

Risk Factors for Primary Postpartum Haemorrhage-related Maternal Deaths: Evidence from Maternal Verbal Autopsy in Jember District, Indonesia

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ABSTRACT

Objective: This study aims to identify risk factors associated with maternal mortality from primary postpartum haemorrhage in Jember district Indonesia.

Methods: 40 primary postpartum haemorrhage maternal deaths (cases) and 80 primary postpartum haemorrhage cases (controls) were collected from maternal verbal autopsy forms. The sample included mothers who suffered from primary postpartum haemorrhage in Jember district from January 2017 to December 2019. Logistic regression analysis was administered to determine risk factors for maternal deaths from primary postpartum haemorrhage.

Results: One factor significantly associated with maternal mortality was transfer time to the referral hospital (OR 0.286, 95% CI 0.112-0.746, $p=0.010$). Other factors, including age (OR 0.813, 95% CI 0.358-1.838, $p=0.618$), parity (OR 0.644, 95% CI 0.264-1.570, $p=0.333$), place of birth (OR 0.883, 95% CI 0.511-1.525, $p=0.654$), birth attendant (OR 1.808, 95% CI 0.791-4.135, $p=0.160$) and travel time to primary healthcare facilities (OR 1.416, 95% CI 0.615-3.257, $p=0.413$), were not significantly associated with primary postpartum haemorrhage-related maternal deaths.

Conclusions: Access to referral hospitals must be considered in reducing maternal mortality from primary postpartum haemorrhage. Ensuring mothers with primary postpartum haemorrhage reach referral hospitals immediately may facilitate prompt and advanced obstetric care.

Keywords: Maternal mortality, postpartum haemorrhage, risk factor, case-control study, lower-middle income country

INTRODUCTION

Maternal mortality remains a global concern and addressing it has been a challenge in developing countries, despite most of its causes being preventable. Maternal mortality refers to obstetrics complications-related deaths occurring between pregnancy and postpartum period¹. Postpartum haemorrhage contributes to 8% of maternal mortality in developed countries and more than 20% in developing countries². Postpartum haemorrhage is the amount of blood lost after birth ≥ 500 mL from the genital tract after vaginal delivery and ≥ 1000 mL for caesarean delivery³. Postpartum haemorrhage maternal deaths are often caused by the three delays, including delay in decision making to be referred to health care facilities, delay in arrival at the referral health facilities, and delay in getting the proper treatment⁴.

Despite the high rate of institutional birth and delivery assisted by skilled health providers, Indonesia continues to have a high Maternal Mortality Ratio (MMR), which constituted 305 deaths per 100,000 live births⁵. This ratio is one of the highest in Southeast Asia and still below the target set by the Sustainable Development Goal 3^{6,7}. The main complications leading to maternal deaths in Indonesia in the last two years have remained haemorrhage, followed by gestational hypertension and blood circulation problems^{8,9}. A study in Eastern Indonesia reported that the maternal deaths were due to delays in the decision to seek care and delays in reaching care¹⁰.

East Java is a province in Indonesia with 40.67 million population across 29 districts and nine municipalities¹¹. In 2019, the MMR in East

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Java was 89.81 per 100,000 live births¹². For more than five years, one of the highest MMR has been in Jember district, caused by postpartum haemorrhage, preeclampsia, and infections during the postpartum period¹³.

Positive maternal outcomes with postpartum haemorrhage are influenced by the availability of institutional birth, assistance of a professional birth attendant, and a good referral system¹⁴. In 2019, although the coverage of institutional birth was high (93.6%), Jember district has not reached the target¹⁵. Delivery assisted by professional birth personnel can reduce the risk of postpartum haemorrhage because skilled birth attendants have the capability to prevent postpartum haemorrhage by carrying out active management of the third stage according to standards¹⁶. A study reported that postpartum haemorrhage after deliveries with traditional birth attendants, including at home, contributes to the increase in morbidity and mortality because traditional birth attendants are not trained in postpartum haemorrhage management, as well as the mothers tend to experience delay in arrival at the referral health facilities¹⁷. Delivery with the right standard can reduce the incidence of complications due to postpartum haemorrhage¹⁸.

MATERIALS AND METHODS

Objective: The aim of this study is to identify risk factors associated with maternal mortality from primary postpartum haemorrhage (PPH) in Jember district, Indonesia. This study assessed the association between age, parity, place of birth, birth attendant, travel time to the primary health facility, transfer time to referral hospitals and maternal mortality.

Study Design: This research is a case-control study.

Study Setting: East Java, a province located in the eastern part of Java island, comprises 29 districts, 9 municipalities, 662 sub-districts and 8,507 villages. It was inhabited by approximately 40.67 million people¹³. Jember, one district in East Java, is divided into 31 sub-districts, which consist of 248 villages. 50 community health centres (In Indonesian: *Pusat Kesehatan Masyarakat*) and 135 auxiliary health centres (In Indonesian: *Pusat Kesehatan Masyarakat Pembantu*) are available to provide primary care for 2,536,729 people; of which the majority of them were female residents (50.13%)¹⁹.

Of the districts and municipalities, Jember district continues to contribute the highest Maternal Mortality Ratio (MMR) for many years. In 2020, the MMR reached 170 per 100,000 live births although their maternal health indicators are good in general²⁰. The coverage of four antenatal visits and three postnatal visits coverage was high (82% and 92.3% respectively) in 2020. Although the coverage of deliveries assisted by professional birth attendants in 2019 was 93.7%¹², there is still a lack of emergency obstetric assistance, which was 80%²¹. Postpartum haemorrhage is the main leading cause of maternal death in the district²⁰.

Data and Sample: A case-control study of mothers who had haemorrhage amidst the first 24 hours after delivery between January 2017 and December 2019 was conducted in Jember district. Cases (n=40) were mothers who died from PPH, and controls (n=80) were surviving mothers who had PPH, obtained from maternal verbal autopsy reports. A study conducted in one district in Central Java, Indonesia, reported that only 2.5% of forms were completely filled in. Moreover, 69.2% of the forms were completed by midwives, while 30.7% were completed by unidentified staff²³. Therefore, to complement the data, we also identified data from medical records and birth registers in 26 community health centres, where the mothers who died from PPH gave birth. Cases were taken through total sampling, while controls were selected purposively. Mothers with secondary PPH deaths, comorbidities,

or other complications were excluded from the study.

Maternal verbal autopsy reports were obtained from the audits conducted by the Maternal Perinatal Audit team, who retraced the causes of maternal and infant morbidity and mortality to prevent future morbidity and mortality and accelerate the reduction of maternal and infant mortality rates. Maternal audit activities used a measuring instrument, Maternal Verbal Autopsy (VA), which was developed by The Ministry of Health. This VA consists of questions such as age, gender, education, factors that contributed to the maternal death, and medical and non-medical factors^{24,25}.

The use of MVA in Indonesia is regulated in a joint regulation of the Minister of Home Affairs and the Minister of Health number 15 of 2010N 2009, number 162 / MENKES / PB / I / 2010 article number 6²⁶ as follows: 1) Every death that occurs outside a healthcare facility must be investigated for the cause of death' 2) the search for the cause of death as referred to in paragraph (1) shall be carried out using the verbal autopsy method; 3) the verbal autopsy as referred to in paragraph (2) shall be carried out by a doctor; 4) in the absence of a doctor as referred to in paragraph (3), a verbal autopsy may be performed by a trained midwife or nurse; 5) the verbal autopsy as referred to in paragraph (3) or paragraph (4) shall be conducted through interviews with the closest family of the deceased or other parties who are aware of the events of death; and 5) the verbal autopsy as referred to in paragraph (5) is coordinated by the local government health service facility.

In this study, postpartum haemorrhage maternal death was the outcome. The risk factors included age, parity, place of delivery, birth attendant, travel time to primary health facilities, and transfer time to referral hospital. The measurements of the variables are adopted from the maternal verbal autopsy documents. Age included < 20 years old, 20 - 35 years old, and > 35 years old. Parity comprised primipara (women who have given birth once), multipara (women who have given birth two or more times), and grand multipara (women who have given birth five or more times). Place of birth was autonomous midwifery practice, community health centre, hospital, home, and traditional birth attendant's place. Travel time to primary health facilities comprised <15 minutes and ≥ 15 minutes. Transfer time to referral hospital included < 2 hours and ≥ 2 hours.

Data Analysis: Analyses were performed using the SPSS for Windows 25.0. Multivariate logistic regression was conducted for each risk factor. The ratio of cases to controls was 1:2, with a 5% level of significance, a sample of approximately 120 mothers (40 cases and 80 controls) was needed to detect an odds ratio of approximately 0.5 or 1.8.

RESULTS

Table 1 shows that the respondents were 40 cases (mothers who died from postpartum haemorrhage) and 80 controls (mothers who survived from postpartum haemorrhage). Both groups were dominated by mothers aged more than 35 years (60 % in the case group and 53.75% in the control group). The second characteristic is maternal parity. Both cases and controls were dominated by multipara (75% of cases and 66.25% of controls).

Majority of mothers, either in cases or controls, gave birth in community health centres, (27.50%) and (51.20%) respectively. The percentage of deliveries in traditional birth attendant's places (22.50 %) in the case group is equivalent to the percentage of deliveries in the autonomous midwifery practices (22.50 %) and hospitals (22.50 %). Meanwhile, in the control group, the percentage of deliveries in the traditional birth attendant's places was higher (25%) than those



Figure 1. Map of Jember District²²

Table 1. Socio-demographic and risk factors for postpartum haemorrhage deaths in Jember district, Indonesia from January 2017 to December 2019

Risk factor	Cases (N = 40)	Controls (N = 80)	OR (95% CI)	p-value
Age			0.618 (0.358-1.838)	0.618
< 20 years old	0 (0.00%)	5 (6.25%)		
20 - 35 years old	16 (40.00%)	32 (40.00%)		
> 35 years old	24 (60.00%)	43 (53.75%)		
Parity			0.644 (0.264-1.570)	0.333
Primipara	6 (15.00%)	22 (27.50%)		
Multipara	30 (75.00%)	53 (66.25%)		
Grande multipara	4 (10.00%)	5 (6.25%)		
Place of birth			0.883 (0.511-1.525)	0.654
Autonomous midwifery practice	9 (22.50 %)	6 (7.50%)		
Community health centre	11 (27.50%)	41 (51.20%)		
Hospital	9 (22.50%)	7 (8.80%)		
Mother's House	2 (5.00%)	6 (7.50%)		
Traditional birth attendant's place	9 (22.50%)	20 (25.00%)		
Birth attendants			1.808 (0.791-4.135)	0.160
Midwife	21 (52.50%)	37 (46.25%)		
Obstetrician	9 (22.50%)	7 (8.75%)		
Traditional birth attendant	10 (25.00%)	36 (45.00%)		
Travel time to primary health facilities			1.416 (0.615-3.257)	0.413
< 15 minutes	25 (62.50%)	41 (51.20%)		
≥ 15 minutes	15 (37.50%)	39 (48.80%)		
Transfer time to referral hospital			0.289 (0.112-0.746)	0.010
< 2 hours	24 (60.00%)	67 (83.75%)		
≥ 2 hours	16 (40.00%)	13 (16.25%)		

delivered in the autonomous midwifery practices (7.50%) and hospitals (8.80%). Furthermore, it was found that the majority of women either in the case group (52.50%) or the control group (46.25%) were assisted by midwives.

Majority of women took less than 15 minutes to access primary health care facilities from their homes (62.50% in the case group and 51.20% in the control group). In addition, regarding transfer time to referral hospitals in both groups showed that the majority of them took less than 2 hours to be transferred to referral hospitals, of which 60% in the cases group and 83.75% in the control group.

There is an association between transfer time to referral hospital (OR 0.286, 95% CI 0.112-0.746, p=0.010). Mothers with primary postpartum haemorrhage, who are transferred to referral hospitals for more than 2 hours were at greater odds of death as compared to mothers who reached referral hospitals in less than 2 hours. Age (OR 0.813, 95% CI 0.358-1.838, p=0.618), parity (OR 0.644, 95% CI 0.264-1.570, p=0.333), place of birth (OR 0.883, 95% CI 0.511-1.525, p=0.654), birth attendant (OR 1.808, 95% CI 0.791-4.135, p=0.160) and travel time to primary healthcare facilities (OR 1.416, 95% CI 0.615-3.257, p=0.413), have no significant relationship with maternal mortality from primary postpartum haemorrhage.

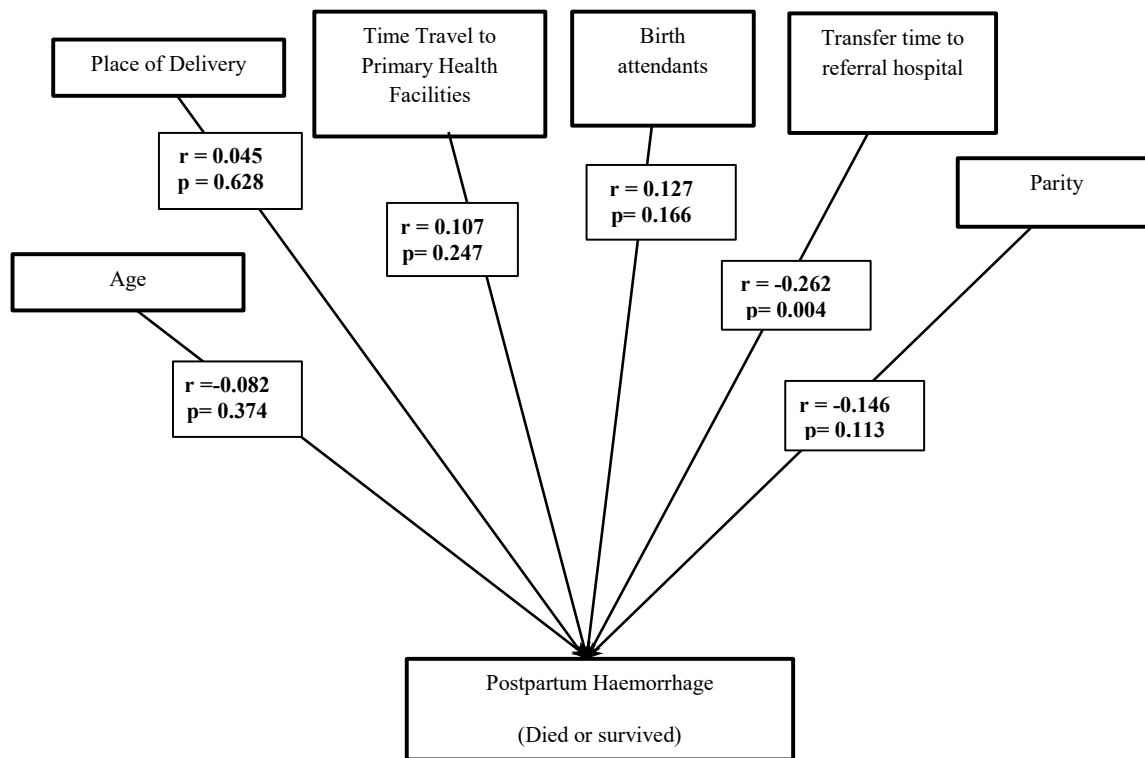


Figure 2. The correlation model of risk factors for preeclampsia maternal death

Figure 1 illustrates that age has an r value of -0.082 and p-value of 0.374 which suggests that age has a weak negative relationship with the incidence of PPH, that is, the older the mothers, the less likely the possibility of having PPH. However, this was not significant. The place of delivery has an r value of 0.045 with a p-value of 0.628. This suggests the place of delivery has a weak positive relationship with the incidence of PPH. Time to travel to primary health facilities has a weak positive correlation with the incidence of PPH. The more the time to reach the primary health facility, the more the incidence of PPH, but this was not significant. The birth attendant has an r value of 0.127 and a p-value of 0.166 which suggest that the availability of birth attendants has a weak positive relationship with the incidence of PPH. Transfer time to referral hospital has an r value of -0.262 and a p-value of 0.004. This suggests a moderate negative relationship between the transfer time to a referral hospital and the incidence of PPH; that is the more the speed to reach the referral hospital, the lesser the incidence of PPH and this was significant. Parity has an r value of -0.146 and p-value of 0.113 which suggests a weak negative relationship between parity and incidence of PPH but was not significant.

DISCUSSION

Our study's results showed no significant relationship between age and maternal death from postpartum haemorrhage. Maternal age of 35 years or older did not significantly increase the risk of postpartum haemorrhage, which is consistent with the results of a meta-analysis that reported no association between risk of postpartum haemorrhage and advanced maternal age²⁷. Advanced maternal age had a more protective effect on the incidence of PPH. A progressive decrease in the OR of 0.84 at the age of 25-29 years of age to 0.59 at the age of >40 years was reported. In other words, women aged 35 years or older had decreased PPH risk because of uterine blood vessel vascularisation as age increases²⁸. Another study found a different result that advanced maternal age was associated with postpartum haemorrhage although there is inconsistency on this subject²⁹. Advanced maternal age was nearly seven times more likely to have experienced postpartum

haemorrhage compared to women in the age group between 20 – 34 years old (AOR = 6.8; 95% CI)²⁹. Therefore, it is important to note that all age groups may have a risk of having postpartum haemorrhage.

As parity increases, a woman's myometrial muscular strength may decrease due to a reduction of collagen fibers³⁰. Therefore, when parity increases, the probability of experiencing PPH increases. The discordancy of parity cut-off values between vaginal delivery and caesarean section indicates that caesarean section might affect the function of collagen fibers³¹. Healthcare workers should be well prepared to deal with women with high parity. Several health professionals should attend vaginal delivery for women with a history of ≥ 7 births. Sufficient blood for transfusion should be prepared before performing caesarean section for the women with a history of ≥ 3 births because more blood loss is expected in comparison to vaginal delivery³¹⁻³⁴. Although some previous research showed the relationship between parity and postpartum haemorrhage^{30,35,36}, in our study the parity did not show a significant relationship with maternal death from postpartum haemorrhage.

The incidence of maternal death was previously reported to be associated with the place of delivery^{37,38}. Health care facilities are the best delivery assistance strategy to avoid the incidence of death due to postpartum haemorrhage because of a clean delivery environment and the availability of treatment and first aid equipment to prevent birth complications, one of which is postpartum haemorrhage¹⁷. However, our study showed no relationship between place of delivery and maternal mortality from postpartum haemorrhage. Many mothers were assisted in health care facilities, but it was not associated with the decrease in MMR³⁹. Another previous study reported that pregnant women who gave birth in health facilities had a much higher risk of dying compared to mothers who gave birth at home⁴⁰. An increase in deliveries in health facilities does not affect maternal mortality from PPH, except for those with good quality of care⁴¹.

Although in our study, birth attendants had no significant relationship with maternal death from postpartum haemorrhage. Many deliveries were assisted by traditional birth attendants, who were not trained to perform clean and safe delivery. Although traditional birth attendants lacked the professional technical care required to deal with childbirth complications, they have been praised and sought after for the quality of the emotional support and continuous labour support they provide to women⁴². A study in Kenya discovered that traditional birth attendants were still dominant; hence, mothers giving birth at home were assisted by untrained traditional birth attendants. The majority of mothers, who experienced postpartum haemorrhage, died because the mothers were being delayed in being transferred to hospitals¹⁷. A midwife is one of professional birth attendants trained to provide emergency care for mothers with postpartum hemorrhage to reduce the risk of death^{43,44}.

There is no significant relationship between travel time to primary health facilities and maternal mortality from postpartum haemorrhage. Women may be at the highest risk of postpartum haemorrhage due to inequalities in accessing quality care, unavailability of skilled birth attendants, limited access to effective uterotonic drugs, and lack of coordination between health care providers during treatment procedures, and delays in implementing PPH identification and management strategies⁴⁵. On the other hand, another study in another district in East Java found that geographical factors, as well as the environment, did not seem to have a contribution to maternal mortality because inter-city road access in East Java was already connected via the highway, and pregnant women who did not own a private vehicle have been facilitated by the district ambulances⁴⁶.

Transfer time to referral hospital was the only variable that had a significant relationship with maternal postpartum haemorrhage-related death. In the three delays model for maternal mortality⁴⁷, the efficiency of the referral system affects the third delay; delay in receiving appropriate care on arrival to a health facility, including time to travel between facilities if the appropriate level of care is not available at the primary healthcare facility. This is affected by several factors that require further research, including the response time of the mother at the referral site and the mother's condition during the referral process³². In the case of postpartum haemorrhage, women must be treated for under two hours because the threshold time from haemorrhage and death is only two hours⁴⁸. In addition, 50% of deaths from postpartum haemorrhage in Senegal and Mali, Sub-Saharan Africa were associated with delays in referrals. Referral of more than 60 minutes increases the risk of maternal death from postpartum haemorrhage by 2.24 times^{49,50}. Research conducted in Yogyakarta Province in Indonesia, reported that near-death cases from PPH were influenced by the delay factor, with an average delay of 2.17 hours⁵¹. Evidence also suggests that the distance between one facility and the other can influence utilization of the referral system⁴⁸. All efforts must be put in place to shorten the time between leaving the initiating facility and arrival at the receiving facility.

CONCLUSION

This study proves that there is a significant relationship between transfer time to referral hospitals and primary postpartum haemorrhage maternal deaths. It is important for health professionals to detect postpartum haemorrhage in order to avoid delay in referral.

Our study used actual data from the District Health Office and 26 community health centres, however our study did not explore further about the risk factors. Hence, a qualitative study exploring

more in-depth the risk factors contributing to maternal deaths from primary postpartum haemorrhage is recommended.

Author Contribution:

MG Study design, Data collection, Statistical analysis, Data interpretation, Manuscript preparation, Literature search, Funds collection. **AI** Study design, Statistical analysis, Data interpretation, Manuscript preparation, Literature search. **OA** Study design, Statistical analysis, Data interpretation, Manuscript preparation, Literature search. **NA** Data collection, Statistical analysis, Manuscript preparation. **DK** Data collection, Statistical analysis, Manuscript preparation. **RA** Manuscript preparation, Critical revision. **NS** Manuscript preparation, Critical revision. **SS** Manuscript preparation, Critical revision. **IW** Manuscript preparation, Critical revision.

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