Risk identification for early warning of bleeding among mothers during childbirth

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ABSTRACT

The study was conducted using the observational method. It assessed blood loss using a calibrated measuring cup every 15 minutes in the first hour after delivery and every 30 minutes for the next hour. The results of the analysis showed that the modelling of early warning identification in laboring mothers is influenced by the age and weight of the mother, which is at a significance of 10%. A major warning sign is an increase in blood pressure rate in the third stage of labor which begins 15 minutes from the start of bleeding, and is categorized as dangerous when the blood volume reaches 600 mL. Therefore, every mother in labor must be monitored regularly and continuously and early warning signs must be taken into account. There is no safe time in cases of blood loss. It is very important to identify the risks in a timely manner to identify the source of bleeding so that it can be handled quickly and appropriately in order to prevent complications and maternal death due to postpartum haemorrhage (PPH). Implication, effective and optimal identification in clinical practice should be evidence-based in order to better determine whether or not intervention is needed to prevent blood loss after childbirth.

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1. INTRODUCTION

During *labor*, a mother is at a higher-than-normal risk for blood loss, especially during the third stage of *labor* [1], which is a major cause of maternal death [2], [3]. More than two thirds of maternal deaths are caused by postpartum haemorrhage (PPH) that occurs within two hours of delivery [4], [5]. The threshold of bleeding as indicator for PPH is ≥500 ml blood loss within 24 hours of a vaginal birth [6], The threshold is said to be the causes of PPH vary widely. Of the current recorded cases of PPH, the most common causes are uterine atony, which accounts for 70% [7] and ≥80% [8], and failure of the uterus to contract [9], including retained placenta, perineal rupture and coagulopathy [7]. Although most cases of bleeding during *labor* are normal, some turn out to be abnormal [10], [11]. This is usually exacerbated by more than one risk factor [12]. The risks of uterine atony include obesity, multiple pregnancies, advanced age, primipara, anaemia, and a history of PPH. Risk factors associated with the delivery process include vaginal, caesarean, and vaginal deliveries, induction, prolonged *labor*, uterotonic deliveries and large babies/macrosomia [13]. Nearly 20% of PPH cases have no risk factors [14], yet midwives must always be alert. As a general rule, all women who are about to give birth should be considered at risk [15], [16].

In addition, one of the major contributing factors in aggravating PPH is the delay in recognizing the signs and effects of PPH [17]. Delay in early detection can trigger severe bleeding that occurs very quickly and carries with it the risk of causing complications [18], infection [19], hypovolemic shock [20], thus the early detection is needed to find the source of bleeding rapidly [21]. Early identification of bleeding will help midwives to intervene and treat bleeding quickly and appropriately, thus reducing the risk by up to 35% [22], preventing death from bleeding by around 67% to 85% [23], as well as to improve the woman satisfaction and safety [24]. However, the facts in the field indicate that early detection is still not optimally carried out, including the services provided are still poor and the information obtained is very limited [23]. Early detection must be carried out immediately on every woman who goes into *labor*, and observations must also be made throughout the delivery process in order to detect any early warning signs [12]. In addition, the monitoring must be carried out strictly and continuously [25].

According to some studies there is no safe time for the mother, so it is necessary to pay close attention at all stages in the delivery process. If the uterus is not contracting and feels flabby then this may be a sign of uterine atony [12]. A retained placenta is considered to have occurred if the placenta has not been delivered within 30 minutes after the baby is born [26]. Another sign is that the uterus is well contracted, bleeding is immediate, or due to excessive traction the umbilical cord breaks which prompts management of bleeding [15], [27]. Furthermore, if the uterus contracts but the height of the uterine fundus does not decrease and part of the placental membrane is incomplete, then bleeding may occur immediately and part of the placenta will be left behind [1]. Consequently, a manual placenta removal should be performed immediately [28]. To avoid tearing the birth canal, the perineum must be protected manually [29] accompanied by supervision, and interventions should be more stringent [30].

Based on various references there is no uniformity in the definition of severe PPH. If the blood loss is more than 1,500 mL to 2,500 mL, the maternal haemoglobin (Hb) level has decreased to 4 g/dL or more, or the mother requires a blood transfusion of at least four bags or more, then the mother should be immediately prepared for surgery [31]. The severity of the bleeding can be estimated by the amount of blood loss, for example more than 50% in the first two hours after delivery [32]. Inaccuracies when measuring blood loss can also lead to maternal death [33].

In daily clinical practice the method for measuring blood loss is still done traditionally, namely by visual estimation [22]. This method is ineffective, has limitations, is typically not permitted in treatment [34]–[36], and is unreliable [37]. Although many measurement methods have been found, none of them are optimal or practical [38]. One of the newest is the early warning systems (EWS) method. This method may be very helpful and can be applied in clinical practice, especially during delivery. Early warning systems when used as a screening tool can predict abnormal cases and is very practical. Because it is carried out directly on the mother, this method can monitor on an ongoing basis, thus reducing complications and the risk of maternal death. This system regularly monitors the mother's vital signs such as blood pressure, temperature, pulse and respiratory rate [6], [39], [40].

Although easy to do, the EWS method is only able to observe maternal vital sign parameters. The lack of references to measuring blood loss in a measurable and objective manner makes precise and accurate blood loss measurements still not possible. Given that bleeding often occurs unexpectedly, it is very important to assess blood loss in a measurable and objective manner. An important step to prevent PPH is to improve the skills of midwives in measuring the amount of blood loss and postpartum blood flow rate [30], so that the results are better [41] and have a high commitment to prevent pain [42].

Information regarding scientific evidence related to measuring the rate of blood loss two hours after delivery is very limited. Based on the literature search and clinical practice observations conducted by the author, there were no articles that measured blood loss every 15 minutes in the first hour and 30 minutes in the next hour. Therefore, it is very important to know the triggers and timing of the occurrence of PPH, considering that bleeding cases often occur at this time. Accuracy in measuring the volume of blood loss should be of the utmost importance, and therefore early identification in an effective and measurable manner should be carried out in every vaginal delivery without exception. This study aims to analyse the identification of early warnings against bleeding in women during *labor* by measuring the rate of blood loss with an estimate in a fast time span and mL/minute volume.

2. RESEARCH METHOD

This was an observational study with cross sectional design. Measurement of variables was only done by observing for a moment or within a certain period. The data analysis technique used in this study was ordinal logistic regression to model the incidence of bleeding in women giving birth. Logistic regression is a statistical analysis method that can be used to see the correlation between the independent variable and the dependent variable on a categorical scale [43]. The dependent variable in this study was the case of bleeding in pregnant women, and the independent variables included maternal age, maternal weight, infant weight, haemoglobin and parity as the child's birth order. Details of research variables are described in Table 1.

Table 1. Operational research variables

Variable	Description	Data scale	Category
Y	Bleeding case	Category	≤ 300 mL 301–500 mL 501–700 mL ≥700 mL
X1	Bleeding case	Nominal	
X2	Mother's age category	Nominal	
X3	Mother's weight	Nominal	
X4	Baby weight	Nominal	
X5	Hemoglobin	Category	-Primipara -Multiparity

The first stage was the process of identifying the rate of blood loss in mothers giving birth. The sample taken at this early stage consisted of 40 respondents who were patients who gave birth at *Klinik Bidan Praktek Mandiri Jawiriah* in Banda Aceh. This research was assisted by enumerators, namely three midwives. The sample of the study was all maternity women who came to the midwife's practice with criteria for pre-delivery, vaginal delivery, and were willing to be respondents. The tools used were plastic measuring cups that had been calibrated, basins, buckets, plastic bags for wet and dry waste, silverware, handscoon, a set of Hb tools and stationery. During the delivery process, monitoring of the mother was focused on observing blood loss in the first two hours after the baby was born. Blood measurements were made with a calibrated measuring cup. The measured blood was waste blood after the baby was born because it did not mix with amniotic fluid, urine and faeces. Measurements were made within the first hour postpartum where every 15 minutes the blood count was recorded. Then the next hour every 30 minutes the blood count was recorded. Other sample characteristics were maternal age at delivery, body weight (kg), haemoglobin level (g), new-born weight (g), and parity. Each pre-delivery mother and the companion were given an explanation and asked for their informed consent. After that, they filled in the biodata forms. The mother who entered the first stage of labor had her Hb checked and recorded.

3. RESULTS AND DISCUSSION

This study analysed the identification of early warnings for bleeding during *labor* with the parameters of the volume of blood loss in postpartum mothers. The rate of blood loss during *labor* was divided into four categories, namely normal (<400 mL), cautious (<500 mL), special (<600 mL), and dangerous (≥600 mL). Blood loss was recorded within 8x15 minutes or the first two hours postpartum (every 15 minutes in the first hour and every 30 minutes in the next hour). In “normal” cases the changes in blood loss began with a small number and continue to decrease to 1 mL/min. In “cautious’ and “special” conditions, from the first observation to a follow-up observation of 1 mL/min as shown in Figure 1, the flow rate was also significantly reduced. this could be an important indicator for the midwife, to avoid the post partum bleeding. Figure 1 shows that a “danger” case is characterized by a constant blood flow rate during the initial 4 observations, i.e., observations 5 to 8. The blood flow rate ranges from 10-13 mL/min. If this condition continues, it will be very risky. According to previous studies, if there is an increase in severe bleeding, the flow rate will exceed 700 mL/minute [44]. When the blood rate in the first 15 minutes increases and in the fourth 15 minutes also increases, it might trigger the placenta not to be born spontaneously which considered as a risk condition and might also be suspected of retained placenta with uterine atony. This finding is in line with previous studies that stated the risk of bleeding is related to time. If it exceeds 15-29 minutes then manual removal of the placenta should be performed [22], [45]. In fact, bleeding generally occurs suddenly, usually due to risk factors that are often unknown. Most PPH is complicated by several factors, one of which is signs and symptoms that are recognized too late [18].

Various studies state that the definition of PPH varies, but this study defines PPH based on the agreement of practitioners and experts, i.e., blood loss of 500 mL or more in vaginal delivery that occurs in the first 24 hours postpartum [3], [9]. According to a recent study based on an updated nomenclature, PPH is a cumulative blood loss of 1,000 mL or blood loss accompanied by signs and symptoms of hypovolemia which occurs within 24 hours of delivery [2]. Therefore, direct, measurable, and objective measurements are urgently needed to identify and prevent blood loss optimally [46]. The results of the Wald parameter test in the Table 2 show that maternal age and maternal weight are variables that have a significant influence on bleeding during the delivery process.

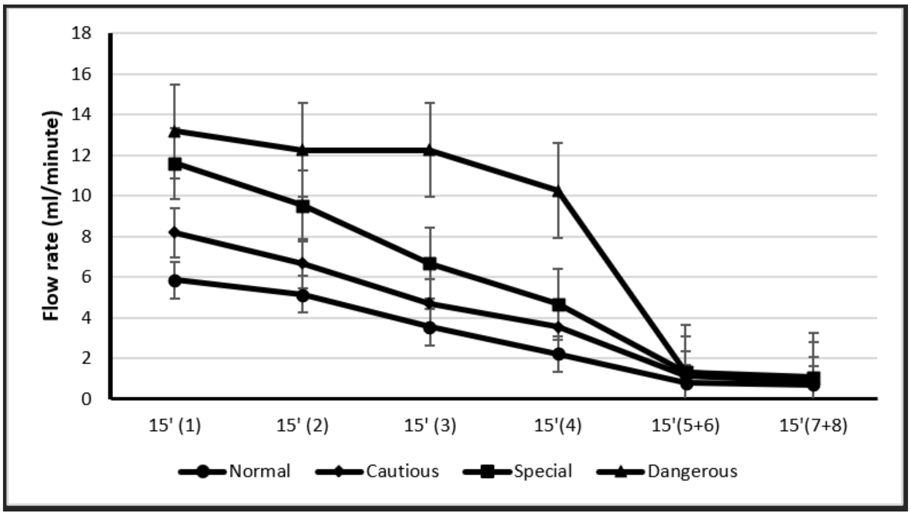

Figure 1. Blood pressure rate by cluster

Table 2. Wald test results

		Estimate	Wald	Sig.	99% confidence interval Lower bound	Upper bound
Threshold	[Amount of Blood = 1]	29.090	5.262	.022	-3.575	61.754
	[Amount of Blood = 2]	42.776	8.016	.005	3.858	81.694
	[Amount of Blood = 3]	51.055	8.621	.003	6.265	95.845
Location	Age	6.255	3.872	.049	-1.933	14.443
	Mother's weight	3.270	3.450	.063	-1.265	7.804
	Baby's weight	.339	.001	.971	-23.869	24.548
	HB	1.277	.155	.694	-7.082	9.636
	[Child=1]	1.120	.111	.739	-7.554	9.794
	[Child=2]	0a	.	.	.	.

The goodness of fit test is shown in Table 3. It was conducted to see if the ordinal logistic regression model obtained was feasible to use. The following are the results of the model goodness test using the Deviance method test:

Table 3. Goodness of fit

	Chi-square	Df	Sig.
Pearson	2.225	37	1.000
Deviance	4.166	37	1.000

The tested hypotheses are H_0: the logit model is feasible to use, and H_1: the logit model is not feasible to use. It is known that the Chi-square value of Deviance method is 4.166 and 37 degrees of freedom. The test criteria are H_0 is rejected if $D > X^2_{(0.1;37)} = 48.36$ or the significant value is less than 0.1 (α=0.1) Value deviance test in the table shows a significance value of 1.00. The conclusion is that H_0 is accepted because the significance value is greater than 0.1. In other words, the logit model obtained is feasible to use. The model significance test was carried out by comparing the models without predictor variables as shown in Table 4.

Table 4. Model fitting information

Model	-2 Log likelihood	Chi-square	df	SSig.
Intercept only	102.690			
Final	.000	102.690	5	.000

The hypotheses to be tested are H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5$, and H_1: there is at least one $\beta_p \neq 0$. It is known that the final value of -2 ln likelihood model B (without predictor variables) is 102.69 and the final value of -2 ln likelihood model A (with predictor variables) is 0.000. Based on this data, it is known that the G statistic value is 102.690. The test criteria were taken using α = 0.05 from the distribution table $X^2_{(0.05;5)} = 9.24$. Because the value of G > $X^2_{(0.1;5)} = 9.24$, then H_0 is rejected. In conclusion, there is $\beta_p \neq 0$. The value of the coefficient of determination in the logistic regression model is shown by the value of Mc Fadden, Cox and Snell, Nagelkerke R Square. The table of determination can be seen Table 5.

Table 5. Pseudo R-square

Cox and Snell	.923
Nagelkerke	1.000
McFadden	1.000

Table 5 shows Mc Fadden's coefficient of determination of 1,000, Cox and Snell's coefficient of determination of 0.923 and Nagelkerke's coefficient of determination of 1,000. Cox and Snell's coefficient of 92.3% means that the independent variables of mother's age, mother's weight, baby's weight, haemoglobin and birth order affect maternal bleeding in general by 92.3%, with the remaining 7.7% being influenced by other factors not included in the model testing. This study is in line with the findings of previous studies [47], [48] that a maternal weight gain of 15 kg during pre-delivery significantly increases the risk of PPH and can cause a larger new-born or macrosomia, thereby exacerbating the uterus and causing uterine atony [23], [49]. Another study found that the length of the third stage of *labor* in overweight or obese mothers was associated with an increased risk of PPH. The implications of obesity are foetal hyperinsulinemia and macrosomia [50]. The findings of another study showed that there was no difference between the second stage of *labor* among overweight and normal-weight mothers [2], [51]. This finding is consistent with and is supported by a previous study in which age >35 years/advanced age, multiple pregnancy and a history of CS can significantly increase the incidence of bleeding [52], [53]. However, this study did not find a significant relationship between PPH and maternal weight and age and parity, but the most dominant cases of PPH occurred in primiparity and overweight women [54].

Another risk factor during *labor* is low Hb levels which has the potential to cause the mother to experience PPH. If the actions that have been taken are ineffective, then a hysterectomy needs to be prepared immediately [54]. This finding is in line with previous research which states that mothers who experience anaemia during childbirth are likely to lose significant amounts of blood. According to the WHO, anaemia is classified as mild if the Hb is 10-10.9 g/dL, moderate if the Hb is 7-7.9 g/dL and severe if the Hb is <7 g/dL. There is a correlation between low Hb levels, blood loss, Hb <10 g/dL, and the incidence of PPH and severe anaemia with hysterectomy intervention [55].

4. CONCLUSION

Timely identification of blood loss and ongoing monitoring of stage three labor can help save the mother. Effective and optimal identification in clinical practice should be evidence-based in order to better determine whether or not intervention is needed to prevent blood loss after childbirth.

The strength of this study is that it is the first study to measure the rate of blood loss in a measurable and objective manner in the first two hours postpartum. This was done in order to identify methods to minimize the risk of blood loss. This is a process that requires patience and thoroughness. The limitation is that it took a long time, due to the fact that most of the delivery times occurred at night and dawn. When more than one delivery patient had a case of severe bleeding, not all risk characteristics were studied. Therefore, this study focuses on measuring the rate of blood loss in a measurable and objective manner during labor to prevent delays and reduce the risk of PPH.

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