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Postpartum as the Dominant Period of Maternal Death in Indonesia: Analysis of Survey Results

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ABSTRACT

Maternal mortality remains a critical public health challenge in Lampung Province, which consistently records one of the highest maternal mortality rates in Sumatra and has not yet reached the national Sustainable Development Goals (SDGs) target. Understanding the temporal patterns and dominant risk factors of maternal deaths is essential for designing more targeted preventive strategies. This case-control study included 193 respondents: 64 cases (maternal deaths) and 129 controls (surviving mothers), selected through purposive sampling from health facilities across Lampung Province. Data were obtained from medical records, maternal death audit reports, and structured interviews, then analyzed using univariate, bivariate (chi-square), and multivariate (binary logistic regression) approaches. The majority of maternal deaths occurred in the postpartum period (78.3%), with the highest concentration within the first 24 hours (63.1%), indicating this as the most critical vulnerability window in Lampung. Hemorrhage was the leading cause of death (53.9%), with most fatalities occurring within hospital settings (71.2%), suggesting that referral delays and suboptimal emergency obstetric care remain persistent challenges in the province. Binary logistic regression revealed that chronic diseases were the most dominant risk factor (OR = 3.80; 95% CI: 1.56–9.24), followed by irregular Antenatal Care visits (OR = 3.77; 95% CI: 1.58–8.99) and history of pregnancy complications (OR = 3.48; 95% CI: 1.45–8.34). Gestational age showed no significant association (p = 0.635). Urgent need for Lampung Province to strengthen early detection of chronic diseases through integrated ANC programs at the primary care level (Community Health Centers), improve emergency obstetric care quality, and reduce referral delays across districts to prevent avoidable maternal deaths.

INTRODUCTION

The maternal mortality rate (MMR) is a key indicator of a health system's quality and of global efforts toward the health and sustainable development agenda. According to the World Health Organization, approximately 260,000 women will die during and after pregnancy and childbirth in 2023, with the majority of these deaths occurring in low- and middle-income countries, and the majority of cases could be prevented with adequate health services. The postpartum period (the first 42 days after delivery) is a critical phase where the risk of complications such as bleeding and infection remains high, and there is often a gap in clinical monitoring during this phase (World Health Organization, 2024).

Indonesia is one of the countries in Southeast Asia with a maternal mortality rate that is still high compared to the global target of SDGs 3.1, which targets an MMR of less than 70 per 100,000 live births by 2030. Analysis of national trends shows that despite a decline in the MMR (maternal mortality ratio) over the past few decades, the maternal mortality rate in Indonesia remains substantial and shows large variations across the region. A systematic review indicates that Indonesia's MMR decreased from 450 per 100,000 live births in 1990 to around 249 per 100,000 in 2020, but remains one of the highest in the region (Syairaji et al., 2024).

Indonesia still records a relatively high maternal mortality rate and has shown a slow decline in the last two decades. National data-based analysis and systematic reviews show that although coverage of antenatal and delivery services in health facilities has increased, its impact on reducing maternal mortality has not been optimal (Badan Pusat Statistik 2024; Syairaji et al. 2024). This condition indicates that there are risk factors that have not been adequately addressed in the overall continuum of maternal health care.

Maternal death can occur at various stages, namely during pregnancy, childbirth, and the postpartum period. The World Health Organization emphasizes that the postpartum period is a very vulnerable period, especially in the first 24 hours to 42 days after delivery, when the risk of fatal complications such as hemorrhage, infection, and hypertensive disorders remains high (Say et al. 2014; World Health Organization, 2024). Global evidence shows that most maternal deaths occur after the completion of labor, not during pregnancy or childbirth itself (Say et al. 2014). From a physiological standpoint, this heightened vulnerability is attributable to the dramatic hemodynamic and hormonal shifts that occur immediately following placental expulsion. The sudden redistribution of approximately 500–700 mL of blood returning to systemic circulation places significant strain on the cardiovascular system, while the loss of placental hormones disrupts uterine contractility, predisposing women to atonic hemorrhage — the single leading cause of maternal death worldwide. Concurrently, the disruption of the uteroplacental barrier creates an entry point for ascending infection, and the persistence of elevated vascular resistance in women with underlying hypertensive disorders increases the risk of eclampsia and stroke in the early postpartum hours (Febles et al., 2026). These overlapping physiological transitions, occurring simultaneously within a narrow time window, explain why the first 24 hours postpartum represent a period of maximum maternal risk and underscore the scientific rationale for focusing surveillance and intervention efforts on this critical phase.

Maternal deaths occur not only during pregnancy or childbirth, but a significant portion occur after delivery. Evidence from the literature shows that the majority of maternal deaths in many countries, both nationally and globally, occur in the postpartum period, many within the first 24 hours to several days after delivery, when women are discharged from health facilities but still in a high-risk phase. In addition to late detection of complications, limited postpartum monitoring, limited follow-up monitoring, and access to services after mothers are discharged from health facilities are contributing factors (Symonds et al. 2023; Clarke-Deelder et al. 2023). In addition, the maternal and neonatal referral system is a key aspect in dealing with maternal emergency cases, especially in rural areas that have limited facilities and resources. Suarni et al. found that referral readiness in terms of infrastructure, human resources, community, and policy support significantly influences the effectiveness of handling fetal and maternal events requiring emergency care in rural areas of Indonesia (Suarni et al., 2024).

In addition to clinical factors, maternal deaths in the postpartum period are also influenced by health system determinants such as facility readiness to handle emergencies, coordination across levels of health care, and family and community support for continued care. Therefore, understanding the distribution of maternal deaths by time of occurrence, including the predominance of the postpartum phase, is a crucial step in assessing whether maternal health programs have been in accordance with the real risks that occur in the field. However, despite the growing body of global and national evidence on maternal mortality, there remains a significant gap in province-level studies that simultaneously examine the temporal distribution of maternal deaths and their associated risk factors within a single analytical framework. Most existing studies in Indonesia have focused either on identifying causative factors in isolation or on national-level aggregates, without capturing the specific epidemiological profile of high-burden provinces such as Lampung. Furthermore, the relative contribution of chronic non-communicable diseases as a risk factor for maternal death compared to obstetric-specific factors such as ANC compliance and pregnancy complications — remains insufficiently explored at the subnational level in Indonesia. It is also unclear whether the critical vulnerability window identified globally, particularly within the first 24 hours postpartum, is reflected in the local mortality patterns of Lampung Province, where health infrastructure, referral systems, and care-seeking behaviors may differ substantially from national averages. This study aims to fill these gaps by providing empirical, province-specific evidence on the temporal distribution of maternal deaths and identifying the dominant risk factors through a case-control design, with the ultimate

goal of informing more targeted and context-appropriate maternal health interventions in Lampung Province.

Based on this, this study aims to analyze the distribution of maternal deaths based on the time of occurrence using health survey data, with a focus on the postpartum period as the dominant phase of maternal deaths in Indonesia. The results of this study are expected to provide a strong empirical basis for strengthening maternal health policies and programs, particularly in optimizing postpartum services as an integral part of the continuum of maternal care.

METHOD

This study used a quantitative analytical approach with a case-control design. A case-control design is an epidemiological method used to examine the relationship between exposure and outcome by comparing individuals with the event of interest (cases) and those who did not experience the event (controls) based on their exposure status. A retrospective analysis was conducted to identify risk factors associated with maternal mortality by assessing previous exposure among both groups. This study was conducted in all district and city health service areas in Lampung Province. Data collection took place from May to July 2025.

The population was divided into case groups and control groups. The case group consists of 96 cases of maternal deaths that occurred in Lampung Province in 2024. The control population consisted of 160,016 pregnant women, based on data from the Lampung Provincial Health Office in 2023. A total of 193 respondents were included in the sample, consisting of 96 cases and 97 controls, with a case-control ratio of 1:1. Control respondents were selected from the same sub-district as the cases to ensure geographic comparability and feasibility.

The case group was selected using total sampling. Inclusion criteria for cases were maternal death occurring during pregnancy, childbirth, or within 42 days of delivery, with a clearly documented residential address in health facility records. The control group was selected using proportional random sampling, consisting of 97 respondents. Inclusion criteria for the control group were pregnant women without complications from pregnancy to the postpartum period, having socioeconomic characteristics comparable to the cases, and residing in the same sub-district as the cases. Exclusion criteria for both the case and control groups were applied to ensure the validity and comparability of the study sample. Cases were excluded if the maternal death was caused by accidental or incidental causes unrelated to pregnancy or childbirth (e.g., traffic accidents, homicide, or suicide), as these do not represent obstetric or pregnancy-related mortality. Controls were excluded if medical records were incomplete or unavailable, if the respondent or next of kin refused to participate, or if the mother had subsequently experienced a maternal near-miss event that could not be clearly distinguished from a case. Additionally, respondents from both groups were excluded if they had delivered outside of Lampung Province or if their data could not be verified through at least one official source, such as medical records, maternal death audit reports, or civil registration documents.

The main instrument used in this study to obtain data on the topic under study was a structured questionnaire. This questionnaire is specifically designed to measure variables (family status, community status, maternal health status, reproductive status, access to health services, and health behavior). Before being used in actual data collection, the questionnaire has gone through a series of tests to ensure the quality and accuracy of the data generated. The validity of the research instrument was assessed through a pilot test involving respondents with characteristics similar to the study population. The results showed that all questionnaire items had Corrected Item-Total Correlation values exceeding the critical correlation value (r table). Therefore, all items were considered valid and suitable for data collection.

Reliability test with internal consistency of the questionnaire was evaluated using Cronbach's alpha coefficient. The instrument produced a Cronbach's alpha value of 0.85, indicating high reliability. Since this value exceeds the acceptable threshold ($\alpha > 0.60$), the questionnaire is considered reliable for use in this study. Data analysis consists of univariate and multivariate analysis. Univariate analysis was used to describe the distribution of each variable and was presented as frequencies and percentages. Multivariate analysis using binary logistic regression was conducted to determine the factors that most influence maternal mortality.

Research ethics issues, including informed consent, anonymity, and confidentiality, have been carefully discussed throughout the research process. A research ethics approval letter has been obtained from the Research Ethics Committee at the Ministry of Health Polytechnic of Tanjungkarang, Indonesia, No. 377/KEPK-TJK/VI/2025 on June 2, 2025.

RESULTS

Table 1. Respondent characteristics

Characteristics	Category	Case Group (Death)		Control Group	
		∑	%	∑	%
Age	<20 Years	7	7.2	7	7.3
	20-35 Years	66	68.1	59	61.5
	>35 years	24	24.7	30	31.2
Education	Elementary and intermediate	87	89.7	89	92.7
	higher education	10	10.3	7	7.3
Parity	Primigravida	22	22.7	31	32.3
	Multiple gravida	67	69.1	62	64.6
	Grande Multi	8	8.2	3	3.1
ANC	Regular	13	13.4	22	16.9
	Irregular	84	86.6	74	77.1
	Amount	97	100	96	100
Time of Death	Pregnancy	13	13.4	0	0
	Labor	8	8.2	0	0
	Postpartum	76	78.3	0	0
	Amount	97	100	0	0

Based on Table 1, the age distribution of respondents, most respondents are aged 20-35, so the highest mortality is in that group. However, mortality in the risk age group (<20 and <35) is also still quite high, namely: 31 (31.9%). Viewed from the level of education, most respondents have primary and secondary education**,** namely 87 (89.7%) in the group of mothers who experienced death and 89 (92.7%) in the control group.

Based on parity, there are still many mothers who are pregnant with grandemulti, especially mothers who experienced death, namely 8 cases (8.2%), more than the control group. Judging from the history of antenatal care (ANC) examinations, most maternal deaths occurred in respondents with irregular ANC**,** namely 84 cases (86.6%). This number is greater than that of respondents from the control group of 74 (77.1%).

Based on the time of death, most maternal deaths occurred in the post-natal period, namely 76 cases, while deaths during pregnancy were 17 cases and during childbirth were 8 cases.

Table 2. Characteristics of mothers who experienced postpartum death based on time, place of death, and complications

Characteristics	Category	Frequency	Percentage
Time of death	< 24 hours	48	63.1
	1-7 Days	11	14.5
	8-42 Days	17	22.4
Complications	Bleeding	41	53.9
	Eclampsia	16	21.1
	Other Causes	19	25.0
Place of delivery	House	3	3.9
	On the way	2	2.6
	Primary Clinic	2	2.6
	PMB	15	19.7
	Hospital	54	71.2
Number Of deaths		76	100

Based on Table 2 of the 97 who died, the most deaths occurred in the postpartum period 72 (76.0%) with the following time details: most deaths occurred in the period of less than 24 hours, namely 42 cases (60%), deaths that occurred in the 1-7 day period amounted to 16 cases (12.22%), while deaths in the 8-42 day period were recorded as many as 12 cases (17.78%). These results indicate that most deaths occurred in the first 24 hours, compared to the time period after. Furthermore, data on the causes of childbirth shows that the highest cause of death in postpartum deaths is bleeding at 38 (53.5%), much higher than other complications, such as eclampsia at 15 (21.1%). Meanwhile, the place where mothers experienced the highest postpartum deaths occurred in the Hospital 54 (71.2%), followed by deaths in PMB, as many as 15 (19.7%).

Table 3. Factors associated with maternal death

Independent Variables	B	Std. Error	Wald	p-value	OR (Exp(B))	95% CI OR
ANC						
Regular	1,327	0.447	8,806	0.003	3,771	1,569 – 9,060
Irregular	–	–	–	–	1.00	–
Pregnancy Age						
No Risk	−0.167	0.352	0.225	0.635	0.846	0.425 – 1.687
Risky	–	–	–	–	1.00	–
Chronic Disease						
There isn't any	1,335	0.453	8,673	0.003	3,801	1,563 – 9,243
There is	–	–	–	–	1.00	–
History of pregnancy complications						
There isn't any	1,246	0.350	12,675	<0.001	3,476	1,751 – 6,902
There is	–	–	–	–	1.00	–

Binary logistic regression analysis showed that ANC, chronic diseases, and a history of pregnancy complications were significantly associated with the incidence of death ($p < 0.05$). Chronic diseases were the most dominant factor (OR = 3.80; 95% CI: 1.56–9.24), followed by ANC (OR = 3.77; 95% CI: 1.57–9.06) and history of pregnancy complications (OR = 3.48; 95% CI: 1.75–6.90). Gestational age did not show a significant association with the incidence of death ($p = 0.635$).

DISCUSSION

Characteristics of maternal death

These findings reflect that although the general reproductive age ranges between 20-34 years, the risk of postpartum death remains significant in older age groups (>35 years), which in many studies in developing countries is associated with increased obstetric complications and higher health risks compared to the "optimal" gestational age (around 20–30 years) (Firmansyah et al., 2022).

International evidence suggests that older maternal age (>35 years) is associated with a higher risk of maternal mortality compared to 20–35 years of age, reflecting an increase in obstetric complications and comorbid health conditions with increasing maternal age. Global Survey shows the risk of mortality increases at age >35 years compared to 20–25 years (Karlsen et al. 2011). In addition, the dominance of mothers with primary and secondary education (88.4%) compared to higher education (11.6%) indicates that lower levels of education may be an indirect risk factor for maternal mortality because it is associated with low health knowledge, delayed access to services, less than optimal use of ANC services, and involvement in maternal health decisions (Yusanti 2022). Studies show that mothers with low education tend to have lower access to and utilization of health services**,** which impacts early detection of pregnancy risks and management of complications, thus contributing to higher maternal mortality (Putri et al., 2024). A global meta-analysis also found that lower education levels were associated with an increased risk of maternal and perinatal death, even when access to obstetric care was available,

highlighting the importance of education as a social determinant of health that has a broad impact on pregnancy and childbirth outcomes (Bello-Álvarez et al., 2026).

The discussion of the results of this study shows that the history of antenatal care (ANC) visits**,** the presence of chronic diseases**,** and the history of pregnancy complications are significantly related to the incidence of death in mothers and/or babies. Various national and international studies consistently show that antenatal care (ANC) visits are one of the most effective health interventions in reducing the risk of maternal and infant mortality during pregnancy and the neonatal period. Meta-analyses of studies in various low- and middle-income countries report that mothers who attend regular ANC visits have a 30–40% lower risk of neonatal death compared to mothers who do not or under-utilize ANC services (Wondemagegn et al. 2018). Other studies also confirm that adequate ANC visits can even significantly reduce the risk of neonatal death in countries with limited resources (Rai et al.,2022; Mengistu et al., 2011; Doku et al., 2017).

Various national studies in Indonesia have shown that antenatal care (ANC) visits play a crucial role in reducing the risk of maternal and infant mortality, particularly during the neonatal period. Data-based analysis of the Indonesian Demographic and Health Survey (IDHS) found that pregnant women who received ANC with comprehensive examination components had a lower risk of neonatal mortality, as potential pregnancy complications could be detected and managed earlier (Azizah et al., 2017). Research at the primary care level (Community Health Centers) also shows that low frequency and regularity of ANC visits are closely related to increased incidence of childbirth complications, such as preeclampsia and hemorrhage, which are the main causes of maternal and infant mortality (Nurkhayati & Septavia, 2023) In addition, a study of maternal health policies in Indonesia confirms that implementing ANC according to national standards, including increasing the number of visits and quality of services, is a key strategy in efforts to reduce maternal mortality rates (MMR) and infant mortality rates (IMR)(Khairani and Gurning 2025). These findings confirm that ANC not only functions as a routine check-up service, but also as a crucial preventive intervention in maintaining the safety of mothers and babies from pregnancy through early life.

In addition to antenatal care visits, the study's finding that chronic diseases are associated with an increased risk of death aligns with scientific literature showing that pre-existing medical conditions, such as diabetes mellitus or hypertension, are strong risk factors for maternal and neonatal complications. For example, a large cohort study in the UK found that women with pre-gestational diabetes had a significantly higher risk of serious complications such as preterm birth, stillbirth, and the need for neonatal intensive care compared with women without diabetes. Such conditions can worsen pregnancy outcomes because the underlying metabolic and vascular disorders affect placental growth, fetal perfusion, and the mother's capacity to cope with the physiological stress of pregnancy.

Various international studies have shown that chronic diseases are closely linked to an increased risk of death from various causes. The World Health Organization reports that non-communicable diseases such as heart disease, stroke, diabetes mellitus, cancer, and chronic lung disease are the leading causes of global death, accounting for more than two-thirds of all deaths worldwide (World Health Organization, 2024). Population-based cohort studies in Europe also found that individuals with one or more chronic diseases had a significantly higher risk of death than individuals without chronic diseases, and this risk increased with the increasing number of comorbidities (Caride-Miana et al. 2025). In addition, meta-analyses have shown that certain chronic diseases, such as chronic pulmonary disease and cardiovascular disease, act as strong predictors of mortality in various clinical conditions, including severe infections (Geng et al. 2021).

Pregnancy accompanied by chronic diseases such as chronic hypertension, diabetes mellitus, chronic kidney disease, and obesity significantly increases the risk of maternal and perinatal death due to pregnancy complications. For example, chronic hypertension during pregnancy is a major risk factor for obstetric complications and has long been identified as a significant contributor to maternal and neonatal morbidity and mortality because it can trigger preeclampsia, eclampsia, preterm labor, and impaired placental perfusion, which directly impact maternal and fetal well-being (Gunderson et al. 2025). Furthermore, analyses from several countries have shown that women with pre-pregnancy chronic conditions such as diabetes, heart disease, or kidney disease have a higher risk of maternal death compared to women

without these conditions, as these conditions worsen the response to pregnancy stress and increase the likelihood of serious complications such as organ failure and severe infections (Souza et al. 2024). This risk is further heightened when chronic conditions are uncontrolled or occur in conjunction with other pregnancy complications, such as preeclampsia, which is also associated with high rates of neonatal and perinatal mortality due to fetal growth restriction or preterm labor.

Descriptive analysis shows that the distribution of neonatal deaths is significantly concentrated in the period **<**24 hours postpartum**.** This phenomenon confirms that the immediate postpartum phase is a critical window of greatest vulnerability for both mother and baby. This pattern is consistent with global epidemiological evidence confirming that the majority of neonatal deaths occur in the first day of life (day of birth), especially in preterm infants and infants with Intrauterine Growth Restriction (IUGR) who were not identified or not optimally managed during pregnancy (Lawn et al., 2014).

Global data shows that approximately 30–40% of neonatal deaths occur within the first 24 hours, a figure closely linked to obstetric complications, poor quality antenatal care (ANC), and the unpreparedness of essential neonatal services in health facilities (Hug et al. 2019). The significant association between irregular ANC visits and maternal death in this study must be interpreted with caution. While ANC attendance is a necessary condition for risk detection, it is not a sufficient one. Evidence consistently shows that ANC visit frequency does not correlate linearly with reductions in maternal mortality unless accompanied by high-quality clinical content capable of detecting and managing risks early (Beňová and Marshall 2018). In Lampung Province, where ANC coverage rates are relatively high yet maternal mortality remains elevated, this quality-coverage gap warrants urgent policy attention. These findings also support the urgency of strengthening maternal and child health systems through increased comprehensive ANC coverage, early risk detection, and management of chronic medical conditions before or during pregnancy, critical steps discussed in various global health policies and World Health Organization reports on the stagnation of maternal mortality reduction when access to essential services is inadequate. Overall, these study results reinforce the scientific consensus that evidence-based clinical interventions across the pregnancy continuum, from early risk detection to postpartum care, are crucial for reducing maternal and infant mortality, particularly in resource-limited settings such as those examined in this study.

Causes of postpartum death

The study results revealed a critical phenomenon in which the majority of deaths occurred in the immediate postpartum period, with 60% of cases (42 deaths) recorded within <24 hours. The concentration of deaths in this time window confirms that the immediate postpartum phase is the most dangerous period for maternal survival. These findings are in line with a global report from Lawn et al. (2014), which stated that the risk of maternal death peaks on the first day after delivery due to drastic physiological changes and the risk of acute complications that arise without prior warning.

The high mortality rate in the first 24 hours is etiologically closely related to the dominance of hemorrhage cases (53.5%) as the main cause in this study. Postpartum hemorrhage (PPH) is an emergency condition that progresses very quickly; failure in management of the third stage of labor or delay in referral can lead to fatal hypovolemic shock within hours. In line with research by the Ministry of Health Republic Indonesia, bleeding remains the main determinant of maternal mortality in Indonesia, which is often triggered by uterine atony or retained placenta that is not handled adequately in primary health facilities (Ministry of Health Republic Indonesia, 2022).

Obstetric complications such as postpartum hemorrhage and hypertensive disorders of pregnancy, including preeclampsia/eclampsia, are the leading causes of maternal death worldwide. Global analysis shows that obstetric hemorrhage remains the largest direct cause of maternal death**,** responsible for about one-third of all maternal deaths, while hypertensive disorders of pregnancy (which include preeclampsia and eclampsia) are the second leading cause of maternal death globally (Say et al. 2014; World Health Organization, 2025)**.** Gestational hypertension and eclampsia are associated with the risk of severe complications such as organ

failure and bleeding that worsen maternal prognosis, thus becoming the main focus of obstetric prevention and management efforts to reduce overall maternal mortality (Cerna et al., 2025).

These global findings are in line with research evidence and studies in Indonesia, which show that obstetric hemorrhage and preeclampsia/eclampsia are the two complications most frequently associated with maternal death in the context of national health services. Observational data from health facilities in Indonesia report that postpartum hemorrhage and hypertensive complications of pregnancy are the main causes of maternal death, with significant figures showing that a history of preeclampsia is statistically associated with the incidence of severe postpartum hemorrhage (Cerna et al., 2025; Triana & Syahredi, 2019; Umar & Wardhani, 2024). Maternal outcomes in cases of severe preeclampsia and eclampsia also show an increased risk of maternal and perinatal mortality, emphasizing the need for early detection, intensive management, and facility readiness in handling obstetric emergencies to prevent maternal deaths (Lumentut & Tendean, 2021).

Overall, these findings emphasize that the number of antenatal care (ANC) visits during pregnancy is not a sufficient predictor of maternal safety if it is not accompanied by quality emergency obstetric care. Efforts to reduce maternal mortality must focus on strengthening emergency management in the first 24 hours, including the availability of blood supplies, a medical team competent in the management of eclampsia, and an efficient referral protocol. As emphasized by Vogel et al. 2018), late intervention in the first hours after delivery will be very difficult to compensate for the clinical severity that occurs, so close monitoring during this golden period is imperative. Other studies have also reported that inadequate prenatal and delivery care contributes to increased early neonatal mortality, which confirms that reducing maternal and infant mortality depends not only on the number of ANC visits, but also on the quality of comprehensive antenatal care and the readiness of health facilities to handle obstetric and neonatal emergencies in the critical postpartum period (Paunno and Siahaya 2022).

The results of binary logistic regression analysis showed that Antenatal Care (ANC) variables, chronic diseases, and history of pregnancy complications had a statistically significant relationship with the incidence of maternal mortality ($p < 0.05$). Among these variables, chronic diseases emerged as the dominant factor with the highest Odds Ratio (OR) value (3.80), followed closely by irregular ANC (OR 3.77). This indicates that interventions in these three aspects have the greatest potential in reducing maternal mortality rates in the study location.

Chronic disease was identified as the strongest predictor of death in this study. Pregnant women with a history of chronic disease (such as heart disease, diabetes, or chronic hypertension) had a 3.8 times higher risk of death compared to women without chronic disease. This finding aligns with global trends reported by Turan et al, which state that non-obstetric medical conditions are now significant contributors to maternal mortality. Chronic comorbidities require multidisciplinary management that is often unavailable in primary health care facilities, increasing the risk of decompensation when facing the physical stress of childbirth (Turan et al. 2020).

A history of pregnancy complications has been shown to increase the risk of death by 3.48 times. A history of complications in a previous pregnancy, such as preeclampsia or hemorrhage, is a strong indicator of maternal biological or systemic vulnerability. Research by Say et al., in their systematic analysis for the World Health Organization, emphasized that mothers with a bad obstetric history require more intensive monitoring (high-risk monitoring). Without integrated medical records, the risk of recurrence is often not properly anticipated by birth attendants (Say et al. 2014). Interestingly, the gestational age variable in this study did not show a significant association with maternal mortality ($p = 0.635$). Although theoretically extreme ages (<20 or >35 years) are often associated with pregnancy risk, this finding suggests that in the study population, clinical factors such as chronic diseases and quality of care (ANC) were far more determinant than demographic factors alone.

The dominance of chronic diseases and complications in this study emphasizes the importance of the concept of preconception screening and strengthening referral management. Maternal deaths caused by medical conditions accompanying pregnancy are often indirect maternal deaths. The Indonesian Health Profile states that strengthening services at the upstream level, namely from the time of pregnancy through high-quality ANC services, is the key to reducing the burden of mortality caused by non-obstetric factors (Ministry of Health Republic Indonesia, 2022).

The integration of regular ANC visits and chronic disease detection creates synergy in preventing death. When pregnant women undergo regular checkups, chronic conditions can be managed pharmacologically and through lifestyle modifications to minimize risks during delivery. Failures in this system, as indicated by the high OR for the ANC variable, reflect barriers to access or a lack of public awareness of the importance of comprehensive maternal health monitoring (Lawn et al. 2014).

As a conclusion of this multivariate analysis, strategies to reduce maternal mortality should focus on close monitoring of high-risk groups (those with chronic diseases and a history of complications) and optimizing ANC visits. These efforts must be supported by a health information system capable of accurately tracking maternal medical histories. As emphasized by Vogel et al, success in reducing mortality is not only about dealing with complications during childbirth, but also about managing maternal health holistically from the beginning of pregnancy (Vogel et al. 2018).

Research limitations

Although this study covered all districts/cities in Lampung Province, the findings cannot be directly generalized to other provinces in Indonesia due to differences in health system characteristics, referral infrastructure, local culture, and population demographic profiles. These findings are specific to the Lampung context and require replication in other regions before they can be interpreted nationally.

The research instrument measured key variables such as family status, community status, maternal health status, reproductive status, access to health services, and health behaviors. However, several important determinants known to influence maternal mortality were not explicitly measured, including: the quality of ANC visits (not just their frequency/regularity), the severity of chronic diseases, the availability and readiness of health workers at the facility, and psychosocial factors such as family support and family decision-making.

CONCLUSION

The main conclusion of this study indicates that the postpartum period is the most dominant phase in maternal mortality in Lampung Province. The most critical time window was found to be the first 24 hours after delivery (the immediate postpartum), accounting for 63.1% of postpartum deaths, with hemorrhage being the primary cause (53.9%) and the hospital being the location of the highest incidence (71.2%). These findings confirm that the immediate postpartum phase is a period of greatest vulnerability, requiring close clinical supervision and high-quality emergency obstetric care. Multivariate analysis concluded that the most dominant risk factor influencing maternal mortality was the presence of chronic disease, followed by irregular antenatal care (ANC) visits and a history of pregnancy complications. Conversely, gestational age did not show a strong significant association in this study population. Therefore, strategies to reduce maternal mortality must focus on strengthening preconception screening, optimizing the quality of ANC for early risk detection, and holistic management of chronic medical conditions from the beginning of pregnancy.

AUTHOR'S DECLARATION

Authors' contributions and responsibilities

LS: Writing original draft, visualization, funding acquisition, conceptualization; **WA:** Writing original draft (supporting), funding acquisition; **RP:** Supervision (lead), validation (equal), visualization (equal), funding acquisition (equal), review and editing; **SS:** Writing original draft, formal analysis, conceptualization;

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Availability of data and materials
All data are available from the authors.

Competing interests
The authors declare no competing interests.

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REFERENCES

Azizah, Nadia, Dr. Wahab Abdul., Wiratama, Bayu Satria. (2017). Pengaruh Kelengkapan Komponen Antenatal Care (ANC) Terhadap Kematian Neonatal: Analisis Data SDKI 2017. *[Thesis]. Yogyakarta: Universitas Gadjah mada.* https://etd.repository.ugm.ac.id/penelitian/detail/263817

Badan Pusat Statistik. (2024). *Profil Kesehatan Ibu Dan Anak 2024*. Jakarta. https://www.bps.go.id/id/publication/2024/12/31/a919c55a72b74e33d011b0dc/profile-of-mother-and-child-health-2024.html.

Bello-Álvarez, Laura-Margarita et al. (2026). Effects of Maternal Education on Maternal and Perinatal Outcomes: An Individual Participant Data Meta-analysis of 2,356,402 Pregnancies. *International Journal of Gynecology & Obstetrics* 172(2): 886–95. https://doi.org/10.1002/ijgo.70401

Beňová, Lenka, and Justine Marshall. (2018). *Quality, Not Just Quantity: Antenatal Care in LMICs*. India: Online media. https://healthynewbornnetwork.org/blog/2018/quality-not-just-quantity-antenatal-care-in-lmics/.

Caride-Miana, Elena, Domingo Orozco-Beltrán, Jose Antonio Quesada-Rico, and Jose Joaquin Mira-Solves. (2025). The Impact of Chronic Diseases on All-Cause Mortality in Spain: A Population-Based Cohort Study. *Atención Primaria* 57(5): 103112. https://doi.org/10.1016/j.aprim.2024.103112

Cerna, N. V. G., Huapaya, N. M. J., & Quispe, W. A. (2025). Preeclampsia as a risk factor for postpartum hemorrhage: a systematic review and meta-analysis. *Journal of Obstetrics and Gynaecology Canada*, 103157. https://doi.org/10.1016/j.jogc.2025.103157

Clarke-Deelder, Emma et al. (2023). Immediate Postpartum Care in Low- and Middle-Income Countries: A Gap in Healthcare Quality Research and Practice. *American Journal of Obstetrics & Gynecology MFM* 5(2): 100764. https://doi.org/10.1016/j.ajogmf.2022.100764

Doku, David T, and Subas Neupane. (2017). Survival Analysis of the Association between Antenatal Care Attendance and Neonatal Mortality in 57 Low- and Middle-Income Countries. *International Journal of Epidemiology* 46(5): 1668–77. https://doi.org/10.1093/ije/dyx125

Febles, M., Scott, G., Gillon, T., Pels, A., Klepp, K., Costa, M. L., ... & Magee, L. A. (2026). Hypertensive Disorders of Pregnancy: A Systematic Review of International Clinical Practice Guidelines. *American Journal of Obstetrics and Gynecology*. https://doi.org/10.1016/j.ajog.2026.02.042

Firmansyah, Firmansyah, Huntari Harahap, and Ariska Kurnia Juniarti. (2022). Studi Literature: Gambaran Determinan Kematian Maternal. *Electronic Journal of Scientific Environmental Health And Disease* 3(2): 154–59. https://doi.org/10.22437/esehad.v3i2.27767

Geng, JinSong et al. (2021). Chronic Diseases as a Predictor for Severity and Mortality of COVID-19: A Systematic Review With Cumulative Meta-Analysis. *Frontiers in Medicine, 8, 588013.* https://doi.org/10.3389/fmed.2021.588013

Gunderson, Erica P. et al. (2025). Severe Maternal Morbidity Associated With Chronic Hypertension, Preeclampsia, and Gestational Hypertension. *JAMA Network Open* 8(1): e2451406. https://doi.org/10.1001/jamanetworkopen.2024.51406

Hug, Lucia, Monica Alexander, Danzhen You, and Leontine Alkema. (2019). National, Regional, and Global Levels and Trends in Neonatal Mortality between 1990 and 2017, with Scenario-Based Projections to 2030: A Systematic Analysis. *The Lancet Global Health* 7(6): e710–20. https://doi.org/10.1016/S2214-109X(19)30163-9

Karlsen, Saffron et al. (2011). The Relationship between Maternal Education and Mortality among Women Giving Birth in Health Care Institutions: Analysis of the Cross-Sectional WHO Global Survey on Maternal and Perinatal Health. *BMC Public Health* 11: 606. https://doi.org/10.1186/1471-2458-11-606

Khairani, K., & Gurning, F. P. (2025). Analisis Implementasi Kebijakan Program Pelayanan Antenatal Care (ANC) dalam Upaya Menurunkan Angka Kematian Ibu di Puskesmas X Kota Medan. *MOTORIK Jurnal Ilmu Kesehatan*, *20*(2), 66-81. https://doi.org/10.61902/motorik.v20i2.1869

Lawn, Joy E et al. (2014). Every Newborn: Progress, Priorities, and Potential beyond Survival. *The Lancet* 384(9938): 189–205. https://doi.org/10.1016/S0140-6736(14)60496-7

Lumentut, Anastasia M., and Hermie M. M. Tendean. (2021). Luaran Maternal Dan Perinatal Pada Preeklampsia Berat Dan Eklampsia. *JURNAL BIOMEDIK (JBM)* 13(1): 18. https://doi.org/10.35790/jbm.13.1.2021.32109

Mengistu, Tigist Astale, and Tadese Ejigu Tafere. (2011). Effect of Antenatal Care on Institutional Delivery in Developing Countries: A Systematic Review. *JBI Database of Systematic Reviews and Implementation Reports* 9(35): 1447–70. https://doi.org/10.11124/01938924-201109350-00001

Nurkhayati, E., & Septavia, D. V. (2023). Analisis kunjungan antenatal care (anc) dengan kejadian komplikasi persalinan. *Jurnal Kesehatan*, *12*(2), 125-131. https://jurnal.uym.ac.id/index.php/kesehatan/article/view/275

Ministry of Health Repbulic Indonesia RI. (2022). *Profil Kesehatan Indonesia Tahun 2021*. https://www.kemkes.go.id/id/profil-kesehatan-indonesia-2021 .

Paunno, Magdalena Lena, and Griennsaty Clawdya Siahaya. (2022). Pengaruh Perawatan Kehamilan Dan Persalinan Dengan Kejadian Kematian Neonatal. *Jurnal Kesehatan Reproduksi* 8(3). https://doi.org/10.22146/jkr.61550

Putri, D. K. (2024). Determinan kematian ibu di Indonesia: literature review. *Journal of Midwifery and Healthcare Sciences*, *1*(1). https://journal.umnyarsi.ac.id/index.php/JMHS/article/view/50

Rai, Rajesh Kumar, Anamitra Barik, and Abhijit Chowdhury. (2022). Use of Antenatal and Delivery Care Services and Their Association with Maternal and Infant Mortality in Rural India. *Scientific Reports* 12(1): 16490. https://doi.org/10.1038/s41598-022-20951-9

Say, Lale et al. (2014). Global Causes of Maternal Death: A WHO Systematic Analysis. *The Lancet Global Health* 2(6). https://doi.org/10.1016/S2214-109X(14)70227-X

Souza, João Paulo et al. (2024). A Global Analysis of the Determinants of Maternal Health and Transitions in Maternal Mortality. *The Lancet Global Health* 12(2): e306–16. https://doi.org/10.1016/S2214-109X(23)00468-0

Syairaji, M. et al. (2024). Trends and Causes of Maternal Mortality in Indonesia: A Systematic Review." *BMC Pregnancy and Childbirth* 24(1): 515. https://doi.org/10.1186/s12884-024-06687-6

Symonds, Nicola E. et al. (2023). Risk Factors for Postpartum Maternal Mortality and Hospital Readmission in Low- and Middle-Income Countries: A Systematic Review. *BMC Pregnancy and Childbirth* 23(1): 303. https://doi.org/10.1186/s12884-023-05459-y

Suarni, L., Rahmayati, E., & Kodri, K. (2024). Maternal and neonatal referral system in rural North Lampung: a qualitative study of referral system readiness. *Healthcare in Low-Resource Settings*, *12*(4). https://doi.org/10.4081/hls.2024.12845

Triana, Esfi, and Syahredi Syahredi. (2019). Eklampsia Antepartum Pada G5P4A0H3 Gravid

Preterm 33-34 Minggu + Sindrom HELLP + AKI + IUFD." *Jurnal Kesehatan Andalas* 8(1S): 79. https://doi.org/10.25077/jka.v8i1S.930

Turan, Ozlem et al. (2020). Clinical Characteristics, Prognostic Factors, and Maternal and Neonatal Outcomes of SARS-CoV-2 Infection among Hospitalized Pregnant Women: A Systematic Review. *International Journal of Gynecology & Obstetrics* 151(1): 7–16. https://doi.org/10.1002/ijgo.13329

Umar, Mareza, and Psiari Kusuma Wardhani. (2024). Riwayat Pre Eklampsia Terhadap Kejadian Post Partum. *Jurnal Maternitas Aisyah (JAMAN AISYAH)* 5(2): 118–22. https://doi.org/10.30604/jaman.v5i2.1588

Vogel, Joshua P. et al. (2018). The Global Epidemiology of Preterm Birth. *Best Practice & Research Clinical Obstetrics & Gynaecology* 52: 3–12. https://doi.org/10.1016/j.bpobgyn.2018.04.003

World Health Organization. (2024). *Maternal mortality*. Geneva. https://www.who.int/news-room/fact-sheets/detail/maternal-mortality.

World Health Organization. (2025). *World Health Organization Compendium on Respectful Maternal and Newborn Care*. Geneva. https://www.who.int/publications/i/item/9789240110939.

Wondemagegn, Amsalu Taye, Animut Alebel, Cheru Tesema, and Worku Abie. (2018). The Effect of Antenatal Care Follow-up on Neonatal Health Outcomes: A Systematic Review and Meta-Analysis. *Public Health Reviews* 39(1): 33. https://doi.org/10.1186/s40985-018-0110-y

Yusanti, Linda. (2022). Analyze Maternal Mortality Factors Causes in Indramayu Regency, West Java. *Jurnal Kebidanan* 12(2): 103–11. https://doi.org/10.31983/jkb.v12i2.8067