimanual compression, aortic compression, uterine tamponade, compression suture, devascularization and hysterectomy) was recorded. Morbidity (amount of blood loss, blood transfusion, ICU admission) and mortality due to PPH in the year following the skill development training were compared to that of the year prior to training.

To evaluate the impact of training, the krikpatrick 4-level training model of evaluation was used. Fig 2

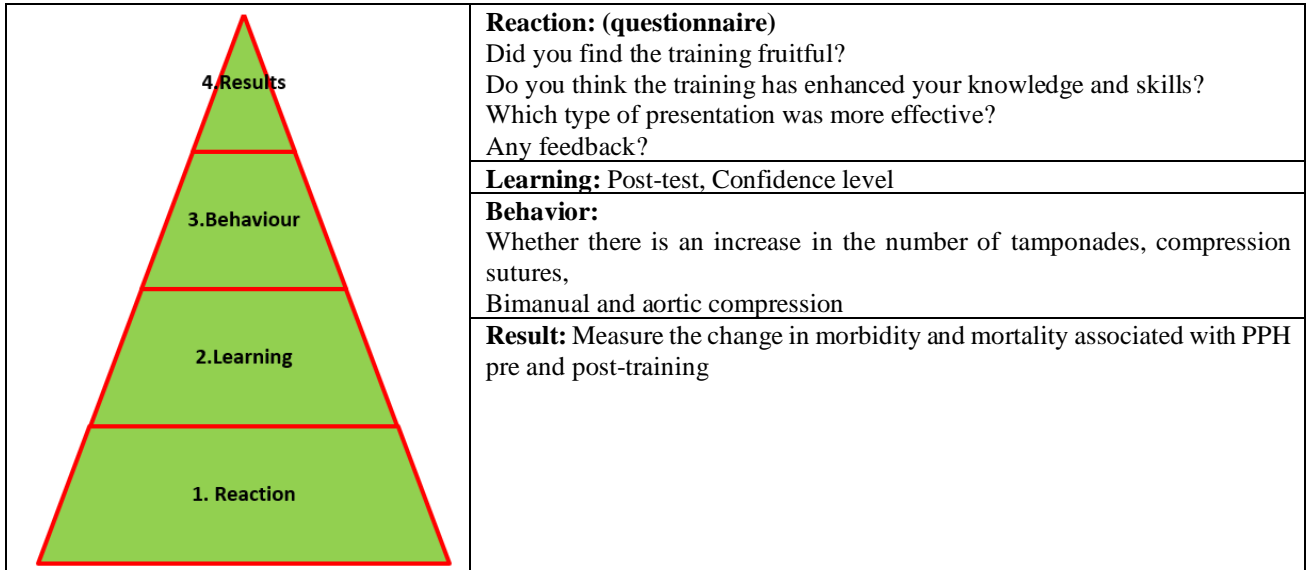


Fig. 2: Krikpatrick 4 level training mode

Data Entry and Statistical Analysis:

Data were entered in SPSS version 21. Pre and post-test scores were evaluated in the form of percentages. Outcomes of the patients like blood loss, blood transfusion, and ICU admission were evaluated in the form of numbers and percentages. A chi-square test was done to evaluate the p-value and the Odds ratio (OR) was calculated. The P-value of <0.05 was considered as significant.

RESULT

There was a significant improvement in the scores of participants before and after the skill development training. The pre-and post-test scores for estimation of blood loss were 38.6% vs 97.29%, for uterine tamponade were 39.2% vs 88.2%, for compression sutures were 33.8% vs 90.6% and for bimanual and aortic compression were 17.1% vs 86.76% with an overall average score of 29.5% vs 72.5%. (Fig 3) All of the participants (100%) found the training fruitful and thought that the training had enhanced their knowledge and skills.

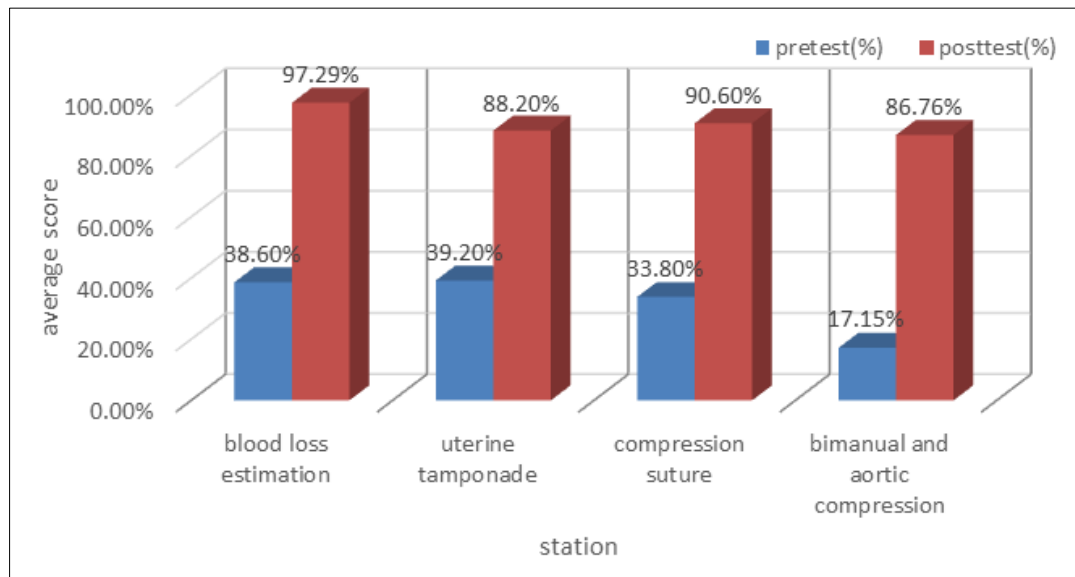


Fig. 3: Pre and post-test scores of the participants

Total deliveries were 22912, and 22592 in the year 2019 (pre-training year) and 2021 (post-training year) respectively and the incidence of PPH was 1005(4.38%) and 985(4.35%) respectively. Fig 4 Majority of PPH occurred in cesarean section in both the

pre-training and post-training years i.e. 645(64.1%) and 674(68.4%). The incidence of PPH in vaginal delivery was found to be 2.4 vs 2.22 in the pre-training and post-training year and the incidence of PPH in cesarean section was 8.04 vs 7.85.

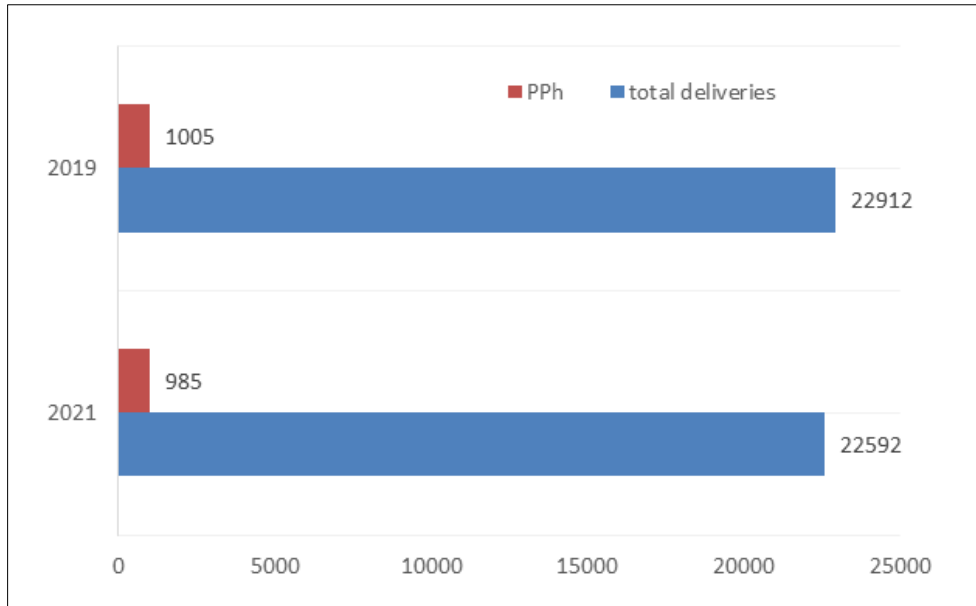


Fig. 4: Total deliveries and PPH during the pre and post-training year

The majority of PPH was due to atony (93.7% vs 95.9%), followed by a tear (4.2% vs 3.2%), tissue

(2.5% vs 0.6%), and thrombin (0.1% vs 0.2%) in both pre-and post-training. Fig 5

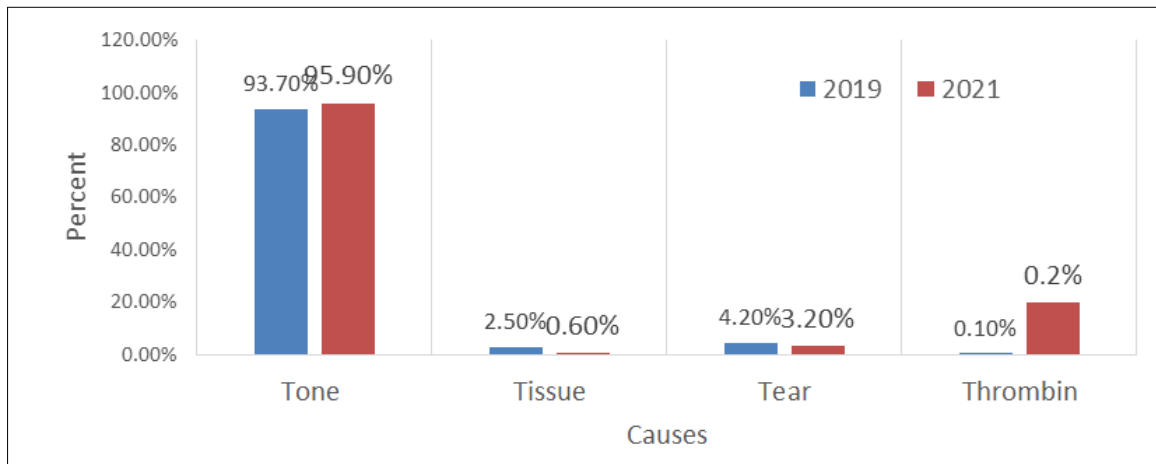


Fig. 5: Causes of PPH

Table 1 shows the comparison between the year before the skills development and training and the year after the training. There was an increased incidence of mild PPH (858, 85.37% vs 927, 93.9%) and a decrease in severe PPH (147, 14.6% vs 58, 6.09%) after the training, with the p-value of 0.0001 and OR 0.36. There was also an increase in the procedures for the management of PPH after the training such as insertion of condom tamponade (67 vs 167, p=0.03, OR=0.35) and

compression suture (5 vs 12, p=0.09). A vast reduction in ICU admission (70, 6.9% vs 15, 1.5%, p=0.0001, OR=0.20) and rate of blood transfusion (412, 40.99% vs 169, 17.15%, p=0.001, OR=0.29) was observed. Hysterectomy due to PPH was also decreased in post-training year (14, 1.3% vs 4, 0.4%, p=0.034, OR=0.28). Most importantly, the maternal mortality due to PPH in a pre-training year was 71.4% and in the post-training year, it was 0% (p=0.009).

Table 1: Patients outcome before and after the training

Outcome	Post training (N=985)	Pre training (N=1005)	P value	Odds Ratio
Blood loss				
500-1000ml (mild PPH)	927 (93.9%)	858(85.37%)	0.0001	0.36
>1000ml (severe PPH)	58 (6.09%)	147 (14.62)		
Tamponade				
Yes	167(16.9%)	67 (6.6%)	0.03	0.35
No	818(83%)	938 (93.33%)		
Compression suture				
Yes	12(1.2%)	5(0.495)	0.09	
No	973(98.7%)	1000(99.55)		
Bimanual compression				
Yes	30 (3.4%)	7(0.69%)	0.08	
No	955(96.9%)	998(99.3%)		
ICU admission				
Yes	15(1.5%)	70(6.9%)	0.0001	0.20
No	970(98.4%)	935(93%)		
Blood transfusion				
Yes	169(17.15%)	412(40.99%)	0.0001	0.29
No	816(82.85)	593(59%)		
Peripartum Hysterectomy				
Yes	4(0.4%)	14(1.3%)	0.03	0.28
No	981(99.5%)	991(98.6%)		
Maternal mortality				
PPH related	0	5(71.4%)	0.009	0.034
Not related	6 (1005%)	2(28.5%)		

DISCUSSION

Postpartum hemorrhage is a serious and dangerous condition that refers to the bleeding from the genital tract after delivery. Typically occurring within 24 hours of childbirth, it can occur up to 12 weeks postpartum. PPH can be minor (500-100ml) or major (>1000ml). Furthermore, major PPH can be divided into moderate (1000-2000ml) or severe (>2000ml) [1].

In this study, we applied the treatment principles of the intensive course in Obstetric Emergencies (ICOE), which is a simulation and skills-based course designed by the Obstetrical and Gynecological Society of Malaysia (OGSM) since 2014, to train the doctors of Maternity and women's Hospital in Nepal and observed the difference in blood loss, incidence of MICU admission, hospital stay, need of blood transfusion and PPH associated mortality in the year before and after the training. With this, we also recorded the frequency of use of skills obtained by the trainee during the skill development training like uterine tamponade, bimanual, aortic compression, and application of condom tamponade. The training was undertaken amidst the pandemic, hence the number of participants in each group was kept very limited. The hospital experienced a chaotic scenario as the number of referral cases, complicated pregnancies, and complicated deliveries increased, with lack of human resources being the utmost challenge. However, when we compared the outcomes of PPH before and after the training, they were satisfying and encouraging.

The post-test score of the participants revealed that all of the participants showed improvement in all three stations. There was a slight difference in pretest score between the participants who had taken similar courses within 2 years compared to those who had not; however, there was not much difference in the post-test score. This shows that such type of training enhances the knowledge and skills and with the implication of these skills.

The incidence of PPH in this study was 4.35 % in the year after training which was similar to the pretraining year, and is low in comparison to other hospital-based studies around the world [12-14]. WHO reports the incidence of PPH as 5% [15]. PPH in vaginal delivery was found to be 2.5% and in cesarean section was 8.04%. This is comparable to the data from India where incidence is 2-4% in vaginal and 6% in cesarean section [16].

Our study showed a significant reduction in the amount of blood loss after the training. The incidence of mild PPH was increased and major PPH was decreased (85.3% Vs 98.9% and 14.62% Vs 6.09%) with a p-value of 0.0001. The reduction of the severity of blood loss was associated with the improvement in the readiness for the management of post-partum hemorrhage. Our study also showed that there was a significant reduction in ICU admissions (6.9% in the pre-test year vs 1.5% in the post-test year, p=0.0001) and blood transfusion (40.99% Vs 17.15%, p=0.0001) which were directly related to the

severity of blood loss. As the amount of blood loss was decreased, this affected the hemoglobin level of the patients, resulting in a decrease in the number of post-delivery blood transfusions and also ICU admissions. In the study by Madden *et al.*, [17], he observed a reduction in the severity of hemorrhage, however, it was not statistically significant.

This study has also revealed that post-skills development training, the incidence of advanced management of PPH, such as condom tamponade (167 vs 67, $p=0.03$), application of compression suture (12 vs 5, $p=0.09$) and bimanual compression (30 vs 7, 0.08) has increased. In a similar simulation-based study by Nellisen *et al.*, [18], he observed an increase in the post-training incidence of uterine massage and use of uterotonic drugs with a p -value of <0.001 . Our study also observed a decrease in peripartum hysterectomy (4 vs 14, $p=0.03$) and maternal mortality (0 vs 5, $p=0.09$) associated with PPH.

Skills development training improves knowledge, readiness, and management of postpartum hemorrhage. Early and effective management of postpartum hemorrhage further ensures limiting the adverse outcomes associated with postpartum hemorrhage.

Limitations:

This training was conducted among the doctors. In the time to come, extending the training and involving nursing staff, especially regarding the estimation of blood loss, bimanual and aortic compression, and uterine tamponade will further help to improve the outcomes among women with postpartum hemorrhage. There is also a lack of proper simulators.

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Conflict of Interest: The authors have no conflict of interest to disclose.

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