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Causes of Maternal Mortality in Indonesia: Hemorrhage, Hypertension, Infection, and Their Implications for Midwifery Practice

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Abstract

Background. According to the 2020 Long Form Population Census, Indonesia's maternal mortality rate (MMR) remains at 189 per 100,000 live births. Strategies to reduce this rate require up-to-date and reliable information on causes of death.
Objectives. To describe trends in causes of maternal mortality in Indonesia from 2019 to 2023, to examine shifts in the proportion of deaths due to pregnancy-induced hypertension (PIH) versus hemorrhage, and to assess the quality of data on causes of death.
Methods. A descriptive-analytical study with a trend design using freely downloadable secondary data from the 2019–2023 Indonesia Health Profile. The proportion of each cause was calculated relative to total deaths. Changes in the composition of PH and hemorrhage were tested using the chi-square test and the Cochran–Armitage trend test, with 95% Wilson confidence intervals and sensitivity analysis.
Results. The number of reported maternal deaths was 4,221 (2019), 4,652 (2020), 7,389 (2021; 40.4% due to COVID-19), 3,572 (2022), and 4,482 (2023). Hemorrhage, preterm birth, and infection accounted for 84–88% of deaths with specific causes from 2019 to 2022. The proportion of HDK relative to the combined total of HDK and hemorrhage rose from 45.4% (95% CI 43.4–47.5) in 2019 to 53.4% (95% CI 49.8–56.9) in 2023 ($z = 4.72$; $p < 0.001$), and PHE has surpassed hemorrhage as the leading cause since 2022. The proportion of deaths due to "other" causes rose from 31.1% to 63.0%.
Conclusion. Hypertension in pregnancy has now become the leading specific cause of maternal mortality in Indonesia, while the quality of data on causes of death has declined. Midwifery care needs to strengthen the early detection and management of preeclampsia, continue to prioritize the management of postpartum hemorrhage, and contribute to improving data recording through surveillance and maternal mortality response.
Keywords: maternal mortality; causes of death; hypertension in pregnancy; hemorrhage; midwifery care

Introduction

Maternal mortality remains a key indicator of the quality of the health system and midwifery services. Globally, approximately 700 women die every day from complications of pregnancy and childbirth—most of which are preventable—and Sustainable Development Goal (SDG) 3.1 calls for a maternal mortality ratio below 70 per 100,000 live births by 2030 (World Health Organization [WHO] et al., 2025). Indonesia is still far from this target. Results from the 2020 Long-Form Population Census show a maternal mortality rate (MMR) of 189 per 100,000 live births, with wide

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disparities across provinces, ranging from 48 in DKI Jakarta to 565 in Papua (Central Statistics Agency [BPS], 2023).

Understanding the causes of death is just as important as knowing the numbers, since preventive interventions are specific to each cause. A WHO systematic analysis covering the period 2003–2009 found that hemorrhage (27.1%), hypertensive disorders (14.0%), and sepsis (10.7%) accounted for more than half of maternal deaths worldwide, while indirect causes accounted for 27.5% (Say et al., 2014). An update for the 2009–2020 period shows a similar pattern: hemorrhage remains the leading cause (27%), followed by indirect obstetric causes (23%) and hypertensive disorders (16%), and the majority of deaths from hemorrhage and sepsis occur in the postpartum period (Cresswell et al., 2025). A review from Sub-Saharan Africa also identified obstetric hemorrhage, hypertension in pregnancy, non-obstetric complications, and infections as the top four causes (Musarandega et al., 2021).

In Indonesia, the composition of causes of maternal mortality is shifting. A systematic review of 63 studies from 1970 to 2022 reported that the proportion of deaths due to hemorrhage decreased from 48% to 18% and those due to sepsis from 15% to 5%, while the proportion of deaths due to hypertensive disorders rose from 8% to 19% and those due to non-obstetric causes from 10% to 49% (Syairaji et al., 2024). A multicenter cohort study conducted at 30 hospitals in 2022–2023 recorded a mortality rate of 1.33% among cases of preeclampsia, with pulmonary edema and intensive care as factors associated with mortality (Akbar et al., 2025). Analysis of census data indicates that the risk of maternal mortality in Indonesia is linked to access to health facilities and skilled personnel (Cameron et al., 2019), consistent with the framework of the “three delays”: delay in deciding to seek care, delay in reaching a facility, and delay in receiving adequate care (Thaddeus & Maine, 1994).

This shift is significant for midwives. Midwives are most often the first point of contact for mothers during pregnancy, childbirth, and the postpartum period, placing them in a key position for early detection and timely referral. Global modeling estimates that expanding the coverage of midwifery interventions could prevent the majority of maternal deaths, neonatal deaths, and stillbirths (Homer et al., 2014; Nove et al., 2021). The quality framework for midwifery care also emphasizes that midwives’ contributions include prevention, detection, and early management of complications—not just assistance with normal deliveries (Renfrew et al., 2014). Interventions with strong evidence for the three leading causes are already available, including a package for the early detection and management of postpartum hemorrhage (Gallos et al., 2023), low-dose aspirin to prevent preterm preeclampsia (Rolnik et al., 2017), and magnesium sulfate to prevent eclampsia (Magpie Trial Collaborative Group, 2002).

However, analyses using the latest national routine data remain limited. Existing systematic reviews combine studies with different designs, regions, and classification methods (Syairaji et al., 2024), while the Indonesia Health Profile presents annual figures without cross-year trend analysis. The quality of data on causes of death is also rarely discussed, even though the large proportion of deaths classified as “other causes” reduces the data’s usefulness for program planning. The WHO has provided the ICD-MM classification to standardize the categorization of causes of maternal mortality (WHO, 2012) as well as guidelines for maternal death surveillance and response (MDSR) to ensure that every death is reviewed and followed up (WHO, 2013).

This study aims to (1) describe the number and proportion of maternal deaths by cause in Indonesia from 2019 to 2023 based on routine reports from the Ministry of Health, (2) examine changes in the proportion of deaths due to hypertension in pregnancy compared to hemorrhage, (3) assess the magnitude of deaths with unspecified causes as an indicator of data quality, and (4) formulate implications for midwifery practice.

Methods

Study Design. This is a descriptive-analytical study with a trend (aggregate *time-series*) design using five years of national-level secondary data, specifically from 2019 to 2023. The unit of analysis was reported maternal deaths categorized by cause group per year. Reporting followed the STROBE guidelines for observational studies to the extent relevant to aggregate data.

Data Sources. Data were downloaded from official publications freely accessible on the internet:

1. Indonesia Health Profile 2019, Appendices 20 and 21, for the number and causes of maternal deaths in 2019 (Ministry of Health of the Republic of Indonesia [Kemenkes RI], 2020).
2. Indonesian Health Profile 2020, Chapter V and appendices, for the year 2020 (Kemenkes RI, 2021).
3. Indonesian Health Profile 2021 for the year 2021. Details on causes of death were taken from a Katadata data publication citing the Directorate General of Public Health, as the original appendix files could not be downloaded in their entirety (Kemenkes RI, 2022, as cited in Kusnandar, 2022).
4. Indonesian Health Profile 2022, Appendices 21 and 22, for the year 2022 (Indonesian Ministry of Health, 2023).
5. Indonesia Health Profile 2023 for the year 2023. Chapter V of the original document was truncated upon download, so the details of the causes were taken from a journal article that cited it (Indonesian Ministry of Health, 2024, as cited in Irnawati et al., 2024).
6. Results from the 2020 Population Census Long Form for national and provincial maternal mortality rates as context (BPS, 2023).

Each figure was checked for consistency by summing all cause categories and comparing them to the total number of deaths in the same year.

Variables. The main variables are the number of maternal deaths by cause group as defined by the Ministry of Health: hemorrhage, pregnancy-induced hypertension (PIH), infection, circulatory system disorders, heart defects, metabolic disorders, COVID-19, abortion, ectopic pregnancy, and others. Since the heart category was separated only starting in 2020, the categories of circulatory system and heart disorders were combined into “cardiovascular” to allow for year-to-year comparisons. In 2023, the categorization changed to follow a framework closer to the ICD-MM (e.g., other obstetric complications, abortion complications, unanticipated management complications, and non-obstetric complications), so the 2023 data were analyzed with caution. The “other” category was used as a proxy indicator of the quality of cause-of-death determination.

Data analysis. The analysis was conducted in three stages.

1. *Descriptive analysis.* The proportion of each cause was calculated relative to the total number of maternal deaths in the same year. Proportions were also

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calculated relative to deaths with specific causes, defined as the total minus the "other" category, COVID-19, and unspecified cases.

2. *Test for changes in composition.* Changes in the proportion of HDK compared to hemorrhage were tested using a 2 × 5 chi-square test and the Cochran–Armitage trend test, with the proportion of HDK/(HDK + hemorrhage) as the measure. The 95% confidence interval (95% CI) for the proportion was calculated using the Wilson method.
3. *Sensitivity analysis.* Trends were re-tested excluding 2023 due to a change in the classification system, and excluding 2021 due to a surge in COVID-19 deaths.

The analysis was performed using Python 3 (SciPy library). A p-value < 0.05 (two-tailed) was considered statistically significant.

Ethics. This study used publicly available aggregated data without any identifying information, so no ethical approval was required.

Results

The number of maternal deaths fluctuated sharply over the five-year period. Routine reports recorded 4,221 maternal deaths in 2019, 4,652 deaths with specified causes in 2020 (4,627 total reported), then surged to 7,389 in 2021 when 2,982 deaths (40.4%) were attributed to COVID-19. The number dropped to 3,572 in 2022 and rose again to 4,482 in 2023. Complete details are presented in Table 1.

Table 1. Number and percentage of maternal deaths by cause, Indonesia 2019–2023

Cause	2019 n (%)	2020 n (%)	2021 n (%)	2022 n (%)	2023 n (%)
Bleeding	1,280 (30.3)	1,330 (28.6)	1,320 (17.9)	741 (20.7)	360 (8.0)
Hypertension during pregnancy	1,066 (25.3)	1,110 (23.9)	1,077 (14.6)	801 (22.4)	412 (9.2)
Infections	207 (4.9)	216 (4.6)	207 (2.8)	175 (4.9)	86 (1.9)
Cardiovascular[a]	200 (4.7)	263 (5.7)	400 (5.4)	259 (7.3)	–
Metabolic disorders	157 (3.7)	144 (3.1)	80 (1.1)	0 (0.0)	–
COVID-19	–	5 (0.1)	2,982 (40.4)	73 (2.0)	–
Abortion	–	–	14 (0.2)	0 (0.0)	45 (1.0)[b]
Ectopic pregnancy	–	–	–	19 (0.5)	–
Other obstetric complications[b]	–	–	–	–	204 (4.6)
Unanticipated management complications[b]	–	–	–	–	43 (1.0)
Non-obstetric complications[b]	–	–	–	–	19 (0.4)
Other	1,311 (31.1)	1,584 (34.0)	1,309 (17.7)	1,504 (42.1)	2,825 (63.0)
Not specified in	–	–	–	–	488 (10.9)

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Cause	2019 n (%)	2020 n (%)	2021 n (%)	2022 n (%)	2023 n (%)
the source					
Total	**4,221**	**4,652**	**7,389**	**3,572**	**4,482**

Note. The symbol – indicates that the category was not reported in that year. [a]Combination of circulatory system disorders and heart defects; in 2019, heart defects were included in circulatory system disorders. [b]2023 classification categories aligned with ICD-MM. The 2020 total represents the number of cases with specified causes. Source: Indonesian Ministry of Health (2020, 2021, 2023); Kusnandar (2022); Irnawati et al. (2024), adapted.

Hemorrhage, hypertension, and infection continue to account for the majority of deaths with specific causes. If the "other," "COVID-19," and "unspecified" categories are excluded, these three causes accounted for 87.7% of deaths in 2019, 86.7% in 2020, 84.1% in 2021, and 86.1% in 2022. In 2023, under the new classification, HDK accounted for 35.2%, hemorrhage for 30.8%, and infection for 7.4% of the 1,169 deaths with specific causes.

Hypertension in pregnancy surpassed hemorrhage as the most common specific cause. From 2019 to 2021, HDK accounted for approximately 45% of the combined total of HDK and hemorrhage, and this composition remained unchanged from year to year ($\chi^2 = 0.19$; df = 2; $p = 0.91$). Since 2022, HDK has surpassed hemorrhage for the first time (Table 2). The Cochran–Armitage trend test showed a statistically significant increase in the proportion of HDK during 2019–2023 ($z = 4.72$; $p < 0.001$). This increase remained significant in sensitivity analyses excluding 2023 ($z = 3.17$; $p = 0.002$), excluding 2021 ($z = 5.29$; $p < 0.001$), and excluding both years ($z = 4.12$; $p < 0.001$).

Table 2. Proportion of pregnancy-induced hypertension among combined cases of preeclampsia and hemorrhage, 2019–2023

Year	HDK + hemorrhage (n)	HDK (%)	95% CI	HDK to Bleeding Ratio
2019	2,346	45.4	43.4–47.5	0.83
2020	2,440	45.5	43.5–47.5	0.83
2021	2,397	44.9	42.9–46.9	0.82
2022	1,542	51.9	49.5–54.4	1.08
2023	772	53.4	49.8–56.9	1.14

Note: The 95% CI was calculated using the Wilson method. Cochran–Armitage trend test for 2019–2023: $z = 4.72$; $p < 0.001$.

Deaths from "other" causes rose sharply. The share of this category rose from 31.1% (95% CI 29.7–32.5) in 2019 to 42.1% (95% CI 40.5–43.7) in 2022 and 63.0% (95% CI 61.6–64.4) in 2023 (Figure 1). The decrease in 2021 (17.7%) occurred because COVID-19 was recorded as a separate category. If COVID-19 deaths are excluded from the denominator, the "other" category accounted for 29.7% of maternal deaths in 2021. When the 488 cases listed as "unspecified" in the 2023 data are included, nearly three-quarters (73.9%) of maternal deaths in 2023 had no specific cause.

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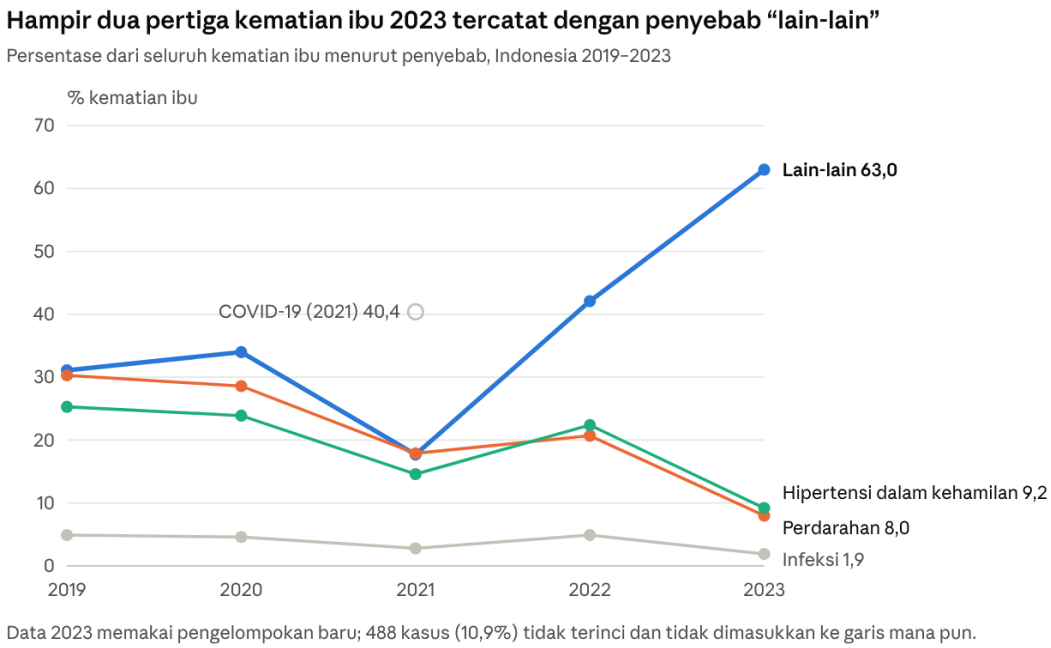


Figure 1. Nearly two-thirds of maternal deaths in 2023 were recorded under the cause "other." Source: Indonesian Ministry of Health (2020, 2021, 2023); Indonesian Ministry of Health (2022, as cited in Kusnandar, 2022); Indonesian Ministry of Health (2024, as cited in Irnawati et al., 2024), processed.

Discussion

This study yielded three main findings. First, hemorrhage, pregnancy-induced hypertension, and infection still account for approximately 85% of maternal deaths with specific causes in Indonesia. Second, since 2022, HDK has surpassed hemorrhage as the leading specific cause of death, and this trend is statistically significant. Third, the proportion of deaths with "other" causes rose sharply to nearly two-thirds in 2023, thereby reducing the ability of routine data to guide programs.

A shift from hemorrhage to hypertension. These findings align with a systematic review showing that the proportion of deaths due to hemorrhage in Indonesia fell from 48% to 18%, while the proportion due to hypertensive disorders rose from 8% to 19% between 1990 and 2022 (Syairaji et al., 2024). This pattern is known as the obstetric transition: as access to facility-based childbirth and uterotonic agents improves, deaths from hemorrhage decline more rapidly than deaths from conditions requiring ongoing detection and management, such as preeclampsia. Globally, hemorrhage remains the leading cause (27%), but the proportion attributable to hypertension varies by region and is highest in Latin America and the Caribbean (Cresswell et al., 2025). In Indonesia, a cohort study across 30 hospitals found that deaths from preeclampsia were associated with pulmonary edema (aOR 3.97) and intensive care (aOR 5.25), indicating that many mothers arrived at the hospital already in a state of severe complications (Akbar et al., 2025). This situation reflects the first and second delays within the framework of the three delays (Thaddeus & Maine, 1994).

A decrease in the incidence of hemorrhage does not mean that the problem of hemorrhage has been resolved. In 2022, 741 deaths due to hemorrhage were still

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recorded, and the majority of global deaths due to hemorrhage occur in the postpartum period (Cresswell et al., 2025). The E-MOTIVE clinical trial demonstrated that objectively measuring blood loss using calibrated absorbent pads, combined with an immediate first-response package, reduces the incidence of severe outcomes due to postpartum hemorrhage (Gallos et al., 2023). This package is simple and can be implemented by midwives at primary-level facilities.

Infections and indirect causes. The proportion of infections is relatively small and stable (approximately 5% of all deaths prior to 2023), consistent with a decline in sepsis from 15% to 5% in a national review (Syairaji et al., 2024). In contrast, cardiovascular causes rose from 4.7% in 2019 to 7.3% in 2022. This increase aligns with the rising proportion of non-obstetric causes and noncommunicable diseases in maternal deaths in Indonesia (Syairaji et al., 2024) and with the significant proportion of indirect causes at the global level (Cresswell et al., 2025; Say et al., 2014). The surge in deaths in 2021, when COVID-19 accounted for 40.4% of maternal deaths, also indicates that pregnant women are vulnerable to non-obstetric illnesses and require services integrated with internal medicine care.

The "other" cause category raises concerns about data quality. The 63% share of "other" causes in 2023 is significantly higher than that found in an ICD-MM-based review in Sub-Saharan Africa, which identified only a small number of deaths with unknown causes (Musarandega et al., 2021). This large "other" category may stem from several factors: incomplete completion of death certificates, deaths occurring outside facilities without audit, classification of indirect causes into the residual category, and the transition period to the new classification system in 2023. Consequently, the decrease in the proportion of hemorrhage and HDK among all deaths in 2023 (8.0% and 9.2%) cannot be interpreted as a true decline, as some cases of hemorrhage or HDK were likely recorded under "other." The ICD-MM classification was developed to address these issues with uniform cause groups and clear definitions (WHO, 2012), and the MDSR guidelines emphasize that every death must be identified, reviewed, and followed up (WHO, 2013). The national review's recommendation to prioritize MDSR (Syairaji et al., 2024) is supported by the findings of this study.

Implications for midwifery practice. Shifts in causes of death demand a shift in the focus of midwifery care:

1. *Hypertension in pregnancy.* Midwives need to measure blood pressure and check for proteinuria at every antenatal visit, assess risk factors for preeclampsia at the first visit, and refer high-risk mothers to receive low-dose aspirin starting at 11–14 weeks of gestation, which has been shown to reduce the incidence of preterm preeclampsia (Rolnik et al., 2017). In cases of severe preeclampsia, midwives must be able to administer an initial dose of magnesium sulfate before referral, as this therapy reduces the risk of eclampsia by more than half (Magpie Trial Collaborative Group, 2002). Blood pressure monitoring should also continue during the postpartum period.
2. *Bleeding.* The implementation of active management of the third stage of labor, objective measurement of blood loss, and the E-MOTIVE protocol for the initial management of postpartum hemorrhage (Gallos et al., 2023) should be standard practice at every birthing facility.

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3. *Infections and indirect causes.* Midwives need to screen for comorbidities such as heart disease, anemia, and diabetes early in pregnancy, and establish collaborative referral pathways with physicians.
4. *Documentation and audits.* Midwives play a role in completing death chronologies, verbal autopsies, and maternal-perinatal audits so that causes of death can be coded correctly.

Global modeling indicates that full coverage of midwifery interventions can prevent the majority of maternal deaths (Homer et al., 2014; Nove et al., 2021), provided that midwives work within a system that supports quality of care (Renfrew et al., 2014). The extremely wide provincial disparities in maternal mortality rates (BPS, 2023) and the association between mortality risk and access to services (Cameron et al., 2019) indicate that these efforts need to be prioritized in eastern Indonesia.

Limitations. This study has several limitations. First, the data consist of routine reports that depend on the completeness of reporting by health facilities and health departments; thus, the number of deaths is likely lower than the actual figure. Second, the categorization of causes was not entirely consistent across years, particularly in 2023; therefore, comparisons were made by combining categories and conducting sensitivity analyses. Third, the detailed cause-of-death data for 2021 and 2023 were obtained from a secondary source citing the Health Profile because the original dataset could not be downloaded in its entirety, and 488 cases in 2023 were not itemized in that source. Fourth, the analysis is a national aggregate, so it cannot assess differences between provinces or individual risk factors. Fifth, trend tests on the aggregate data treat each death as an independent observation and do not account for changes in reporting practices.

Conclusion

Hemorrhage, pregnancy-induced hypertension, and infection remained the leading specific causes of maternal mortality in Indonesia from 2019 to 2023, accounting for approximately 85% of deaths with known causes. The composition has shifted: since 2022, hypertension in pregnancy has surpassed hemorrhage, and its share of the combined total for these two causes rose from 45.4% to 53.4%. At the same time, the share of deaths classified as “other” causes rose from 31.1% to 63.0%, making routine data increasingly inadequate for describing the actual causes of death.

Recommendations.

1. *For midwives and primary care facilities:* strengthen screening and monitoring of blood pressure during pregnancy and the postpartum period; ensure early referral of mothers at risk for preeclampsia; ensure readiness of initial-dose magnesium sulfate; and implement the postpartum hemorrhage early management protocol.
2. *For health departments and the Ministry of Health:* consistently apply the ICD-MM, train staff in determining causes of death, and strengthen the MDSR system to reduce the proportion of “other” causes.
3. *For midwifery education:* incorporate competencies in the detection of noncommunicable diseases during pregnancy and in maternal death audits into the curriculum.

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4. *For researchers:* conduct analyses at the provincial and district levels using MDSR data, and assess the validity of determining causes of death through verbal autopsies.

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Note: Details on the causes of maternal deaths in the 2021 Indonesian Health Profile (Indonesian Ministry of Health, 2022) and the 2023 Indonesian Health Profile (Indonesian Ministry of Health, 2024) were cited from secondary sources, namely Kusnandar (2022) and Irnawati et al. (2024), in accordance with APA 7 secondary citation guidelines.