Implementation of Quantitative Blood Loss Tool to Detect Postpartum Hemorrhage After Vaginal Delivery

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Implementation of Quantitative Blood Loss Tool to Detect Postpartum Hemorrhage After Vaginal Delivery

Rachael Williams

A Dissertation Submitted to The Graduate School at the University of Missouri-St. Louis in partial fulfillment of the requirements for the degree of Doctor of Nursing Practice

August 2022

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IMPLEMENTATION OF QUANTITATIVE BLOOD LOSS TOOL TO DETECT POSTPARTUM HEMORRHAGE AFTER VAGINAL DELIVERY

Abstract

**Problem** Maternal deaths and comorbidities related to postpartum hemorrhage (PPH) continue to be high despite being quite preventable. The delay in recognition and treatment of PPH due to the use of imprecise estimated blood loss (EBL) instead of precise measurement using quantitative blood loss (QBL) attributes to this issue.

**Methods** For this quality improvement (QI) project, a descriptive, observational design was used to gather quantitative data regarding QBL implementation instead of EBL as well as the number of PPH’s identified. A pilot cohort of staff nurses participated by documenting QBL two hours after each delivery. The nurses were given an educational inservice prior to implementation as well as the necessary resources throughout the entire 8 week period. The recourses outlined how to implement QBL and how to document their findings. Patient’s demographic data including race and age were reported. Also, patients’ body mass index (BMI) was collected using AWHONN’s PPH risk assessment tool.

**Results** A total of 340 singleton vaginal deliveries met criteria over the 8 week period. Out of these deliveries, EBL was implemented 299 times (78.5% of the total deliveries) and QBL was implemented 41 times (10.8% of the total deliveries). The 41 deliveries in which QBL was used, 3 PPH’s were identified. All 3 women were identified as low risk for PPH. This shows while the overall number of QBL deliveries did not meet the increase projected, QBL did accurately identify hemorrhage in patients who were assessed as low risk for PPH prior to delivery.

**Implications for Practice** Overall, the nurses’ knowledge of the need for QBL implementation in all patients regardless of risk assessment has increased as a result of
this QI project. QBL implementation should be adopted in all labor and delivery units in order to guarantee patient quality and safety as well as align with the current evidence-based practice guidelines.

Detection of Postpartum Hemorrhage after Vaginal Delivery Using Quantitative Blood Loss

Throughout the world, the single most common cause of maternal death is severe bleeding or hemorrhage in the postpartum period (Diaz et al., 2018). In 2018, a review outlining the methods used to determine blood loss estimation after vaginal birth was published. This was necessary due to data showing nearly 358,000 women die globally during or after childbirth each year (Diaz et al., 2018). In the United States, postpartum hemorrhage (PPH) has been shown to cause approximately 11% of maternal deaths (Smith et al., 2019). Ironically, PPH is the number one most preventable cause of maternal death yet is the fourth leading cause of maternal death in the United States (Blosser et al., 2021). In fact, out of all the maternal deaths resulting from PPH, it is estimated that about 70% of those deaths were preventable (Blosser et al., 2021). The leading cause of significant maternal morbidity stems from postpartum hemorrhages that result in the need for blood transfusion (Smith et al., 2019). Lastly, Smith et al. (2019) noted low-risk women make up approximately 40% of postpartum hemorrhages showing how the risk for postpartum hemorrhage applies to all women giving birth.

Early recognition and treatment of PPH has been linked to the reduction of adverse effects related to PPH (Hire et al., 2020). An article by The American College of Obstetricians and Gynecologists (ACOG) shares how studies have evaluated factors associated with postpartum hemorrhage (Smith et al., 2019). Specifically, this article
shares how imprecise health care provider estimation of blood loss (EBL) is directly related to delayed postpartum hemorrhage response (Smith et al., 2019). ACOG states that quantitative measurement of obstetrical blood loss (QBL) has been shown to increase accuracy and identification of blood loss when compared to EBL (Smith et al., 2019). QBL requires the practitioner to legitimately weigh the blood loss whereas EBL is simply an estimate per the practitioner’s discretion. Due to these findings, the women’s health community has made decreasing PPH rates an increasing priority.

The Alliance for Innovation on Maternal Health developed an Obstetric Hemorrhage Patient Safety Bundle that is growing in popularity and quickly becoming best practice across the United States (Smith et al., 2019). This bundle outlines specific practices to reduce morbidity and mortality rates, anticipate hemorrhage risk, and to quickly recognize and treat women having a postpartum hemorrhage (Smith et al., 2019). Correspondingly, this standardized method of managing postpartum hemorrhage is outlined and recommended by ACOG to decrease the incidence of maternal mortality and morbidity (Smith et al., 2019).

According to the ACOG Committee Opinion by Smith et al., (2019), one of the attributes of the Obstetric Hemorrhage Patient Safety Bundle is to enable measurement of cumulative blood loss in a quantitative manner. Use of this safety bundle ensures accuracy and specificity when measuring blood loss. Therefore, the purpose of this clinical scholarship project is to increase the identification of PPH through the detection of accurate blood loss amounts using QBL techniques as recommended by ACOG’s Obstetric Hemorrhage Patient Safety Bundle in a suburban Midwest hospital labor and delivery unit. The project aim is a 30% increase in the use of QBL documentation to
better identify postpartum hemorrhage by labor and delivery nurses over 8 weeks. The question for study guiding this quality improvement project is among patients who had vaginal deliveries, how does use of QBL documentation aid in identifying hemorrhage two hours post-vaginal delivery? The primary outcome measures of this study include any hemorrhages identified by two hours post-vaginal delivery through the use of QBL documentation and the number of patients who had QBL documentation during their two hour post-vaginal delivery recovery.

**Literature Review**

Methods for determining blood loss by The American College of Obstetricians and Gynecologists’ Committee Opinion was developed by Smith et al. (2019) to shed light on their stance on quantitative blood loss in obstetric hemorrhage. The purpose was to review and explain the current evidence regarding the methods of determining obstetric blood loss. Root cause analyses have shown that delayed diagnosis and delayed initiation of treatment are repeated problems in obstetrical blood loss situations. Quality improvement opportunity is needed to implement more timely diagnosis and treatment of PPH. Smith et al., (2019) states that quantitative methods of measuring blood loss are more accurate compared to visual estimation of blood loss. The opinion includes the idea that EBL is more likely to underestimate as well as overestimate blood loss when compared to QBL documentation. ACOG supports the use of the Alliance for Innovation on Maternal Health’s Obstetric Hemorrhage Patient Safety Bundle which aligns with the use of QBL. The opinion included a statement of the need for more quality improvement projects to be performed to ensure patient safety and improve QBL strategies. However,
based on current data, implementation of the safety bundle in the United States has proven to significantly reduce maternal morbidity.

A literature search was conducted to identify the history surrounding postpartum hemorrhage, how it has been identified and treated in the past, and recommendations for the future. Databases used included the Cochrane Database of Systematic Reviews, MEDLINE/National Library of Medicine, the Cumulative Index of Nursing and Allied Health Literature (CINAHL), Google Scholar, and PubMed. Phrases and key words used included quantitative blood loss after vaginal delivery, identification of postpartum hemorrhage, and current recommendations for postpartum blood loss. Inclusion criteria included singleton pregnancies and vaginal deliveries. Exclusion criteria included cesarean section statistics and multiple gestation. Studies conducted before 2016 were excluded. Pregnant females of childbearing age were included, and all other non-pregnant personnel were excluded. There were 11 studies retrieved and out of these 11, 6 were deemed relevant for review.

Overall, the literature showed that QBL as opposed to EBL is essential to accurate identification of blood loss. In addition, all studies showed the lack of a QBL tool resulted in delayed initiation of postpartum hemorrhage thus increasing maternal morbidity and mortality rates. The literature emphasized that determining blood loss using EBL also leads to increased maternal morbidity and mortality due its inability to detect and treat postpartum hemorrhage in a timely manner. Finally, the literature concludes most hospitals still use EBL because of time, cost, and training ease despite the national recommendation to implement documentation of QBL to detect PPH.
Andrikopoulou, and D'Alton (2019) reviewed 43 studies all showing how PPH is a multifactorial process. Certain challenges including lack of early identification of PPH were elucidated in these articles. Included in these reviewed articles were current risk assessment tables and tools to help providers identify women at high risk for hemorrhage. Also included were the initial steps, medication use, blood transfusion and actions recommended in each stage of hemorrhage severity. A major focus of this review emphasized implementation of the recommendation of QBL for all postpartum patients for hemorrhage assessment. The review concluded that although accurate QBL is essential, the assessment focus should include other factors such as clinical signs of hypovolemia, patient symptoms, shock index, and the rate of blood loss to assess for PPH and need for further intervention. Most importantly, the authors stated that early warning signs of PPH should not be ignored and, any delay of treatment of PPH should not be tolerated.

A retrospective observational study by Blosser et al. (2021) sought to evaluate the differences in using EBL versus QBL when predicting the need for blood transfusion in postpartum hemorrhage patients. The study occurred at a military tertiary care center from June 2016 to May 2018. The aim was to implement a protocol for QBL following all births and to compare blood loss, hematocrit changes, need for blood transfusions, and patient outcomes prior to and after the implementation of the QBL protocol. This study used a QBL calculator containing all dry weights of pads to ensure the weight of QBL was accurate and simplified. In this study, the EBL group had 2,731 patients and the QBL group contained 2,705 patients. In vaginal births, the 90th percentile for blood loss was 400ml when EBL was used compared to 526 ml when QBL was used. The chi-square
test, Fisher exact tests, t-test, Mann Whitney U, and Pearson correlation coefficient tests were used to analyze variables. Analysis showed there was not a significant difference when it came to the rate of blood transfusions between the two groups, however, there was a statistically significant difference of postpartum hemorrhage recognition in the QBL group versus the EBL group. The researchers concluded QBL is more sensitive for identifying clinically significant blood loss which results in quicker recognition and timely intervention for PPH.

Diaz et al. (2018) reviewed 62 studies regarding alternative methods for blood loss estimation after vaginal birth. Of the 62 total reports, 12 were assessed fully in the review. This review outlined the background of PPH and the importance of increased research to study PPH to reduce morbidity and mortality rates. The objective of this review was to evaluate the alternative methods to EBL during the immediate postpartum period. All the trials across the 62 studies were randomized, cluster-randomized, and evaluated blood loss estimation after vaginal birth. Diaz et al. (2018) concluded there was insufficient evidence to support one specific modality of detecting blood loss amount. This review suggested the need for further trials to identify the most appropriate way to identify blood loss identified by the increasing accuracy shown throughout the 62 clinical trials from the use of QBL. This research suggests the need for early and efficient identification of blood loss and interventions to help decrease blood loss and improve health outcomes.

Joseph et al. (2020) sought to implement the Alliance for Innovation on Maternal Health Safety Bundle in an urban safety-net hospital. This study took place over an 18-month period and included risk assessment, hemorrhage identification, hemorrhage
management, team simulations and communication, and debriefings. This safety bundle included the use of QBL to identify the amount of blood loss which was then used to implement the management course of action. Interventions started by improving identification of risks and delivery preparation for every patient. The risk categories were low, medium, and high and each risk category corresponded with an anticipatory intervention. After the risk assessment, the next part of this study was geared toward improving PPH recognition and response. The study focused on the use of QBL to identify the amount of blood loss which then was used to implement the management course of action. In vaginal deliveries, a metered plastic bag was used to collect blood and amniotic fluid. Amniotic fluid volume was subtracted from the total QBL. Weighed sponges were also used to measure QBL (1:1 ratio in milliliters to grams). QBL was used to identify PPH stages and subsequent needed interventions. Findings showed the application of the safety bundle improved PPH risk assessment rates by more than 90%. Joseph et al. (2020) concluded the use of the PPH safety bundle and its’ stepwise approach is an achievable goal to strive for in all hospital settings to ensure patient safety and PPH best practice. To achieve this goal, Joseph et al. (2020) recommended the need for a standardized hemorrhage protocol to include a defined hemorrhage response team educated in the use of the PPH risk assessment tool. Further recommendations were the employment of QBL for all deliveries, the development of hemorrhage carts, and streamlined protocol adherence.

A quality improvement project conducted by Ladouceur and Goldbort (2019) sought to educate nurses and physicians on how to switch their practice from EBL to QBL after vaginal deliveries. The goal was to replace EBL with QBL for at least 85% of
vaginal births during a 3-month span. This study took place in a midwestern U.S. urban community hospital. This hospital had 1,200 births annually and current practice was use of EBL. The participants included 43 intrapartum nurses and 17 physicians. First, participants were given a survey to gather a baseline on their knowledge of using QBL. Then, a 10-minute educational program on QBL was presented by a clinical nurse specialist. Steps used in quantification of blood loss were outlined. Each shift had a support person to offer tips on how to successfully implement QBL into practice. A chart audit was used to determine the QBL analysis compliance rate. The results of this project concluded that precise blood loss detection is helpful in preventing maternal morbidity and mortality. This study showed practitioners must be educated on how to implement QBL and be able to ask questions if any arise to ensure accuracy. Clinical implications of this study outlined how nurses play a crucial role in the adoption of QBL in order to achieve more timely interventions that can reduce and prevent PPH complications.

The Plan-Do-Study-Act (PDSA) framework will guide this proposed quality improvement study. The PDSA framework was chosen for the proposed project in order to help plan and implement a test of change in this specific labor and delivery unit. The change includes implementation of the evidence-based practice of using QBL to measure blood loss two hours after vaginal deliveries. This PDSA framework will also allow for analysis of implementation strategies and give leeway on what is needed for future implementation.

Methods

Design
The quality improvement (QI) project utilized a descriptive, observational design. Quantitative data regarding QBL was collected. Documentation of the use of QBL was collected along with the number of times QBL was used to identify postpartum hemorrhage (PPH) (which is defined as blood loss greater than 500 milliliters).

**Setting**

This QI project was implemented in a labor and delivery unit at a suburban hospital in St. Louis County in Missouri. This hospital is a recognized “Magnet” hospital designated for excellence in nursing care. This project was implemented in a labor and delivery unit which has approximately 4,000 newborn deliveries per year. This labor and delivery unit staffs approximately 80 registered nurses who care for patients during and after labor and delivery.

**Sample**

A convenience sample of women who delivered singleton babies vaginally was used for this project. Patients ages 18 and older who delivered vaginally were included. Patients under 18 were excluded. Patients who delivered multiple fetuses or delivered by cesarean section were excluded. Medical records of all patients who met inclusion criteria from January 20, 2022 through March 20, 2022 were included in the analysis. Unique alphanumeric identifiers were created and applied to each patient for de-identification purposes. The patients’ first and last initials and were identified and stored on a password protected file on the student investigator’s clinic laptop.

**Approval Process**

Formal, written approval was obtained from the labor and delivery manager and educator on August 1, 2021. Formal, written approval from the clinical scholarship
IMPLEMENTATION OF QUANTITATIVE BLOOD LOSS TOOL TO DETECT POSTPARTUM HEMORRHAGE AFTER VAGINAL DELIVERY

project site was granted on September 18, 2021, and the project protocol was determined to not be human subjects research. Approval for this project was granted from the University of Missouri-St. Louis’ (UMSL) Institutional Review Board (IRB) prior to implementation.

Data Collection/Analysis

De-identified patient data from patients who met exclusion criteria was collected via chart review after patient discharge. Demographic data variables collected were age, gender, race/ethnicity, and zip code. The patient data included total QBL for each patient as well as body mass index (BMI). A QBL tab in the hospital computer system was used to collect and record total QBL for each patient by the labor and delivery nurses. QBL data from this tab was collected including compliance to the QBL implementation tool (yes/no) and the number of hemorrhage detections (QBL greater than 500 milliliters). Staff used the Maternal Postpartum Hemorrhage Safety Bundle as the guide for QBL.

Procedures

A pilot cohort of staff nurses participated in the quality improvement project. Staff nurses documented QBL two hours after each singleton vaginal delivery. An educational inservice, led by the primary investigator, was held with the cohort one week prior to implementation of the project. Education for staff included how to implement the practice of QBL documentation, guidance on weighing pads, and how to use the under-buttocks drape to quantify blood loss after delivery of the newborn. Participating staff also received education on how to document QBL in the hospital electronic medical record.
A list of dry weights of pads was provided as well as the instructions on how to accurately implement QBL. Quantification of blood loss started immediately after delivery of the newborn and before the delivery of the placenta (Smith et al., 2019). The amount of amniotic fluid, urine, and feces was noted using an under-buttocks drape. The total volume of fluid collected in the drape was recorded before the delivery of the placenta. The preplacental fluid volume was then subtracted from the post-placenta fluid volume for accurate blood loss calculation. Next, the pads were weighed on the metal scale provided by using the weighing guide provided. All blood-soaked materials were weighed to determine QBL. Calculated blood loss was 1 gram weight = 1 milliliter of blood loss.

The unit staff nurses also evaluated the patients using BMI and the AWHONN postpartum hemorrhage risk assessment tool and determined that if patients were either low or medium hemorrhage risk. (Colalillo et al., 2021).

Results

The sample size was N= 41. Use of descriptive statistics showed the sample consisted of 85.4% Caucasian women, 2.4% American Indian women, 7.3% Asian women and 4.9% African American women. See Table 1. Age of the sample was divided into two groups: 1) women 18 years old to 34 years old (not considered advanced maternal age); and 2) women 35 years and older (considered advanced maternal age). Statistics showed that 95.1% of the women in the sample were ages 18 through 34 and 4.9% of the women were age 35 years and older. See Table 2. See also Figure 1.

The next variable, body mass index (BMI) was also divided into two groups in the sample. The first group included those women with a BMI of less than 40 kg/m^2 and the
second group included those women with a BMI of greater than or equal to 40 kg/m^2. See Table 3. Out of the sample size of 41 women, 40 of them had a BMI of less than 40 kg/m^2 equaling 97.6% of the total sample. Only 1 participant had a BMI of greater to or equal to 40 kg/m^2 equaling 2.4% of the total sample. Regarding AWHONN Postpartum risk assessment, 39 of the 41 were deemed low risk and 2 patients deemed medium risk.

Table 4 shows the percentage of estimated blood loss implementation versus quantitative blood loss implementation throughout the 8-week project. Of a total of 340 vaginal deliveries, EBL was implemented 299 times (78.5% of the total deliveries) and QBL which was implemented 41 times (10.8% of the total deliveries).

Lastly, of interest is that of the 41 deliveries in which QBL was used to calculate blood loss, 3 postpartum hemorrhages were identified, yet all three were identified as low risk for postpartum hemorrhage. This data shows while the overall number of QBL deliveries did not meet the increase of 30% projected by the PI, the use of quantitative blood loss did accurately identify patients who were assessed as low risk prior to delivery.

Discussion

The aim of this project was to increase the use of QBL documentation by 30% to identify postpartum hemorrhage more accurately over an 8-week period. This project was able to increase the use of QBL documentation on this unit by 10.8%. By focusing the project question on the use of QBL to identify postpartum hemorrhage, QBL did successfully identify postpartum hemorrhage in 3 of the 41 patient deliveries.

The primary outcome measures of this project included the identification of hemorrhages identified two hours post-vaginal delivery using QBL documentation and
IMPLEMENTATION OF QUANTITATIVE BLOOD LOSS TOOL TO DETECT POSTPARTUM HEMORRHAGE AFTER VAGINAL DELIVERY

the number of patients who had QBL documentation during their two-hour post-vaginal delivery recovery compared to the current practice of EBL documentation. There were identified hemorrhages using the QBL method in this QI project. While the number of identified postpartum hemorrhages appears low, the three identified patients were identified before delivery as low risk for postpartum hemorrhage. It is possible that had EBL been used for these three patients, that the postpartum hemorrhage may not have been identified due to the assumption of low risk when estimating blood loss.

Additionally, due to the volunteer nature of the staff involved in the project, only 41 of the 340 deliveries used the QBL methods, and data collection ended after eight weeks due to academic time constraints. Overall, this quality improvement project was successful in raising awareness of the need for accurate blood loss identification as well as the importance of timely hemorrhage response knowledge.

There were several limitations to this project. Two of the major limitations included lack of nurses’ time to implement this project due to other requirements and lack of nurse acceptance. The most important recommendation for future PDSA cycles would be to ensure nurse buy in and acceptance. While major stakeholders approved of the project, including staff nurses as major stakeholders in a future implementation is important. The education and resources for this project were adequately implemented, however, the nurse acceptance and implementation appear insufficient.

Another limitation resulted from physician and midwife knowledge and support of the project. Before another PDSA cycle implementation, all stakeholders should be identified and the interdisciplinary standpoint of the value of this project also emphasized to medicine along with nursing. Ensuring that all members of the interdisciplinary team
are aware of the importance of the project goals would help to ensure project implementation. This would also be the best strategy for maintaining and sustaining change.

Overall, the specific labor and delivery unit nurses’ knowledge of the need for QBL implementation has increased due to this project implementation and the use of pre implementation education. The unit manager and educator plan to continue this project with the recommendations listed above to help improve patient outcomes regarding identification of postpartum hemorrhage in accordance with the current evidence-based recommendations.

Conclusion

In conclusion, this QBL implementation project showed that even with adequate education and resources, staff acceptance and willingness to adopt new evidence-based guidelines is of utmost importance. This likely points to a stronger engagement of stakeholders for the next cycle of QBL. Future DNPs must fully understand the role they assume when leading quality improvement projects and find various ways to lead change and engage all stakeholders for better patient outcomes. It is particularly important that DNPs understand the use of and importance of evidence-based practice implementation to guarantee patient quality and safety. This first PDSA cycle was able to implement QBL on this unit as a start toward ensuing improved quality and patient outcomes. For this unit, this project has outlined the need for further implementation of QBL to help increase timely identification and treatment of PPH.
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References


Joseph, N. T., Worrell, N. H., Collins, J., Schmidt, M., Sobers, G., Hutchins, K., Chahine, E. B.,


Smith C. M., Borders A. E., & King, T. L. ACOG committee opinion no. 794.


## Appendix A

### Table 1

<table>
<thead>
<tr>
<th>Race</th>
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<tr>
<td>American Indian</td>
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<td>Asian</td>
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<td>7.3%</td>
</tr>
<tr>
<td>African American</td>
<td>2</td>
<td>4.9%</td>
</tr>
</tbody>
</table>

### Figure 1

![Pie chart showing race distribution](chart.png)

- **Caucasian**
- **American Indian**
- **Asian**
- **African American**
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Table 2

Age

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<th>Age</th>
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<tr>
<td>Age 18-34 (Not advanced maternal age)</td>
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<td>95.1%</td>
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<tr>
<td>Age 35 &amp; older (Advanced maternal age)</td>
<td>2</td>
<td>4.9%</td>
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Table 3

Body Mass Index (BMI)

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<th>Frequency</th>
<th>Percent</th>
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<td>10.5</td>
<td>97.6</td>
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<tr>
<td>BMI &gt;/= 40 kg/m^2</td>
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<td>0.3</td>
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<tr>
<td>Total</td>
<td>41</td>
<td>10.8</td>
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Table 4

EBL vs. QBL

<table>
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<th></th>
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<th>%</th>
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</thead>
<tbody>
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<td>EBL Implementation</td>
<td>299</td>
<td>78.5%</td>
</tr>
<tr>
<td>QBL Implementation</td>
<td>41</td>
<td>10.8%</td>
</tr>
</tbody>
</table>
IMPLEMENTATION OF QUANTITATIVE BLOOD LOSS TOOL TO DETECT POSTPARTUM HEMORRHAGE AFTER VAGINAL DELIVERY

Figure 2

Hemorrhages

Frequency

Hemorrhage (≥500 ml blood loss at 2 hours)  No Hemorrhage (<500 ml blood loss at 2 hours)

Figure 3

Hemorrhage Risk

Frequency

Low Risk on PPH Risk Assessment  Medium Risk on PPH Risk Assessment