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Antenatal Visit Coverage (K1, K4, K6) and Its Association with Maternal Mortality Rates Across Provinces in Indonesia

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Abstract

Background. Indonesia's Maternal Mortality Rate (MMR), based on the 2020 Long Form Population Census, is 189 per 100,000 live births, with a range across provinces from 48 (DKI Jakarta) to 565 (Papua). Antenatal visits (K1, K4, and, since 2021, K6) are the primary midwifery services for early detection of pregnancy risks.
Objective. To analyze the relationship between K1 and K4 coverage and MMR across provinces in Indonesia, and to contextualize the K6 standard within this framework.
Methods. A cross-sectional ecological study using downloadable secondary data: the 2020 Indonesia Health Profile (K1 and K4 coverage, number of maternal deaths, and live births in 34 provinces) and MMR data from the Long Form of the 2020 Population Census (SP2020) by the Central Statistics Agency (BPS). Relationships were tested using Spearman's correlation.
Results. National coverage rates were 93.3% for K1 and 84.6% for K4. K4 coverage was negatively correlated with the MMR from the Long Form 2020 Population Census (rho = −0.57; p = 0.007; n = 21 provinces) and with facility-reported maternal mortality (rho = −0.41; p = 0.017; n = 34). Papua (K4 27.5%; MMR 565) and West Papua (K4 34.5%; MMR 343) ranked second-worst on both measures.
Conclusion. Provinces with lower antenatal care coverage tend to have higher MMRs. Strengthening the role of midwives to ensure pregnant women continue to attend visits from K1 through K4/K6, particularly in eastern Indonesia, should be a priority.
Keywords: antenatal care, K1, K4, K6, maternal mortality rate, midwives, provinces

Introduction

Maternal mortality is the most sensitive indicator for assessing the performance of a country's health system. The World Health Organization estimates that approximately 287,000 women died due to pregnancy and childbirth in 2020, with a global maternal mortality ratio of 223 per 100,000 live births, and about 95% of these deaths occurred in low- and lower-middle-income countries (World Health Organization [WHO], 2023). Most of these deaths could be prevented if women received effective care during pregnancy, childbirth, and the postpartum period (Campbell & Graham, 2006; Souza et al., 2024).

Indonesia has recorded a significant decline. A systematic review of 63 studies showed that the national maternal mortality ratio fell by approximately 45% between 1990 and 2020, although it remains among the highest in Southeast Asia (Syairaji et al., 2024). Results from the 2020 Population Census Long Form (LF SP2020) recorded a Maternal Mortality Rate (MMR) of 189 per 100,000 live births (Central Statistics Agency [BPS], 2023). This figure remains above the 2020–2024 National Medium-Term Development

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Plan (RPJMN) target of 183 (Ministry of National Development Planning/Bappenas, 2020) and is far from the *Sustainable Development Goals* (SDGs) 3.1 target of less than 70 per 100,000 live births by 2030.

A more fundamental issue is the disparity across regions. The MMR in Papua (565) is nearly twelve times that of DKI Jakarta (48), and the provinces with the highest MMRs are concentrated outside of Java–Bali (BPS, 2023). Syairaji et al. (2024) reported a similar pattern, with the MMR in Sulawesi and eastern Indonesia more than twice the national average. Analysis of census data shows that approximately 23% of the difference in MMR between high- and low-performing provinces can be explained by access to and characteristics of health services, particularly the availability of doctors at community health centers and distance to hospitals (Cameron et al., 2019).

Antenatal care (ANC) serves as the gateway to midwifery care and the first point of contact between the health system and pregnant women. Through ANC, midwives screen for risk factors such as anemia, hypertension, preeclampsia, and chronic energy deficiency; administer immunizations and iron supplements; and develop birth plans and referral strategies through the Program for Birth Planning and Complication Prevention (P4K). In *the "three delays"* model, comprehensive ANC reduces delays in deciding to seek care and delays in reaching a health facility (Thaddeus & Maine, 1994).

Empirical evidence in Indonesia supports this role. An analysis of the 2017 SDKI data showed that ANC visits are associated with the incidence of detected obstetric complications (Sudaryo & Sam, 2022). A case-control study in Purwakarta found that high-quality ANC significantly reduces the risk of maternal mortality (Zenitasari et al., 2026), and a study in Banyumas showed that the completeness of integrated ANC service components is associated with maternal mortality rates at the community health center level (Aldila et al., 2025). In East Java, the quality of ANC was negatively correlated with maternal mortality during the COVID-19 pandemic (Satyawan et al., 2023).

Standards for the number of visits continue to evolve. Indonesia previously used a minimum standard of four visits (K4). The WHO (2016) subsequently recommended a minimum of eight contacts for a positive pregnancy experience, and Indonesia adjusted this through Ministry of Health Regulation No. 21 of 2021 to a minimum of six visits (K6), with at least two examinations by a doctor, including ultrasounds in the first and third trimesters (Ministry of Health of the Republic of Indonesia [Kemenkes RI], 2021b). Utilization of ANC in accordance with standards is influenced by the mother's education, economic status, distance to facilities, insurance coverage, and region of residence (Fauzi et al., 2021). Laksono et al. (2020) even found that women in Nusa Tenggara and Java–Bali were 4.4 and 3.6 times more likely, respectively, to have ≥4 ANC visits compared to women in Papua.

Most of these studies were conducted at the individual or district level. Analyses at the provincial level linking routine service coverage to MMR remain limited, even though policies on personnel deployment and budget allocation are established at this level. Data on ANC coverage and MMR by province are actually publicly available, so ecological analyses can provide a quick overview for planning purposes.

This study aims to: (1) describe the coverage of K1 and K4, as well as the *dropout* rates from K1 to K4, across 34 provinces in Indonesia; (2) analyze the relationship between

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this coverage and MMR; and (3) discuss the implications for midwifery practice in the era of the K6 standard.

Methods

Study Design. This is a quantitative study using *an* ecological cross-sectional design. The unit of analysis is the province, not the individual. The year 2020 was selected as the reference year to ensure that service coverage data align with the year of MMR measurement in the 2020 Population and Housing Census (LF SP2020).

Population and Sample. The population consists of all 34 provinces in Indonesia according to the 2020 administrative division. All provinces were included (*total sampling*). The analysis using the 2020 Population and Housing Census (LF SP2020) MMR data covered 21 provinces for which values were available in open-access sources accessible to the researchers. Gorontalo was excluded from the K1 analysis because its K1 coverage was recorded as 0% in the source, indicating that the data were not reported.

Data sources and collection. All data are aggregated secondary data downloaded from the official website in October 2026:

Table 1. Research Data Sources

Variables	Source	Data Type
Coverage of K1 and K4 (%)	Indonesian Health Profile 2020, Appendix 23.a (Indonesian Ministry of Health, 2021a)	Provincial health department routine reports
Number of maternal deaths and live births	Indonesia Health Profile 2020, Appendices 20–21 (Indonesian Ministry of Health, 2021a)	Provincial health department routine reports
MMR from the 2020 Population and Housing Census by province	Central Statistics Agency (2023), via publications citing BPS tables (Kompas.com, 2024a, 2024b)	Census-based estimates
National K1, K4, K6 2023	2023 Indonesian Health Survey (Health Development Policy Agency, 2024)	Household survey

Operational definitions.

Table 2. Operational definitions of variables

Variable	Definition	Scale
K1 Coverage	Percentage of pregnant women who received their first antenatal care visit from a health worker relative to the target population of pregnant women	Ratio (%)
Coverage K4	Percentage of pregnant women who received at least four antenatal care visits according to trimester distribution relative to the target population of pregnant women	Ratio (%)
Dropout Rate for K1–K4	Difference in K1 and K4 Coverage	Ratio (percentage points)
Maternal Mortality	Estimated pregnancy-related deaths per	Ratio

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Variable	Definition	Scale
Rate (MMR) from the 2020 Population and Housing Census	100,000 live births based on the 2020 Population and Housing Census	
Reported maternal mortality rate	Number of reported maternal deaths divided by the number of live births, multiplied by 100,000	Ratio

The reported maternal mortality rate is calculated using the formula:

$$\text{AKI}_{\text{lapor}} = \frac{\text{jumlah kematian ibu yang dilaporkan}}{\text{jumlah kelahiran hidup}} \times 100.000 \quad (1)$$

Data processing and analysis. Data were processed using Python 3 (the pandas and SciPy libraries). Univariate analysis presented the median, interquartile range (IQR), minimum, and maximum values. Normality was tested using the Shapiro–Wilk test; since none of the variables were normally distributed ($p < 0.05$), relationships between variables were analyzed using Spearman's rank correlation (rho) at $\alpha = 0.05$. The 95% confidence interval for rho was calculated using the Fisher-z transformation and the Bonett–Wright standard error. Correlation strength was interpreted as weak (< 0.40), moderate (0.40–0.59), and strong (≥ 0.60). A sensitivity analysis was conducted by excluding two provinces whose K4 data were suspected of having recording issues (East Kalimantan and Riau).

$$z = \frac{1}{2}\ln\left(\frac{1+\rho}{1-\rho}\right), \qquad SE = \frac{1{,}06}{\sqrt{n-3}} \quad (2)$$

$$\text{IK } 95\% = \tanh\left(z \pm 1{,}96 \times SE\right) \quad (3)$$

Research ethics. This study uses publicly available aggregate data without individual identifiers; therefore, no ethical approval is required. If the target journal requires *it*, the researcher may submit a letter of ethical exemption to the institutional ethics committee.

Results

K4 coverage is negatively and significantly associated with the maternal mortality ratio (MMR): the lower a province's K4 coverage, the higher its MMR. Nationally in 2020, K1 coverage reached 93.3% and K4 coverage 84.6%, meaning that approximately 8.7 percentage points of pregnant women who had completed K1 did not complete K4.

Descriptively, the median K1 coverage across provinces was 91.0% (IQR 83.7–99.4; range 57.0–108.8) and the median K4 coverage was 80.9% (IQR 68.3–92.8; range 27.5–98.9). The median reported maternal mortality rate was 104.6 per 100,000 live births (IQR 88.6–125.5), while the median maternal mortality rate from the 2020 Population and Housing Census (SP2020) across 21 provinces was 179 (IQR 158–264; range 48–565). The Shapiro–Wilk test indicated that none of the variables were normally distributed ($p = 0.0004$–0.040).

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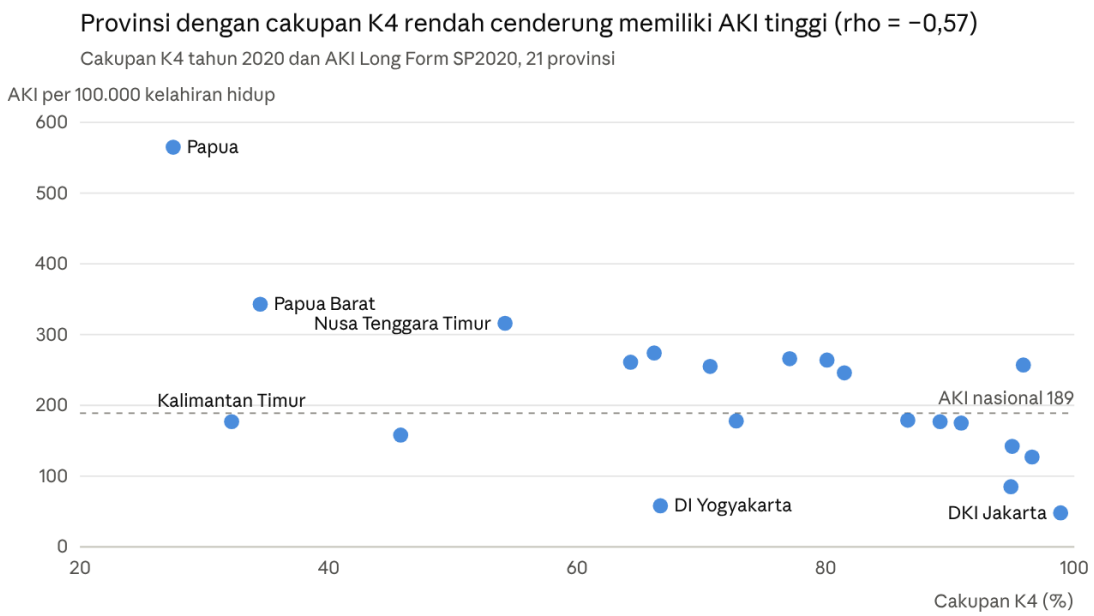


Figure 1. Provinces with low K4 coverage tend to have high AKI (rho = −0.57). Source: 2020 Indonesia Health Profile (Ministry of Health) and AKI Long Form SP2020 (BPS) · 21 provinces for which AKI values are available

Papua, West Papua, and East Nusa Tenggara are in the upper left of the graph (low K4, high MMR). DKI Jakarta is in the lower right. East Kalimantan is an exception: its K4 is only 32.2%, but its MMR is 177, which likely reflects problems with K4 reporting rather than low service coverage, since its K1 is 89.5%.

Table 3. Spearman's correlation between antenatal care coverage and MMR

Variable pairs	n	rho	95% CI	p
K4 vs AKI LF SP2020	21	−0.57	−0.81 to −0.16	0.007
K1 vs. AKI LF SP2020	20	−0.60	−0.83 to −0.19	0.005
Dropout Rates for K1–K4 vs. AKI LF SP2020	20	0.56	0.12 to 0.81	0.011
K4 vs. reported maternal mortality rate	34	−0.41	−0.67 to −0.06	0.017
K1 vs. reported maternal mortality rate	33	−0.31	−0.61 to 0.05	0.076
Reported figures vs. MMR from the 2020 Population and Housing Census	21	0.70	0.36 to 0.87	< 0.001
Sensitivity: K4 vs. AKI LF SP2020, excluding East Kalimantan and Riau	19	−0.74	−0.90 to −0.40	< 0.001
Sensitivity: K4 vs. reported figures, excluding East Kalimantan and Riau	32	−0.47	−0.72 to −0.13	0.006

CI = confidence interval. The greater *the dropout rate* for K1–K4, the higher the AKI (rho = 0.56). After excluding two provinces with K4 data suspected of being problematic, the correlation between K4 and AKI actually strengthened to become strong (rho = −0.74). The two measures of AKI are strongly correlated (rho = 0.70), but the figures reported by facilities are much lower. Nationally, the reported rate is only 97.6 per 100,000 live births (4,627 deaths out of 4,740,342 live births), about half of the census estimate of 189. This means that many maternal deaths go unrecorded by the routine system.

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Table 4. Data by province, 2020

Province	K1 (%)	K4 (%)	Dropout K1–K4 (points)	Reported maternal mortality	Reported rate per 100,000 live births	MMR LF 2020 Census
Aceh	89.6	76.7	12.9	173	151	
North Sumatra	85.6	79.8	5.8	187	63	
West Sumatra	83.2	72.8	10.4	125	115	178
Riau	83.7	45.8	37.9	129	83	158
Jambi	99.4	89.2	10.2	62	95	177
South Sumatra	94.2	90.9	3.3	128	81	175
Bengkulu	93.6	86.6	7.0	32	87	179
Lampung	93.7	93.0	0.7	115	78	
Bangka Belitung Islands	92.0	92.0	0.0	26	95	
Riau Islands	99.8	95.0	4.8	38	94	142
Jakarta	100.6	98.9	1.7	117	72	48
West Java	101.8	96.0	5.8	745	85	
Central Java	99.7	94.3	5.4	530	101	
Yogyakarta	76.7	66.7	10.0	40	95	58
East Java	97.7	91.1	6.6	565	101	
Banten	102.7	96.6	6.1	242	102	127
Bali	101.4	94.9	6.5	56	87	85
West Nusa Tenggara	105.0	95.9	9.1	122	119	257
East Nusa Tenggara	68.6	54.2	14.4	151	107	316
West Kalimantan	91.0	81.5	9.5	115	116	246
Central Kalimantan	89.3	80.4	8.9	68	126	
South Kalimantan	80.8	77.4	3.4	97	122	
East Kalimantan	89.5	32.2	57.3	92	123	177
North Kalimantan	108.8	96.7	12.1	18	148	
North Sulawesi	94.8	81.9	12.9	48	119	
Central Sulawesi	89.7	80.1	9.6	81	130	264
South Sulawesi	91.5	83.2	8.3	133	80	
Southeast Sulawesi	85.9	67.5	18.4	61	108	
Gorontalo	not reported	77.1		56	234	266
West Sulawesi	76.7	66.2	10.5	46	139	274
Maluku	78.6	64.3	14.3	70	156	261
North Maluku	86.0	70.7	15.3	39	133	255
West Papua	57.0	34.5	22.5	48	218	343
Papua	59.1	27.5	31.6	72	101	565
Indonesia	**93.3**	**84.6**	**8.7**	**4,627**	**97.6**	**189**

Coverage exceeding 100% occurs because the denominator uses projected targets for pregnant women rather than actual numbers. The MMR column for the 2020 Population

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Census is blank for 13 provinces whose data has not yet been compiled; these values can be obtained from BPS tables.

Discussion

Continuity of visits is a more distinguishing factor than the first visit. Nearly all provinces have achieved K1 rates above 80%, but K4 rates vary much more widely, ranging from 27.5% in Papua to 98.9% in DKI Jakarta. The correlation between K4 and reported maternal mortality rates is significant (rho = −0.41), whereas K1 is not (p = 0.076), and the magnitude *of dropout* from K1 to K4 is positively correlated with the MMR (rho = 0.56). This means that high-risk provinces not only lack initial access but also lose many mothers during pregnancy. These findings align with those of Laksono et al. (2020), who found that the Papua and Maluku regions lagged the farthest behind in the utilization of ≥4 ANC visits, as well as Fauzi et al. (2021), who identified distance to facilities, insurance coverage, and residential area as determinants of visit completion.

Incomplete visits are dangerous because the third trimester is the period when preeclampsia, antepartum hemorrhage, and severe anemia most frequently occur. Sudaryo and Sam (2022) demonstrated that ANC visits are associated with the detection of obstetric complications; thus, mothers who stop attending visits miss the opportunity for detection precisely when their risk is highest. Changes in the patterns of maternal causes of death in Indonesia—with the proportion attributable to hypertensive disorders rising from 8% to 19% (Syairaji et al., 2024)—make monitoring blood pressure and urine protein during the third trimester increasingly critical.

This relationship is ecological in nature and reflects the strength of the system. ANC coverage does not stand alone. Provinces with low K4 rates generally also have island and mountainous regions, low population density, and long distances to referral hospitals. Cameron et al. (2019) found that the number of doctors at community health centers and in villages, as well as the distance to hospitals, are the largest contributors to differences in maternal mortality rates between Java–Bali and other islands. Wenang et al. (2024) also demonstrated that the availability of obstetric specialists and midwives at the provincial level accounts for the majority of the variation in MMR and stillbirths. Thus, K4 coverage is more accurately interpreted as an indicator of the overall strength of the maternal care system within the “three delays” framework (Thaddeus & Maine, 1994), rather than the sole cause of MMR disparities.

The number of visits does not guarantee quality. West Nusa Tenggara has a K4 rate of 95.9% but a MMR of 257, while the Special Region of Yogyakarta has a K4 rate of 66.7% but a MMR of only 58. This pattern indicates that the content of visits and the speed of referrals are just as important as the frequency of visits. Zenitasari et al. (2026) found that the quality of ANC—not merely the number of visits—is associated with maternal mortality, and Aldila et al. (2025) demonstrated that each component of integrated ANC services (10T) is associated with the MMR at the community health center level. A mortality audit study at referral hospitals in East Java also found that most mothers arrived in a condition where they could still be saved, but died due to delays in treatment and ineffective tiered referrals (Mahmood et al., 2021).

The quality of routine data must be interpreted with caution. Coverage rates above 100%, a recorded K1 rate of 0% in Gorontalo, and a K4 rate of 32.2% in East

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Kalimantan with a K1 rate of 89.5% indicate issues with the denominator and reporting. Sensitivity analysis shows that after excluding East Kalimantan and Riau, the correlation between K4 and MMR actually strengthens (rho = −0.74), suggesting that recording errors tend to weaken—rather than create—the observed relationship. Facility-reported maternal mortality figures also amounted to only about half of the census estimates (97.6 versus 189), consistent with findings that out-of-facility deaths and administrative barriers in the maternal mortality notification system lead to *underreporting* (Susiarno et al., 2026; Syairaji et al., 2024).

Implications for the K6 era. The 2023 SKI recorded a K4 rate of 68.1% and a K6 rate of only 17.6% nationally (Health Development Policy Agency, 2024). If K4 alone already accounts for variations in MMR across provinces, the K6 disparity is likely even wider in provinces with few doctors and limited access to ultrasound equipment, as suggested by Cameron et al. (2019). Collaboration between midwives and community health center doctors, schedules for traveling doctors' visits, and teleconsultations are essential to ensure that the two required doctor contacts are met.

Implications for midwifery practice. International evidence positions midwives as key to reducing maternal mortality: the quality framework for midwifery care in *The Lancet* Series shows that educated and regulated midwives can provide most essential interventions for mothers and infants (Renfrew et al., 2014), and a midwife-led model of continuity of care is associated with fewer interventions and fewer preterm births (Sandall et al., 2016). In Indonesia, participation in prenatal classes has been shown to more than double the likelihood of adequate ANC (Azhar et al., 2020). Therefore, midwives need to: (1) identify pregnant women as early as possible in collaboration with posyandu cadres; (2) track mothers who do not return through maternal cohorts, home visits, and prenatal classes; and (3) ensure the quality of each visit in accordance with the 10T standards and develop a P4K plan together with the family.

Limitations. First, the available 2020 SP maternal mortality rate (MMR) data only covers the 21 provinces with the highest and lowest rates, so the selection of these extreme groups may have strengthened the correlation. Second, the ANC data comes from routine reports, which have issues with denominators and completeness. Third, 2020 coincided with the onset of the COVID-19 pandemic, which disrupted visits to health facilities (Satyawan et al., 2023). Fourth, provincial-level analysis cannot be generalized to the individual level (*ecological fallacy*) and has not controlled for confounding factors such as poverty, education, and the availability of healthcare workers. Further research is recommended using multivariate analysis with complete data from all 34 provinces.

Conclusions and Recommendations

Antenatal visit coverage is negatively associated with MMR across provinces in Indonesia. The strongest association is observed for the fourth antenatal visit (K4) (rho = −0.57 with respect to the MMR from the 2020 Population Census), and provinces in eastern Indonesia—particularly Papua, West Papua, and East Nusa Tenggara (NTT)—have both the lowest coverage and the highest MMR.

Recommendations:

- **For midwives and community health centers:** use the difference between K1–K4 and K6 as a monthly performance indicator and a target for home visits.

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- **For health departments:** prioritize the placement of midwives and doctors, as well as ultrasound equipment, in provinces with the lowest K4 and K6 values, and adjust the denominator for pregnant women targets so that coverage does not exceed 100%.
- **For future researchers:** complete the 2020 Population and Housing Census (SP2020) maternal mortality rate (MMR) data for all 34 provinces and use province-level K6 data from the 2023 Health Survey (SKI 2023) or the 2023 Health Profile to test associations under the new standards.

References

Aldila, S. A., Rejeki, D. S. S., Wijayanti, S. P. M., & Nurmutia, P. A. (2025). Analysis of the relationship between integrated antenatal care (ANC) services and maternal mortality rates. *Holistik Health Journal, 19*(3), 578–585. https://doi.org/10.33024/hjk.v19i3.926

Azhar, K., Dharmayanti, I., Tjandrarini, D. H., & Hidayangsih, P. S. (2020). The influence of pregnancy classes on the use of maternal health services in Indonesia. *BMC Public Health, 20*(1), Article 372. https://doi.org/10.1186/s12889-020-08492-0

Health Development Policy Agency. (2024). *The 2023 Indonesian Health Survey (SKI) in Figures*. Ministry of Health of the Republic of Indonesia. https://www.badankebijakan.kemkes.go.id/ski-2023-dalamangka/

Central Bureau of Statistics. (2023). *Mortality in Indonesia: Results from the 2020 Population Census Long Form*. Central Bureau of Statistics. https://indonesia.unfpa.org/sites/default/files/pub-pdf/mortalitas-di-indonesia-hasil-long-form-sensus-penduduk-2020.pdf

Cameron, L., Contreras Suarez, D., & Cornwell, K. (2019). Understanding the determinants of maternal mortality: An observational study using the Indonesian Population Census. *PLOS ONE, 14*(6), Article e0217386. https://doi.org/10.1371/journal.pone.0217386

Campbell, O. M. R., & Graham, W. J. (2006). Strategies for reducing maternal mortality: Getting on with what works. *The Lancet, 368*(9543), 1284–1299. https://doi.org/10.1016/S0140-6736(06)69381-1

Fauzi, R., Kyi, Y. P., Mon, M. M., Munira, L., Herman, B., Hounnaklang, N., & Viwattanakulvanid, P. (2021). Factors affecting optimal antenatal care utilization in Indonesia: Implications for policies and practices. *Journal of Public Health Policy, 42*(4), 559–573. https://doi.org/10.1057/s41271-021-00307-9

Ministry of Health of the Republic of Indonesia. (2021a). *Indonesia Health Profile 2020*. Ministry of Health of the Republic of Indonesia. https://layanandata.kemkes.go.id/file/profil-kesehatan/2020/bab-5.pdf

Ministry of Health of the Republic of Indonesia. (2021b). *Minister of Health Regulation No. 21 of 2021 on the Provision of Health Services During the Pre-pregnancy, Pregnancy, Childbirth, and Postpartum Periods, Contraceptive Services, and Sexual Health Services*. Ministry of Health of the Republic of Indonesia.

Ministry of National Development Planning/Bappenas. (2020). *National Medium-Term Development Plan 2020–2024* (Appendix to Presidential Regulation No. 18 of 2020). Ministry of National Development Planning/Bappenas.

e-ISSN: 2985-4415
DOI: 10.57254/irma.v3i10.92

Kompas.com. (2024a, February 23). *Maternal mortality rate in Papua is the highest in Indonesia*. https://lestari.kompas.com/read/2024/02/23/120000786/angka-kematian-ibu-di-papua-tertinggi-di-indonesia

Kompas.com. (2024b, February 26). *Maternal mortality rate in DKI Jakarta is the lowest in Indonesia*. https://lestari.kompas.com/read/2024/02/26/110000086/angka-kematian-ibu-di-dki-jakarta-terendah-se-indonesia

Laksono, A. D., Rukmini, R., & Wulandari, R. D. (2020). Regional disparities in antenatal care utilization in Indonesia. *PLOS ONE, 15*(2), Article e0224006. https://doi.org/10.1371/journal.pone.0224006

Mahmood, M. A., Hendarto, H., Laksana, M. A. C., Damayanti, H. E., Suhargono, M. H., Pranadyan, R., Santoso, K. H., Redjeki, K. S., Winard, B., Prasetyo, B., Vercruyssen, J., Moss, J. R., Bi, P., Masitah, S., Warsiti, Pratama, A. W., Dewi, E. R., Listiyani, C. H., & Mufidah, I. (2021). Health system and quality of care factors contributing to maternal deaths in East Java, Indonesia. *PLOS ONE, 16*(2), Article e0247911. https://doi.org/10.1371/journal.pone.0247911

Renfrew, M. J., McFadden, A., Bastos, M. H., Campbell, J., Channon, A. A., Cheung, N. F., Silva, D. R. A. D., Downe, S., Kennedy, H. P., Malata, A., McCormick, F., Wick, L., & Declercq, E. (2014). Midwifery and quality care: Findings from a new evidence-informed framework for maternal and newborn care. *The Lancet, 384*(9948), 1129–1145. https://doi.org/10.1016/S0140-6736(14)60789-3

Sandall, J., Soltani, H., Gates, S., Shennan, A., & Devane, D. (2016). Midwife-led continuity models versus other models of care for childbearing women. *Cochrane Database of Systematic Reviews, 2016*(4), Article CD004667. https://doi.org/10.1002/14651858.CD004667.pub5

Satyawan, D. C., Setyaningsih, W., Supangat, R. W., Ernawaty, & Wulandari, R. D. (2023). The correlation between the quality of antenatal care, maternal COVID-19, and maternal mortality during the pandemic period in East Java, Indonesia. *The Indonesian Journal of Public Health, 18*(3), 432–444. https://doi.org/10.20473/ijph.v18i3.2023.432-444

Souza, J. P., Day, L. T., Rezende-Gomes, A. C., Zhang, J., Mori, R., Baguiya, A., Jayaratne, K., Osoti, A., Vogel, J. P., Campbell, O., Mugerwa, K. Y., Lumbiganon, P., Tunçalp, Ö., Cresswell, J., Say, L., Moran, A. C., & Oladapo, O. T. (2024). A global analysis of the determinants of maternal health and trends in maternal mortality. *The Lancet Global Health, 12*(2), e306–e316. https://doi.org/10.1016/S2214-109X(23)00468-0

Sudaryo, M. K., & Sam, A. Q. (2022). The association between antenatal care (ANC) visits and the incidence of obstetric complications in Indonesia: A secondary data analysis of the 2017 Indonesia Demographic and Health Survey (IDHS). *Journal of Community Health Epidemiology, 7*(2), 587–595. https://doi.org/10.14710/jekk.v7i2.11866

Susiarno, H., Adnani, Q. E. S., Khaerani, I., Nurdiawan, W., Nisa, A., & Adepoju, V. (2026). Qualitative analysis of maternal mortality reporting gaps and the emerging fourth delay in Garut Regency, Indonesia. *International Journal of Women's Health, 18*, 1–13. https://doi.org/10.2147/IJWH.S552705

Syairaji, M., Nurdiati, D. S., Wiratama, B. S., Prüst, Z. D., Bloemenkamp, K. W. M., & Verschueren, K. J. C. (2024). Trends and causes of maternal mortality in

e-ISSN: 2985-4415
DOI: 10.57254/irma.v3i10.92

Indonesia: A systematic review. *BMC Pregnancy and Childbirth, 24*(1), Article 515. https://doi.org/10.1186/s12884-024-06687-6

Thaddeus, S., & Maine, D. (1994). Too far to walk: Maternal mortality in context. *Social Science & Medicine, 38*(8), 1091–1110. https://doi.org/10.1016/0277-9536(94)90226-7

Wenang, S., Emilia, O., Wahyuni, A., Afdal, A., & Haier, J. (2024). Obstetric care in Indonesia: Determinants of maternal mortality and stillbirth rates. *PLOS ONE, 19*(7), Article e0303590. https://doi.org/10.1371/journal.pone.0303590

World Health Organization. (2016). *WHO recommendations on antenatal care for a positive pregnancy experience*. World Health Organization.

World Health Organization. (2023). *Trends in maternal mortality 2000 to 2020: Estimates by WHO, UNICEF, UNFPA, the World Bank Group, and UNDESA/Population Division*. World Health Organization.

Zenitasari, S., Ganap, E. P., & Hadijono, S. (2026). Quality of antenatal care and maternal mortality: A mixed-methods study in Purwakarta District, Indonesia. *BMC Public Health, 26*(1), Article 2875. https://doi.org/10.1186/s12889-026-28555-y