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Determinants of miscarriage among pregnant women at Haji Hospital, Medan City, North Sumatra Province

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Abstract

Background: Miscarriage (recorded as "abortion" in hospital medical records) is a major health issue among pregnant women and can contribute to maternal morbidity and mortality. Hemorrhage resulting from miscarriage complications is a primary factor in maternal deaths.
Purpose: To analyze the determinants of miscarriage among pregnant women at Haji Hospital, Medan City.
Method: A quantitative approach with an observational, cross-sectional design was employed. The study population consisted of all pregnant women registered in the medical records at Haji Hospital, Medan City, in 2026. A sample of 64 pregnant women was selected based on inclusion and exclusion criteria, and data were analyzed using the Chi-Square test.
Results: The results showed a p-value of 0.004 ($p < 0.05$); thus, the alternative hypothesis (Ha) was accepted and the null hypothesis (Ho) was rejected. This indicates a significant relationship of age on the occurrence of miscarriage among pregnant women at Haji Hospital, Medan City, North Sumatra.
Conclusion: There is a significant relationship regarding the determinants of miscarriage among pregnant women at Haji Hospital, Medan City, North Sumatra Province.

Keywords: Age; Hb Levels; History of Previous Illnesses; History of Miscarriage; Parity.

INTRODUCTION

Miscarriage remains a significant public health issue among pregnant women, contributing to maternal morbidity and mortality. Hemorrhage resulting from miscarriage complications is recognized as a primary factor in maternal deaths. Nationally, the five leading causes of maternal mortality include hemorrhage, hypertensive disorders of pregnancy (HDP), infection, prolonged or obstructed labor, and miscarriage (Ministry of Health of the Republic of Indonesia, 2022).

The World Health Organization (WHO) defines miscarriage as the loss of a fetus before 22 weeks of gestation, with a fetal weight not exceeding 500 grams. According to the March of Dimes, the miscarriage rate remains relatively high—between 10% and 15%—among women who are aware of their pregnancy (World Health Organization, 2022). Maternal morbidity and mortality, encompassing pregnancy, childbirth, and the postpartum period, continue to pose major challenges in developing countries, including Indonesia. Globally, approximately 25–50% of deaths among women of reproductive age are attributed to complications related to pregnancy, childbirth, and the postpartum period. By the end of 2022, WHO estimated 287,000 maternal deaths worldwide, equating to nearly 800 deaths per day, or approximately one death every two minutes (World Health Organization, 2025).

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In Indonesia, maternal mortality remains high. Data from the Ministry of Health in 2021 reported 7,389 maternal deaths, with leading causes including hemorrhage, hypertension, infection, and miscarriage. The maternal mortality rate in 2022 was approximately 183 per 100,000 live births, a figure that contrasts sharply with Malaysia's rate of 20 per 100,000 live births (Ministry of Health of the Republic of Indonesia, 2022). At the provincial level, the North Sumatra Health Office reported 27 maternal deaths in Medan City in 2023 out of 33,497 live births, yielding a Maternal Mortality Rate (MMR) of 75 per 100,000 live births. This represented an increase compared to 2022, when 18 maternal deaths were recorded out of 33,529 live births. Contributing factors included pregnancy complications such as miscarriage, eclampsia, and other causes (Health Office of North Sumatera Province, 2024).

The 2022 Medan City Health Profile highlighted miscarriage as a persistent reproductive and maternal health issue requiring serious attention. Hospital records confirmed that miscarriage cases contributed significantly to maternal morbidity and were closely linked to maternal mortality. Between 2023 and 2024, epidemiological and clinical studies conducted at referral health facilities and teaching hospitals in Medan City indicated that miscarriage cases—including threatened, inevitable, and incomplete miscarriage—remained frequently observed (Health Office of Medan City, 2024).

Several risk factors have been identified in relation to spontaneous miscarriage, including maternal age, socioeconomic status, history of previous miscarriage, and underlying health conditions. Women under 20 and over 35 years of age face higher risks, while low socioeconomic status limits access to safe care. A history of prior miscarriage increases recurrence risk, and chronic diseases, smoking, and alcohol consumption further exacerbate vulnerability. Statistical analysis using the Chi-square test demonstrated a significant association between parity and miscarriage incidence ($p = 0.043$, $\alpha = 0.05$). Younger maternal age (<20 years) reflects limited physical and psychological readiness, while advanced maternal age (>35 years) is associated with declining reproductive function. High parity, meanwhile, may weaken uterine muscles, reducing the ability to sustain pregnancy. These findings underscore the importance of education on pregnancy planning, antenatal care, and birth spacing to reduce risks (Sari et al., 2022).

Although national and local data highlight miscarriage as a major contributor to maternal morbidity and mortality, there remains limited evidence on the specific determinants of miscarriage within hospital-based populations in Medan City. Previous studies have identified general risk factors such as age, parity, and socioeconomic status, but few have systematically analyzed their statistical associations in the local context using hospital medical records. This gap underscores the need for focused research to clarify the determinants of miscarriage among pregnant women in Medan City, thereby informing targeted interventions to reduce maternal morbidity and mortality.

RESEARCH METHOD

This study employed a quantitative analytical observational design using a cross-sectional approach. The study assessed the independent and dependent variables at a single point in time without follow-up. The independent variables consisted of maternal age, parity, history of miscarriage, hemoglobin (Hb) level, and history of prior illness, while the dependent variable was miscarriage occurrence. The study aimed to examine the associations between selected maternal risk factors and miscarriage occurrence among pregnant women.

The study was conducted at Haji Hospital, located at Jalan Rumah Sakit H. No. 47, Kenangan Baru, Percut Sei Tuan District, Deli Serdang Regency, North Sumatra, Indonesia, during 2026. Data were obtained from maternal medical records available at the hospital during the study period.

The study population comprised 175 pregnant women who received pregnancy-related care or examinations at Haji Hospital during 2026. The sample consisted of 64 pregnant women selected using simple random sampling. The sample size was calculated using Slovin's formula with a 10% margin of error: $n = N / (1 + Ne^2)$; where n represents the required sample size, N represents the population size, and e represents the margin of error. With a population of 175 women and a margin of error of 10%, the calculated sample size was 63.64 and was rounded to 64 participants.

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Eligible records were selected according to predefined inclusion and exclusion criteria. The inclusion criteria were pregnant women whose medical records were available at Haji Hospital and contained complete information on maternal age, parity, hemoglobin level, history of miscarriage, history of prior illness, and miscarriage status. Records were excluded if they were incomplete, lacked information on one or more key study variables, or represented duplicate records.

Maternal age was defined as the woman's age at the time of pregnancy assessment, based on the medical record, and was categorized as high-risk age (<20 or >35 years) and low-risk age (20–35 years). Parity was defined as the number of previous deliveries reaching the defined viable gestational age and was categorized into high-risk parity, consisting of primipara and grand multipara, and low-risk parity, consisting of multipara.

A history of miscarriage was defined as a documented miscarriage occurring before the current pregnancy and was categorized as yes or no. Hemoglobin level was obtained from laboratory results recorded in the medical record and categorized as anemia (<11 g/dL) or normal (≥11 g/dL). A history of prior illness was defined as a documented history of maternal disease before or during the current pregnancy, including hypertension, diabetes mellitus, heart disease, or other chronic medical conditions, and was categorized as yes or no.

Miscarriage occurrence was defined as pregnancy loss before fetal viability, as documented and diagnosed by the attending physician in the medical record. Miscarriage status was categorized as yes or no.

This study used secondary data obtained from maternal medical records. Data were collected using a structured data-extraction checklist developed according to the study variables and their operational definitions. The checklist was used to systematically record maternal age, parity, history of miscarriage, hemoglobin level, history of prior illness, and miscarriage occurrence. Data extraction was performed based on information documented in the medical records, and only records meeting the eligibility criteria were included in the analysis.

Data were analyzed using IBM SPSS Statistics version 32. Univariate analysis was performed to describe the distribution of the study variables using frequencies and percentages. Bivariate analysis was conducted to examine the association between each maternal risk factor and miscarriage occurrence. Because the variables were categorical, the Pearson chi-square (χ^2) test was used. Fisher's exact test was applied when the expected cell-count assumptions for the chi-square test were not met. Statistical significance was determined using a two-sided significance level of $\alpha = 0.05$, with $p < 0.05$ considered statistically significant.

Multivariable analysis was performed using binary logistic regression to assess the independent association of maternal age, parity, history of miscarriage, hemoglobin level, and history of prior illness with miscarriage occurrence after adjustment for the other variables. The regression model was evaluated using the Omnibus Test of Model Coefficients and Nagelkerke R^2. The results were presented as regression coefficients (B), standard errors (SE), Wald statistics, *p*-values, odds ratios (ORs), and 95% confidence intervals (CIs). The variable with a statistically significant adjusted association was identified based on a *p*-value <0.05. The reference categories and coding of categorical variables were specified during regression analysis to ensure appropriate interpretation of the odds ratios.

This study received ethical approval from the Health Research Ethics Committee of the Institute of Health Sciences Mitra Husada Medan (No. 3667/KEP-MHM/III/2026). Institutional permission was obtained from the study setting before data collection. Because the study used secondary data from medical records, confidentiality and privacy of participants were maintained throughout the research process. Personal identifiers were not included in the analytical dataset, and the extracted data were stored securely with access restricted to the research team.

All research procedures were conducted in accordance with internationally recognized ethical principles, including respect for autonomy, beneficence, non-maleficence, and justice, as outlined in the Declaration of Helsinki and applicable national research regulations.

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RESEARCH RESULTS

Tabel 1. Characteristics of Respondents (N=64)

Variables	Results
Age (Mean±SD)(Year)	(27.42±7.98)
High-risk maternal age <20, >35	31/48.44
Low-risk maternal age 20-35	33/51.56
Parity (n/%)	
High-risk (Primipara & Grandemultipara)	24/37.50
Low-risk (Multipara)	40/62.50
History of Miscarriage (n/%)	
Yes	19/29.69
No	45/70.31
Hemoglobin Level (Hb) (n/%)	
Anemia (<11 g/dL)	26/40.62
Normal (≥11 g/dL)	38/59.38
History of Prior Illness (n/%)	
Yes	23/35.94
No	41/64.06
Occurrence of Miscarriage (n/%)	
Yes	45/70.31
No	19/29.69

Table 1 presents the demographic and clinical characteristics of respondents. The mean age was 27.42 years (SD ± 7.98), with the majority classified in the low-risk age group (20–35 years), accounting for 33 respondents (51.56%). In terms of parity, most participants had non-risk parity (multipara), totaling 40 respondents (62.50%). Regarding miscarriage history, the majority reported no prior miscarriage (45 respondents, 70.31%). Based on hemoglobin levels, most respondents were not anemic (Hb ≥11 g/dL), comprising 38 respondents (59.38%). With respect to medical history, the majority had no prior disease (41 respondents, 64.06%). Conversely, when considering the occurrence of miscarriage, 45 respondents (70.31%) reported having experienced miscarriage.

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Table 2. Association between Risk Factors and Miscarriage Outcomes (N=64)

Variables	Occurrence of Miscarriage		p-value
	Yes	No	
Age (n/%)			
High-risk maternal age <20, >35	27/87.10	4/12.90	0.004
Low-risk maternal age 20-35	18/54.55	15/45.45	
Parity (n/%)			
High-risk (Primipara & Grandemultipara)	21/87.50	3/12.50	0.020
Low-risk (Multipara)	24/60.00	16/40.00	
History of Miscarriage (n/%)			
Yes	17/89.47	2/10.53	0.029
No	28/62.22	17/37.78	
Hemoglobin Level (Hb) (n/%)			
Anemia (<11 g/dL)	22/84.62	4/15.38	0.038
Normal (≥11 g/dL)	23/60.53	15/39.47	
History of Prior Illness (n/%)			
Yes	20/86.96	3/13.04	0.029
No	25/60.98	16/39.02	

Table 2 summarizes the association between maternal risk factors and miscarriage outcomes. Among 31 respondents in the high-risk age group (<20 years or >35 years), 27 (87.10%) experienced miscarriage, compared with 18 (54.5%) of 33 respondents in the low-risk age group (20–35 years), yielding a significant association (χ^2, p = 0.004). Similarly, 21 of 24 respondents with high-risk parity (primipara or grand multipara) reported miscarriage (87.50%), whereas 24 of 40 respondents with non-risk parity (multipara) experienced miscarriage n (60.00%) (χ^2, p = 0.020). Miscarriage was also more frequent among respondents with a prior history of miscarriage (17 of 19; 89.47%) compared to those without such history (28 of 45; 62.22%) (χ^2, p = 0.029). In terms of hemoglobin status, 22 of 26 respondents with anemia (Hb <11 g/dL) experienced miscarriage (84.62%), compared to 23 of 38 respondents without anemia (Hb ≥11 g/dL) (60.53%) (χ^2, p = 0.038). Likewise, respondents with a history of medical conditions demonstrated higher miscarriage occurrence (20 of 23; 86.96%) than those without comorbidities (25 of 41; 61.98%) (χ^2, p = 0.029).

Table 3. Multivariate Analysis

Variables	B	S.E	Wald	p-value	OR (Exp(B))	95% CI
Age	-1.653	0.733	5.089	0.024	0.191	0.046–0.805
Parity	-1.558	0.811	3.688	0.055	0.211	0.043–1.033
History of Miscarriage	-1.556	0.912	2.908	0.088	0.211	0.035–1.262
Hemoglobin Level (Hb)	-1.012	0.771	1.720	0.190	0.364	0.080–1.649
History of Prior Illness	0.033	0.888	0.001	0.971	1.033	0.181–5.885

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The multivariate analysis using binary logistic regression demonstrated that the Omnibus Test of Model Coefficients produced a Chi-square value of 19.036 with a p-value of 0.002 ($p < 0.05$), confirming the suitability of the model in explaining the relationship between independent variables and miscarriage occurrence. The Nagelkerke R^2 value of 0.366 indicates that maternal age, parity, history of miscarriage, hemoglobin levels, and prior medical conditions collectively accounted for 36.6% of the variance in miscarriage occurrence, while the remaining 63.4% was attributable to unmeasured factors. The model achieved a classification accuracy of 73.4%. After adjustment for confounding variables, maternal age remained significantly associated with miscarriage ($p = 0.024$), whereas parity ($p = 0.055$), history of miscarriage ($p = 0.088$), hemoglobin levels ($p = 0.190$), and prior medical conditions ($p = 0.971$) did not reach statistical significance. These findings suggest that maternal age is the most dominant predictor of miscarriage among pregnant women at Haji General Hospital of Medan, after controlling for other covariates.

DISCUSSION

Relationship Between Age and the Incidence of Miscarriage

Maternal age is widely recognized as a critical determinant of pregnancy outcomes. Pregnancies occurring before the age of 20 are often complicated by incomplete maturation of reproductive organs, which may impair implantation and fetal development. Conversely, pregnancies after 35 years are associated with declining oocyte quality, increased chromosomal abnormalities, and higher prevalence of comorbidities such as hypertension and diabetes, all of which elevate miscarriage risk (Andriyani, 2018; World Health Organization, 2022). Recent meta-analyses confirm that advanced maternal age significantly increases the risk of spontaneous miscarriage, particularly due to age-related aneuploidy and diminished ovarian reserve (Magnus et al., 2021).

Our findings are consistent with previous research which reported that women in high-risk age groups (<20 or >35 years) were 2.4 times more likely to experience miscarriage compared to those aged 20–35 years (Rinawati et al., 2024). This aligns with global evidence showing that maternal age outside the optimal reproductive window compromises biological readiness and increases adverse pregnancy outcomes (Londero et al., 2019). These results underscore the importance of reproductive health education and counseling, particularly for adolescents and women of advanced maternal age, to mitigate risks through preconception care and timely family planning.

Relationship Between Parity and the Incidence of Miscarriage

Parity, defined as the number of pregnancies reaching viability, also influences miscarriage risk. Primiparous women face challenges due to limited physiological adaptation to pregnancy, while grand multiparous women often experience reduced uterine elasticity, weakened myometrium, and impaired uteroplacental circulation, predisposing them to complications (Ertiana et al., 2024; Fahriani et al., 2019). Recent studies corroborate these findings, showing that both primiparity and grand multiparity are associated with increased risks of miscarriage, preterm birth, and hypertensive disorders (Peled et al., 2024).

Our results highlight the need for differentiated antenatal monitoring strategies. Primiparous women may benefit from enhanced education and psychosocial support, while grand multiparous women require closer surveillance for uterine and placental function. These findings reinforce WHO recommendations for individualized antenatal care tailored to parity status (World Health Organization, 2022).

Association Between History of Miscarriage and Occurrence of Miscarriage

A prior history of miscarriage emerged as a significant predictor of subsequent pregnancy loss in our study, with nearly 90% of women with previous miscarriage experiencing recurrence. This finding is consistent with a previous study which reported similar associations (Usru'ah, 2020; Wulandari, 2024; Situmorang et al., 2025). Recent international studies further support this, noting that recurrent miscarriage is often linked to genetic, immunological, and endocrine factors, as well as uterine abnormalities (Melo et al., 2023).

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The recurrence risk emphasizes the importance of comprehensive evaluation for women with prior miscarriage, including genetic counseling, thrombophilia screening, and assessment of uterine anomalies. Evidence suggests that targeted interventions—such as progesterone supplementation, lifestyle modification, and management of underlying medical conditions—can reduce recurrence rates (European Society of Human Reproduction and Embryology, 2023). Our findings highlight the need for hospital-based protocols to identify and manage women at risk of recurrent miscarriage.

Relationship Between Hemoglobin (Hb) Levels and the Incidence of Miscarriage

Anemia, defined as Hb <11 g/dL, was significantly associated with miscarriage in our study. Women with anemia were more likely to experience pregnancy loss compared to those with normal Hb levels. This finding is consistent with previous research (Nurfauziah et al., 2024; Siregar et al., 2026; Tejowati et al., 2026). Recent global evidence confirms that maternal anemia contributes to adverse outcomes, including miscarriage, preterm birth, and low birth weight, primarily through impaired oxygen delivery to the fetus and increased risk of placental insufficiency (Chen, 2024).

Iron-deficiency anemia remains highly prevalent in Indonesia, particularly among women of reproductive age. Interventions such as iron and folic acid supplementation, dietary counseling, and early detection during antenatal visits are critical to reducing miscarriage risk. Our findings reinforce the importance of strengthening maternal nutrition programs and integrating anemia screening into routine antenatal care.

Association Between Medical History and Miscarriage Incidence

Women with pre-existing medical conditions—including hypertension, diabetes, thyroid disorders, and infections—demonstrated significantly higher miscarriage rates in our study. This aligns with previous research (Karlensi et al., 2023; Tambunan & Barbara, 2025) as well as recent international literature showing that chronic diseases and infections substantially increase miscarriage risk (Quenby et al., 2021). Pathophysiological mechanisms include impaired placental development, altered immune responses, and systemic inflammation.

These findings underscore the need for integrated maternal care that addresses chronic disease management before and during pregnancy. Preconception screening, early diagnosis, and multidisciplinary care models have been shown to improve pregnancy outcomes among women with comorbidities (Cristodoro et al., 2023). In the context of Medan City, strengthening referral systems and ensuring access to specialized care for high-risk women could reduce miscarriage-related morbidity and mortality.

CONCLUSION

This study found significant associations between maternal age, parity, history of miscarriage, hemoglobin level, and history of prior illness with miscarriage occurrence in the bivariate analysis. Women with high-risk maternal age, high-risk parity, a previous history of miscarriage, anemia, and a history of prior illness had a higher proportion of miscarriage occurrence. However, after adjustment for the other variables using binary logistic regression, only maternal age remained statistically significantly associated with miscarriage occurrence. These findings indicate that maternal age is an important factor associated with miscarriage in the study population, although other maternal and clinical factors may also contribute to miscarriage risk. Further studies involving larger samples and additional potential risk factors are recommended to provide a more comprehensive understanding of factors associated with miscarriage.

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