RESEARCH ARTICLES

Gravimetric assessment of postpartum blood loss: training and implementation in a low resource setting

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ABSTRACT

Objective: This study aimed to evaluate the training and implementation of the gravimetric method for estimating postpartum blood loss in clinical practice in Indonesian midwife-led birth centres.

Background: Postpartum haemorrhage remains a leading cause of maternal death, particularly in low-resource settings. There is no gold standard for assessing blood loss volume during labour and childbirth. Studies recommended using a gravimetric method to measure blood loss in low-resource settings due to its relative accuracy and simplicity.

Study design and methods: An online training module for the use of the gravimetric method was developed. All participants undertook the training and were asked to implement the method in clinical practice. A pre/post-test study design was used to examine midwives' understanding of the gravimetric method; their implementation experience was explored using a structured questionnaire. Knowledge was assessed pre-training. The training consisted of both theoretical and practical elements and the opportunity for participants to ask questions. Post-training tests were administered, followed by a one-month period of implementation and an evaluation of their experience of using the method in practice.

Results: Two hundred and eighty-five midwives from 17 health facilities were recruited to the study, and a total of 101 midwives from 12 health facilities completed all elements. The participants' understanding of the gravimetric method improved significantly following the training. Although a number of challenges were identified regarding the implementation of the gravimetric method in practice, the participants were generally positive about its use, and 89% said that they would recommend this method to colleagues.

Conclusion: A three-hour online training effectively improved participants' understanding of the gravimetric method for assessing blood loss volume. This study identified midwives' positive experiences with the gravimetric method and identified areas to improve practitioner experience of implementation in practice.

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Implications for research, policy, and practice: A three-hour online training followed by a one-month implementation period could be an effective and efficient approach to developing midwives' understanding and use of the gravimetric method of blood loss estimation postpartum.

What is already known about the topic?

- The gravimetric method estimates the blood loss volume by weighing sanitary materials used during the labour process (i.e., gauze, sheets, swabs, pads, etc.) before and after being contaminated by the blood.
- In clinical practice, the weight difference (in grams) is considered as 'blood loss volume' for ease of measurement and reported in millilitres without any formal conversion of units of weight to volume.
- The benefits of the gravimetric method have been reported previously. However, there is limited evidence on the evaluation of this method to train midwives regarding implementation of the gravimetric method in clinical practice.

What this paper adds

- An online training programme is effective in increasing midwives' knowledge and awareness of the gravimetric method for postpartum blood loss assessment.
- The midwives found the gravimetric method simple to adopt in clinical practice, which increased their confidence in detecting postpartum haemorrhage.
- The midwives encountered some barriers while implementing the gravimetric method and provided strategies to mitigate the issues raised.

Keywords: Gravimetric method; birth; blood loss assessment; online training; postpartum haemorrhage.

OBJECTIVE

This article reports the evaluation of an online gravimetric method (GM) training and implementation program for midwives in clinical practice in Indonesian midwife-led birth centres.

BACKGROUND

Postpartum haemorrhage (PPH) is defined as "a blood loss of 500 ml or more within 24 hours after birth[1(p.3)]" while severe PPH is "blood loss greater than or equal to 1000 ml within 24 hours.[2(p.1)]" Severe PPH is associated with one or more of the following conditions: blood transfusion, transcatheter arterial embolisation, arterial ligation, uterine surgery, hysterectomy, long-term psychological impact, or even maternal death.[3-5] As a life-threatening condition,[4] postpartum haemorrhage is estimated to account for 27% of maternal deaths worldwide[6] and 30% of maternal deaths in Indonesia.[7] In Indonesia, this percentage has remained stable from 2012 to 2019.[7,8]

Postpartum haemorrhage diagnosis relies in part on the accuracy of blood loss assessment.[9,10] A delay in PPH management may lead to poor outcomes which is often caused by a delayed diagnosis of PPH.[11] Rosmaria et al. found that 94% of Indonesian midwives involved in that study did not routinely assess blood loss volume.[10] Moreover, there is currently no recommended gold standard for assessing blood loss to help PPH diagnosis.[12,13] Blood loss can be measured using a number of methods, including colourimetric,[14] photometric,[15] semi-automatic,[16,17] mathematical formulas,[18] computer-based mathematical modelling,[19] and radioisotope dilution methods.[20] Nevertheless, most of them are complicated and impractical to apply in a real-life midwifery practice.[18] The most common method used to estimate blood loss by health professionals worldwide is a visual method due to its ease of use, and can be easily and quickly done at various levels of health facilities.[9,18,21] Despite the benefits of this method, it has been found to be inaccurate, in particular when there are higher levels of blood loss.[10,15,18,22] Therefore, Bose et al. (2006) and Schorn (2010) suggested replacing visual checks with a more accurate measure for assessing blood loss volume.[15,22] The gravimetric method (GM) has been recommended due to its accuracy and relative simplicity of use.[23,24] This method is an assessment carried out by weighing all maternity pads before and after being exposed to blood, followed by calculating the weight difference.[9,25,26] It is an evidence-based method of blood loss assessment, and evidence suggests that it may help in the diagnosis and management of PPH by providing a more accurate assessment of blood loss, therefore improving patient safety.[27] However, this method is not routinely used by Indonesian midwives.[10] No previous research was identified that explored the evaluation of training midwives in the GM and exploring barriers and facilitators to the implementation in practice. This study therefore aimed to evaluate an online GM training and implementation programme for midwives in clinical practice in Indonesia.

STUDY DESIGN AND METHODS

A pre/post-test design was used to measure midwives' knowledge before and after online GM training and evaluate implementation in practice in the first month following training. A midwives' experiences questionnaire (MEQ) was designed and used to study the barriers and facilitators to implementation.

Data were collected from December 2020 to March 2021. Technology-based learning using an online platform (Zoom Video Communications, Inc.) was adopted following Coronavirus disease (COVID-19) restrictions to avoid the risk of COVID-19 transmission associated with conventional face-to-face approach.

The midwives who participated in this study came from various clinical settings (i.e., primary health centres and independent midwifery clinics) and geographical locations (i.e., urban and rural areas). In order to familiarise participants with online learning technologies and address any potential technical issues that may arise during the actual training rollout, all participants were given the opportunity to test the online processes. We identified and rectified various technical issues encountered by the participants during this process. We proposed that the midwives attend the training from their workplaces rather than from home to avoid any internet connection issues and allow them to demonstrate the GM immediately following the training. Furthermore, we recommended an online backup strategy for individuals who attended the training from home (e.g., tethering internet from another mobile phone in case of poor connectivity, where possible).

GRAVIMETRIC ASSESSMENT OF BLOOD LOSS

The gravimetric method has been previously described in detail.[9,25] Briefly, it comprises the assessment of blood loss volume by weight. It is estimated by weighing maternity pads used during labour to calculate the increase in weight of maternity pads due to absorption of blood lost during labour. The total weight gain in grams is considered as 'blood loss volume' and reported in millilitres without any formal conversion of units of weight into volume for the ease of conversion, and to avoid complexities around inter- and intra-subject variability in blood density across women.

STUDY SETTINGS

The study was undertaken in maternity units at primary health centres (PHCs) and independent midwifery clinics (IMPs), located in the West Nusa Tenggara, West Java, and Riau provinces of Indonesia. In preparation for the training and implementation, all maternity units were equipped with a digital scale with a built-in tray (model PS2000 with a weighing capacity of 3000 g with an accuracy of ±0.1 g).

PARTICIPANT RECRUITMENT

All midwives who worked in the selected maternity units were invited to take part in the study. To be eligible to take part in the study, the participants should be qualified with a minimum of Diploma 3 in midwifery (i.e., the qualification required to practise midwifery in Indonesia) and showing willingness to participate in the study and implement the GM in their clinical practice.

MEASURES

The pre/post-tests were developed in three phases, (i) identification of components from the literature, (ii) item generation, and (iii) content validity. It was a 5-item multiple-choice knowledge test with scores of 1 for correct and 0 for incorrect answers. Test topics covered postpartum haemorrhage diagnosis, gravimetric method implementation, blood loss volume calculations, and starting and ending assessment times. Furthermore, the midwives' experiences questionnaire (MEQ) was adapted from Smith's customer satisfaction survey questions and adopted to fit the research context and content.[28] A reverse translation (i.e., translating English into Indonesian and then back into English) was performed on both questionnaires to ensure accuracy.

INTERVENTION

This training was held in collaboration with the Indonesian Midwives Association (IBI), Branch of Indragiri Hilir District. During the training course development, the researchers consulted extensively with the IBI (its Regional Executive Board for Riau Province and its Branch Executive Board for Indragiri Hilir District), the heads of health facilities, midwives' coordinators, and midwives' practitioners. The curriculum development also followed the guidelines and regulations for the training and development of healthcare professionals as a basis for its formulation. Furthermore, the training was registered and accredited by the Regional Executive Board of the IBI in Riau Province to ensure its credibility.

A three-hour training covered an overview of maternal mortality and PPH and the GM to measure blood loss, discussion, and demonstration. The training materials included PowerPoint slide notes, standard operating procedures of the GM, and video tutorials. Participants were asked to complete the pre-test and post-test via the link sent to Zoom's chat box before and after the training. Some participants with interrupted internet access completed the post-test using another phone's mobile data connection.

The participants were trained together. Some participants accessed the training from their workplace whereas some attended from home. During the training, the head of health facilities assigned some midwives who worked in antenatal and postpartum wards to take over maternity unit duties temporarily so that participants could focus on the training. At the end of the training, a representative midwife from each health facility was asked to practically demonstrate the GM by weighing the maternity pads and calculating the weight difference. The participants were then asked to implement the GM in their workplace for a month. The experience of implementing the GM was explored using the MEQ.

STATISTICAL ANALYSIS

Data were analysed using a IBM Statistical Package for Social Sciences (SPSS) for Windows, version 19.0.[29] Participants' demographic details and experiences in applying the GM were analysed using descriptive statistics. The normality of the difference scores of interval data (n = 232) were assessed by Kolmogorov-Smirnova test, and Wilcoxon's matched pairs Signed Ranks test then compared the midwives' understanding of the GM before and after attending the training (for non-normally distributed outcomes and rank measures).

ETHICS AND TRAINING ACCREDITATION

Ethical approval was obtained from University of Huddersfield, United Kingdom (SREIC Ref: SREIC/2020/093) and the EHSC (Ethics of Health Study Committee, the Medicine Faculty of Universitas Padjadjaran, Indonesia, No. 1184/UN6.KEP/EC/2020). This training was also accredited and awarded 3 CPD points (Registration No. 104/PDIBI.RIAU/SKP/IX/2020) from the Regional Executive Board of the Indonesian Midwives Association (IBI) in Riau Province.

RESULTS

A total of 285 midwives from 17 health facilities (i.e., 13 primary health centres (PHCs) and four independent midwifery clinics (IMPs) were recruited to the study. Different numbers of midwives from each health facility participated, depending on how many worked in maternity units. Two hundred and thirty two of the 234 participants who attended the training completed a knowledge test before and after the training. Further, midwives from one PHC could not attend the training, and four other PHCs dropped out during the implementation period due to the COVID-19 pandemic. Finally, 101 participants from 12 health facilities completed the training, implemented the gravimetric methods in midwifery practice and completed the MEQ (Figure 1).

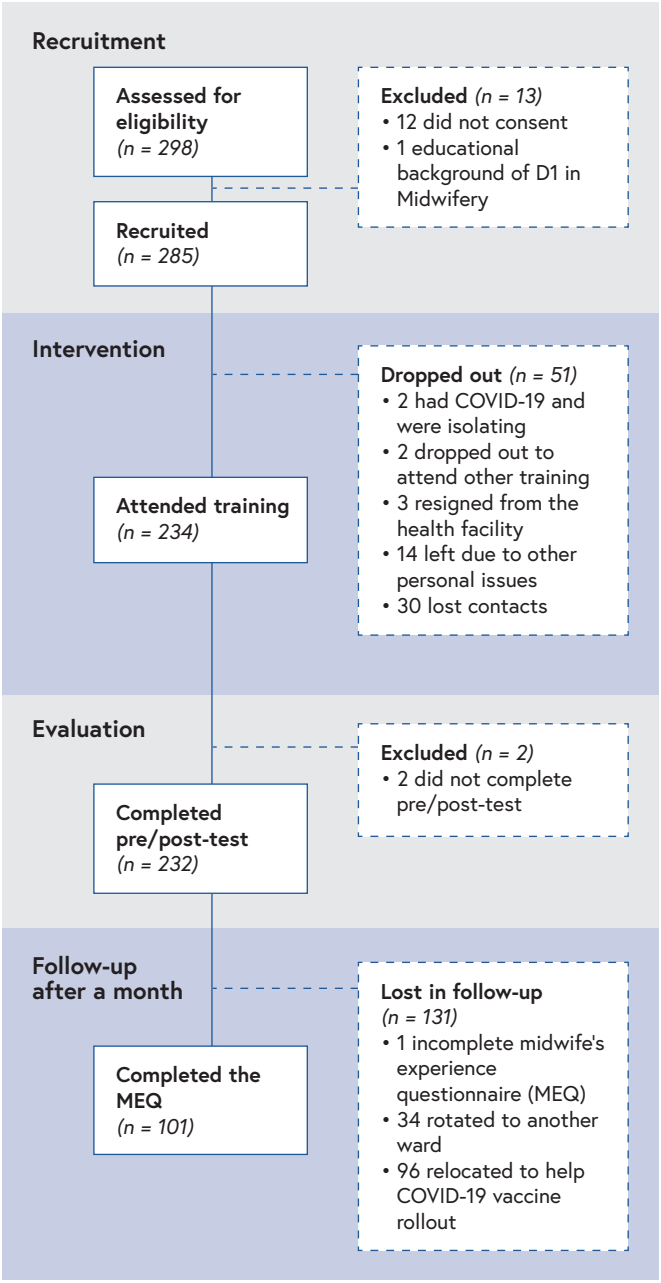

FIGURE 1: PARTICIPANT RECRUITMENT FLOWCHART

TRAINING ON GRAVIMETRIC METHOD

Pre/post-test

The mean age of participants at the recruitment was 31.87 (SD 7.75) years. Nearly 20% of participants had higher than Diploma 3 in midwifery and most had no prior knowledge of the GM (73.3%), as described in Table 1.

TABLE 1: PARTICIPANTS' CHARACTERISTICS (N = 232)

	n (%)
Age	
20-30 years old	120 (51.7)
31-40 years old	73 (31.5)
41-50 years old	31 (13.4)
+51 years old	8 (3.4)
Education	
Diploma 3 of Midwifery	185 (79.7)
Diploma 4 of Midwifery	44 (19.0)
Bachelor of Midwifery	1 (0.4)
Master of Midwifery	2 (0.9)
Having prior knowledge of the GM	
No	170 (73.3)
Yes	62 (26.7)
Source of prior knowledge	
Friends or relatives	14 (6.0)
Internet	16 (6.9)
Midwifery school	15 (6.5)
Midwifery training	9 (3.9)
Research articles	8 (3.4)

The distribution of the difference scores was not normal, as revealed by the Kolmogorov-Smirnov test results; therefore, the comparison between midwives' understanding of the GM before and after attending the training was analysed using Wilcoxon's matched pairs Signed Ranks test. The average score of participants' overall understanding of the GM significantly increased by 77% (3.73 to 4.50) ($Z=-8.2$, $p<0.001$) after joining the training.

Training experience

Interactive training via Zoom was offered on two occasions; those who missed the first session could attend the second one. During the training, participants also watched the GM video, followed by a practical demonstration of weighing pads by a representative midwife from the respective health facility. Before and after demonstration, participants were encouraged to ask questions. All training activities went according to the plan. However, some participants had interrupted access to the internet; consequently, the facilitator re-explained the missing information during question and answering sessions. Moreover, the video recorded training was also made available to affected participants. It also allowed them to watch the training at their own pace and convenience.

IMPLEMENTATION OF THE GRAVIMETRIC METHOD

All participants who successfully completed the training and implemented the gravimetric method (GM) in their workplace for one month were invited to complete the MEQ. All participants (n=101) who implemented the GM completed the MEQ. The experience of implementing the GM were analysed using content analysis.[30]

None of the participants had previous experience with the GM of measuring postpartum blood loss (Table 2). The COVID-19 pandemic significantly affected the number of women who gave birth in primary health facilities. Most women were referred to hospital due to COVID-19-related symptoms. This resulted in reduced opportunities for midwives to use the GM. As a result, most participants (89.1%) only performed the GM one to three times during the one-month implementation period. Overall, 86% of participants were generally satisfied with using the GM and, 90.3% felt that the GM was extremely or very helpful in diagnosing PPH. Almost 90% said that they would be between likely and extremely likely to recommend this method to colleagues. However, even though there was general satisfaction with implementing the GM, only 14% of participants stated that they had no difficulties implementing the GM, but these barriers were generally considered to be minor (Table 2).

The specific barriers were explored using an open-ended question. Responses were then categorised based on similar answers and counted for frequency. Many of the participants stated that the GM was beneficial in diagnosing PPH. A list of problems faced by midwives during implementation is summarised in Table 3. Over a third of participants who had only performed the GM once found it was not easy to implement, mainly due to their unfamiliarity with the technique. Further, half of the participants who worked alone while performing the GM felt it was time consuming as they were already busy in providing intrapartum care and weighing the maternity pad and calculating weight difference added to their workloads. The blood loss assessment was initially started from the second stage of labour or immediately after amniotomy procedures (if any), as Bell et al. (2020) suggested,[31] and ended two hours after placental delivery. However, after initial implementation and discussion the assessment was restricted to the postnatal period only (i.e., immediately following the birth of the baby) this improved the accuracy and ease of implementation.

We also provided space for open-ended text comments on the MEQ to identify further recommendations from the participants. Sixty participants made recommendations to improve midwives' experiences in using GM in their routine practice. The recommendations were analysed using content analysis.

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TABLE 2: MIDWIVES' EXPERIENCE IN IMPLEMENTING THE GRAVIMETRIC METHOD (N = 101)

Questions	n	%
1. Have you implemented the GM in assessing primary PP blood loss in practice?		
Yes	101	100
No	0	0.0
2. Previously, what is the method that you have been used to assess PP blood loss?		
None	72	71.3
Physiological parameters (blood pressure and pulse)	1	1.0
Visual method	21	20.8
Collecting blood into a kidney dish tray	5	5.0
Gravimetric method	0	0.0
Combination of visual method and physiological parameters	2	2.0
3. How many birth(s) assisted by you have used the gravimetric method?		
1-3 birth(s)	90	89.1
4-6 births	8	7.9
7-9 births	2	2.0
+10 births	1	1.0
4. Do you think this method helps you in diagnosing primary PPH?		
Extremely helpful	30	29.7
Very helpful	61	60.4
Somewhat helpful	9	8.9
Not so helpful	1	1.0
Not at all helpful	0	0.0
5. Based on your experiences, what are the benefits of the gravimetric method?		
Easy to be implemented		
Yes	72	71.3
No	29	28.7
Quick or less time-consuming		
Yes	49	48.5
No	52	51.5
Accurate		
Yes	52	51.5
No	49	48.5
6. Are you having problems implementing this method?[a]		
Not at all	14	13.9
A little (in the beginning)	41	40.6
A little	40	39.6
A medium amount	6	5.9
A great deal	0	0.0
7. Overall, how satisfied or dissatisfied are you with using this method in practice?		
Very satisfied	46	45.5
Somewhat satisfied	41	40.6
Neither satisfied nor dissatisfied	12	11.9
Somewhat dissatisfied	2	2.0
Very dissatisfied	0	0.0
8. How likely is it that you would recommend this method to your colleagues?		

	Not at all likely										Extremely likely
Scale	0	1	2	3	4	5	6	7	8	9	10
f	0	0	0	0	2	7	2	23	31	22	14
%	0.0	0.0	0.0	0.0	2.0	6.9	2.0	22.8	30.7	21.8	13.9

[a] Further finding regarding the problems faced by the midwives can be seen in Table 3.

TABLE 3: CHALLENGES FACED BY MIDWIVES DURING THE GM'S IMPLEMENTATION (N = 87)

SHORTCOMINGSa	N	%
If blood mixed with urine or amniotic fluids, the result will be unreliable.	23	26.4
It took longer to weigh all the maternity pads because it was a new method.	34	39.1
It took longer to weigh because the size of the scale and the second tray was imbalance.	20	23.0
It took longer to calculate the weight difference.	4	4.6
The accuracy of the results depends on the accuracy of the scale and the procedures applied.	4	4.6
Sometimes forgot to weigh the maternity pads because it was a new method.	3	3.4
It needed more underpads or maternity pads	2	2.3
There was no time to weigh the maternity pads if the midwife was alone, there were many patients to look after, or in emergency case.	12	13.8
There was no time to weigh dry delivery pad if the pregnant woman came with a full cervix dilatation (10 cm)	5	5.7

[a] Some participants reported more than one problem.

The size and number of digital scales

The built-in tray's size from the scale was too small and did not fully contain the maternity pads; therefore, the default tray was replaced with a larger sized tray. Twenty-two participants perceived that the size of the digital scale and the additional tray provided caused difficulties as they felt it made it difficult to weigh and read the scale simultaneously. They further recommended a larger scale with a built-in tray.

> "*My suggestion is that the scales should be bigger with a built-in tray, so we could use it directly without adjusting the additional tray. The existing scale is too small, and the extra tray is too big, so it took time to adjust it.*" (P1)

Moreover, due to limited resources, we could only provide one digital scale to each health facility. One participant recommended that the number of digital scales available in the facility should be based on average number of patients visiting the health facilities. In an ideal world, if resources were not an issue in a particular health facility, a dedicated scale per labour bed would make it more convenient for the midwives.

> "*Please provide more scales because, sometimes, we have many patients to look after at the same time.*" (P20)

Broader training dissemination

Twenty-one participants felt that this method was objective and valuable to support PPH diagnosis and felt that it should be widely disseminated to other midwives across the country.

> "*This method is more accessible to implement than the visual method, so it is recommended to train more midwives (not only midwives in public health centres, independent midwifery practices, and midwives in hospitals in Indonesia but also in other countries).*" (P26)

Contamination by other fluids

There was concern about the accuracy of the measurement due to the contamination with other fluids (urine and amniotic fluid specifically)

> "*In some cases, patients urinated during labour. As a result, the blood was not only contaminated by amniotic fluid but also with urine. What is the solution for this case? Please provide a solution in this case so that we could assess blood loss accurately*". (P63)

Additional tool and assessment frequency

Participants had difficulties calculating the weight difference manually; therefore, they used a calculator on their smartphones to calculate the weight difference. Three participants felt that a smartphone application that could record the result in each stage and calculate the final weight difference.

> "*…, it would be great if there is a specific application (smartphone) to help us in recording and calculating the weight difference. Otherwise, it would be complicated and may lead to a miscalculation*". (P33)

Peer support

Four participants recommended supporting staff to assist the midwife to help weigh the maternity pad and calculating the weight difference to allow the midwife to focus on providing care.

> "*The application of this method was easy if a peer or student midwife could help us to do it. However, it was hard to look after [by] ourselves because we have to write the results immediately after weighing. Otherwise, we would miss it. It was not straightforward as we were wearing gloves, especially when there was a referral case (such as an emergency situation*)". (P60)

DISCUSSION

Postpartum haemorrhage is a preventable cause of death and yet women continue to die from it.[32] Prior research indicated that many Indonesian midwives did not routinely assess blood loss volume during labour.[10] Blood loss assessment (BLA) plays a crucial role in diagnosing PPH. Clinicians may be able to offer interventions in time if PPH was diagnosed promptly and accurately.[9,10] Delays in recognising PPH may result in inadequate treatment, a major cause of maternal mortality during labour.[33]

According to many studies, PPH is more likely to cause maternal death in rural areas than in urban areas.[34,35] One of the factors contributing to the delays in appropriately managing PPH in low-resource settings was the lack of equipment, supplies, and support.[36] The gravimetric method could help in the timely diagnosis of PPH, a key factor to ensure appropriate management. Lilley et al. (2015) suggested that, during a simulated exercise, the gravimetric method was found to be easy to teach and implement, required simple equipment, and could be applied at all levels of healthcare.[9]

The participants experienced difficulties in weighing and reading balances due to the smaller sized scale and the bigger sized additional tray. Replacement of the previous scale with a new larger scale with a proportionate built-in tray with a maximum capacity of 5000±1g resolved the issue. A further challenge for midwives was the limited availability of scales; due to limited resources, each health facility received only one digital scale. It was recommended that the average number of concurrent births and midwives per shift should be considered to determine the number of digital scales needed in each health facility.

Furthermore, using a calculator on a smartphone to calculate the difference in weight was impractical, especially when the midwives were wearing gloves contaminated with amniotic fluid and blood. This issue has been addressed by using a real large calculator placed near the digital scale or taped to the wall. The calculator could easily be used, cleaned, and disinfected after being used.

Further, some participants reported that urine or amniotic fluid contaminated blood during some deliveries, making the PPH assessment potentially unreliable. A similar finding was reported in previous studies.[31,37,38] For women who had episiotomies, gauze and swabs that were used to hold the wound and absorb the blood before the baby's birth had to be weighed in addition to the maternity pads.

The participants felt that the gravimetric method would prove helpful to most participants in diagnosing primary PPH. The results from Bell et al. (2020) also support this finding, high diagnostic rates of PPH were reported using this method.[31] GM has been applied in many clinical settings, including intraoperative,[23,39] and vaginal delivery.[25] Despite the benefits of GM, some midwives in busy clinics found it

increased their workload and posed a challenge in emergency obstetric cases. Therefore, they recommended additional supporting staff (e.g., a midwife peer or a student midwife) to help with the blood loss assessment in the labour ward.

The strengths of the study were that it was conducted in two different levels of health facilities across three provinces in Indonesia and included a month-long follow-up to capture the midwives' experience and reflections. The study, therefore, provided an accurate picture of the benefits and weaknesses of the implementation of the GM in midwifery clinical practice to help measure postpartum blood loss.

However, the study had a number of limitations. It was conducted in the backdrop of COVID-19 pandemic and significantly affected the training process and continuing participation. The online training module was implemented successfully and proved to be an effective alternative in settings like COVID-19 pandemic where a conventional face to face program was not possible. An increase of COVID-19 cases nationally led to the closure of several wards within health facilities in Indonesia during the study and consequently resulted in extensive ward rotations that resulted in study participant withdrawals. Most health workers were also relocated to help COVID-19 national vaccine rollout and hence withdrew from this study (Figure 1). The increase in workload amid the pandemic also created additional pressures and limited opportunity to apply the GM in everyday practice. Shoja et al. also reported that the COVID-19 pandemic increased the health professionals' workload and put more stressors, physical and time pressures, and frustration.[40] Nonetheless, the online methodology and use of technology provided an opportunity to continue research in this challenging context and this method of training was well suited. It also offered the flexibility to complete the recorded material at their own pace and convenience in contrast to the conventional approach where there may have been an expectation to attend full training in-person, demanding greater resources.

Moreover, currently, there is no validated questionnaire to assess midwives' experience in implementing the GM. Hence, we developed the MEQ by referring to the customer satisfaction survey questions proposed by Smith.[28]

CONCLUSION

We conclude that a three-hour training effectively improved midwives' understanding of the GM. Following one month implementation, midwives felt competent in assessing the BLV using GM during labour. The study also identified useful adaptations to improve the GM implementation in routine practice.

Stakeholders need to consider equipping maternity units with adequate equipment and human resource to support the implementation of the GM (e.g., calculators and digital scales with adequate specifications and amounts, and midwife buddies). A midwives' peer group is beneficial not only for applying GM but also for easing midwives' workload when handling emergency situations.

Participants believed GM may result in early detection of the PPH and therefore enable health professionals to manage PPH more effectively. We, therefore, recommend policy makers adopt GM procedures as part of normal intrapartum care in low-resource settings. The long-term impact of GM on reducing postpartum haemorrhage still remains to be evaluated in future studies.

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