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Maternal mortality in Buleleng, Bali, Indonesia (2021–2023): a mixed-methods analysis of clinical, systemic, and sociocultural contributors

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A B S T R A C T

Background: Despite increasing access to institutional deliveries in Indonesia, maternal mortality remains a major public health challenge—particularly in decentralized settings where systemic, clinical, and sociocultural barriers persist. Buleleng District in Bali exemplifies this paradox, with maternal deaths continuing to occur in health facilities despite widespread service availability.

Objective: This study aimed to analyze the clinical, systemic, and sociocultural contributors to maternal mortality in Buleleng District using a sequential explanatory mixed-methods approach.

Methods: The study was conducted in two phases. The quantitative phase involved a retrospective review of 49 maternal death cases reported between 2021 and 2023, sourced from the Buleleng District Health Office. Variables included age, parity, education, timing and place of death, delivery method, and cause of death. Descriptive statistics were used to analyze quantitative data. The qualitative phase consisted of in-depth interviews with six midwives from five primary health centers. Thematic analysis was used to explore health system barriers, provider capacity, community decision-making, and digital health implementation.

Results: Most maternal deaths occurred postpartum (67.3%) and in health facilities (91.8%), with cesarean section as the predominant mode of delivery (83.7%). COVID-19 was the leading cause of death, followed by hemorrhage and hypertensive disorders. Qualitative analysis identified eight key themes, including delays in emergency response, insufficient postnatal monitoring, staff shortages, cultural hesitation in care-seeking, and fragmented digital tools. These findings revealed contributors spanning clinical mismanagement, system-level inefficiencies, and sociocultural decision dynamics.

Conclusion: Maternal mortality in Buleleng is shaped by the interplay of clinical complications, systemic gaps, and sociocultural constraints. Addressing these multilevel contributors requires reinforcing postnatal care, expanding digital health integration, strengthening frontline provider capacity, and engaging families and communities in maternal health decisions.

INTRODUCTION

Maternal mortality remains a critical global health concern and is widely regarded as a sentinel indicator of health system performance. In 2023, an estimated 260,000 women died from complications related to pregnancy and childbirth.[1] More than 90% of these deaths occurred in low- and lower-middle-income countries, with sub-Saharan Africa and Southern Asia bearing the highest burden.[2] While the global maternal mortality ratio (MMR) declined by 40% between 2000 and 2023, progress has been uneven and fragile, particularly in conflict-affected and resource-limited settings.[3,4]

Indonesia exemplifies both progress and persistent challenges. The national MMR declined from 450 to 249 per 100,000 live births between 1990 and 2020,[5] yet substantial regional disparities remain. Provinces such as Papua report MMRs exceeding 500, while Bali reports a lower MMR of 85—still above global targets.[6] Despite expanded access to institutional care, maternal deaths persist—highlighting gaps in service quality and emergency response.[4] Buleleng District in northern Bali exemplifies the persistent challenges in reducing maternal mortality, even in areas

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with relatively good access to health services. Most women in the district deliver in hospitals and reside within close proximity to health centers. Nevertheless, maternal deaths—particularly those occurring postpartum or following cesarean sections—have continued to be reported in local health audits and government reviews.[7]

This "institutional paradox"—where women reach health facilities but still die from preventable causes—has been observed in various parts of Indonesia. Maternal death audits have revealed recurrent issues including poor triage, delayed referrals, insufficient staff response, and fragmented postoperative care.[8] Even with improved infrastructure, facilities often lack the internal capacity to manage high-risk deliveries effectively.[9] The COVID-19 pandemic added further complexity to maternal health systems.[10] In 2021, global maternal deaths rose to 322,000, reversing decades of progress.[1] In Indonesia, the pandemic increased emergency cesarean sections and disrupted services, with additional risks posed by comorbidities such as obesity, diabetes, and cardiovascular disease.[11,12] Lockdowns further interfered with antenatal care, referral processes, and family support.[13] However, empirical studies exploring how pandemic-related disruptions affected maternal health outcomes in specific districts remain scarce.

Research on maternal mortality in Indonesia has largely emphasized clinical diagnoses and epidemiological trends, with limited exploration of the systemic and sociocultural mechanisms that contribute to preventable deaths.[5,9,12] Critical dimensions such as provider preparedness, referral system functioning, digital health adoption, and family or community involvement remain underexplored. While the Three Delays Model offers a valuable framework,[14] it is rarely applied in integrated, mixed-methods approaches that incorporate frontline narratives. To address these gaps, this study employs a sequential explanatory mixed-methods design to investigate maternal mortality in Buleleng District, analyzing how clinical risks, systemic shortcomings, and sociocultural factors intersect to shape maternal outcomes. The study aims to generate context-sensitive evidence to improve maternal death audits and inform system-level reforms in Indonesia's decentralized health system.

METHOD

Study Design

This study employed a sequential explanatory mixed-methods design to investigate the clinical, systemic, and sociocultural contributors to maternal mortality in Buleleng District, Bali. The research was conducted in two phases: (1) a quantitative review of maternal death reports from 2021–2023, and (2) qualitative in-depth interviews with maternal health providers. This design allowed integration of statistical trends with contextual explanations to explore not only observable patterns, but also underlying clinical, systemic, and sociocultural factors influencing maternal health outcomes.[15]

Study Setting

The study was conducted in Buleleng District, northern Bali, Indonesia, which includes both urban and rural areas. Health services in the district are delivered through public health centers and hospitals under the supervision of the Buleleng District Health Office. Quantitative data collection took place at the health office, while qualitative interviews were conducted at five public health centers that had reported maternal deaths during the study period, representing geographic and service variation within the district.

Quantitative Component

Data Source and Participants

Quantitative data were obtained from maternal death audit reports archived by the Buleleng District Health Office for the period January 2021 to December 2023. These reports were part of the district's Maternal Death Surveillance and Response (MDSR) system. The inclusion criterion was all recorded maternal deaths meeting the WHO definition.[16] A total of 49 cases were analyzed.

Variables and Measures

Data extracted included both sociodemographic and clinical variables: Age, parity, and educational attainment; Timing of death (antenatal, intrapartum, postpartum); Place of death (home, en route, health facility); Mode of delivery (vaginal, cesarean section); Primary cause of death, based on ICD-MM classification (e.g., hemorrhage, eclampsia, COVID-19). The variables were selected to represent clinical (e.g., timing, delivery mode, medical cause), systemic (e.g., place of death), and sociodemographic (e.g., education, parity, age) dimensions of maternal mortality. All variables followed national MDSR guidelines and WHO standards.[16]

Data Analysis

Descriptive statistics were used to summarize the distribution of maternal characteristics, causes of death, and care contexts. Analysis was performed using Microsoft Excel, and results were presented in tables and charts.

Qualitative Component

Participants and Sampling

Six midwives were purposively selected from five public health centers with reported maternal deaths. Inclusion criteria included at least ten years of experience in maternal care and direct involvement in maternal death cases. All participants provided informed consent. The selection ensured variation in facility characteristics and service roles.

Data Collection

Data were collected through semi-structured, in-depth interviews guided by key topics: Policy implementation and clinical protocols; Risk screening and referral pathways; Health system barriers and digital tool usage; Community involvement and decision-making processes. Interviews were conducted face-to-face, lasted 45–60 minutes, and

were audio-recorded with consent. Transcripts were produced verbatim and reviewed for accuracy.

Data Analysis

Thematic analysis followed Braun and Clarke's six-phase approach: familiarization, coding, theme development, review, naming, and synthesis.[17] Coding was performed manually, using a structured framework based on the interview guide and emergent insights. The analysis emphasized how providers interpreted systemic and sociocultural contributors to maternal death. To enhance trustworthiness, data validation involved triangulation through multiple sources, including interview data, field notes, and verbal autopsy reports.

Integration of Quantitative and Qualitative Findings

A side-by-side explanation-building approach was used to integrate findings, wherein quantitative trends were interpreted and expanded through qualitative narratives. Quantitative results identified patterns in causes and timing of maternal deaths, which were further explored through qualitative data to illuminate the clinical circumstances, systemic breakdowns, and sociocultural factors shaping these patterns. This strategy enabled a deeper understanding of how access, care quality, and decision-making intersect to influence maternal outcomes in the district.[18]

Ethical Considerations

Ethical approval for the qualitative phase of this study was obtained from the Health Research Ethics Committee, Buleleng Health Sciences College, with approval number 947/EC-KEPK-SB/VIII/2024. Written informed consent was obtained from all interview participants. The quantitative component used anonymized secondary data from the Buleleng District Health Office and did not require individual consent.

RESULTS

Quantitative Findings

Sociodemographic and Clinical Characteristics of Maternal Deaths

Between 2021 and 2023, a total of 49 maternal deaths were reported in Buleleng District, Bali, Indonesia (Table 1). The majority of women were within the reproductive age range of 20–35 years (59.2%), followed by women aged over 35 years (40.8%). Educational attainment varied, with most mothers having completed secondary education (High School: 36.7%; Junior High School: 32.7%), while only a small proportion had tertiary education (6.1%). Most of the deceased were housewives (89.8%), and a large share were primigravida (26.5%) or multigravida with three pregnancies (26.5%). Despite the relatively optimal reproductive age and access to maternal health programs (89.9%), maternal deaths still occurred, suggesting the need to explore beyond demographic risk factors and investigate health system dynamics.

Table 1. Characteristics of Maternal Deaths in Buleleng (n=49)

Characteristics	Result
Age, yo	
<20	0 (0%)
20-35	29 (59.2%)
>35	20 (40.8%)
Education	
Elementary school	12 (24.5%)
Junior high school	16 (32.7%)
High school	18 (36.7%)
University	3 (6.1%)
Occupational	
Housewife	44 (89.8%)
Private workers	5 (10.2%)
Gravida	
I	13 (26.5%)
II	8 (16.3%)
III	13 (26.5%)
IV	7 (14.3%)
V	6 (12.2%)
VI	1 (2.1%)
X	1 (2.1%)
Access to maternal health programs	
Yes	44 (89.8%)
No	5 (10.2%)

Timing, Place, Delivery Method and Causes of Maternal Deaths

The highest proportion of deaths occurred during the postpartum period (67.4%), followed by the antenatal period (30.6%), with only one case during labor (2.0%). Most deaths (91.8%) occurred in hospitals, while 6.1% occurred en route, and only 2.0% at home. In terms of delivery method, 83.7% of mothers underwent cesarean section, and only 14.3% delivered vaginally (Figure 1). Regarding causes of death, COVID-19 was the leading contributor (46.9%), particularly in 2021, followed by postpartum hemorrhage (14.3%), cardiac disorders (8.2%), and pre-eclampsia/eclampsia (6.1%) (Figure 2). Only 4.1% of cases involved delayed care-seeking, and 6.1% were recorded as Dead-on-Arrival (DOA). These patterns suggest that although access to delivery in health facilities was high, other systemic factors may have contributed to maternal deaths.

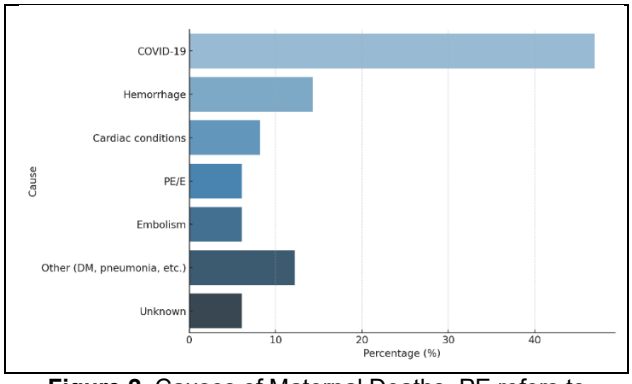

Figure 2. Causes of Maternal Deaths. PE refers to preeclampsia, and E refers to eclampsia

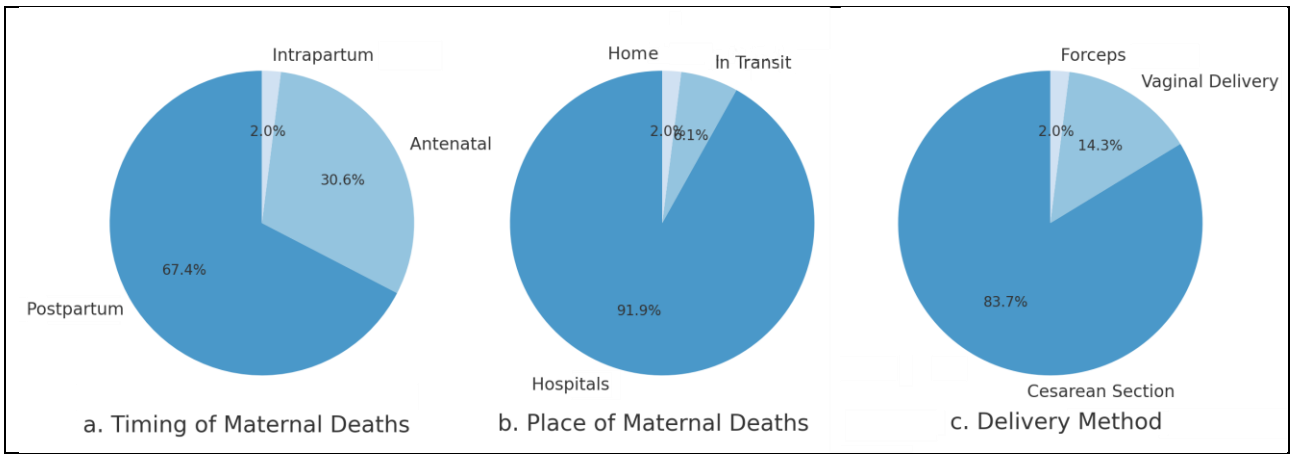

Figure 1. Distribution of Maternal Deaths by Timing, Place of Death, and Delivery Method (n=49)

Health System Access and Referral Conditions

Most mothers resided within <5 km of a health facility (83.7%) and had easy access to transportation (100%). Skilled birth attendants were involved in nearly all cases, with 87.8% managed by obstetricians. Despite this, maternal deaths still occurred, indicating potential quality-of-care gaps (Table 2). Only two cases (4.1%) explicitly involved delays in seeking care, but qualitative data revealed broader issues related to health system responsiveness, referral efficiency, and cultural decision-making processes that may have influenced outcomes. To explain the clinical trends and explore underlying systemic and sociocultural contributors, in-depth interviews were conducted with frontline maternal health providers. The following thematic findings provide insight into system-level challenges and potential interventions.

Table 2. Access to Health Services and Referral Conditions Among Maternal Death

Indicator	Result
Distance to facility, km	
<5	41 (83.7%)
5-15	7 (14.3%)
>15	1 (2.0%)
Access to transportation	
Available	49 (100%)
Not available	0 (0%)
Attended by skilled birth attendant	
Yes	49 (100%)
No	0 (0%)
Managed by obstetrician	
Yes	43 (87.8%)
No (Midwife, Doctor)	9 (12.2%)
Delay in seeking care	
Yes	2 (4.1%)
No	47 (95.9%)

Qualitative Findings

Systemic and Sociocultural Factors Contributing to Maternal Deaths

Thematic analysis of in-depth interviews with six midwives across five primary health centers revealed eight major themes, including health policy and program implementation, risk detection systems, stakeholder roles, community empowerment, maternal death audits and evaluation, barriers and challenges, digital health integration, and innovation needs. A thematic summary of qualitative findings is presented in Table 3.

Integration of Quantitative and Qualitative Findings

While quantitative data showed that the majority of maternal deaths occurred postpartum (67.4%) and in health facilities (91.8%), qualitative insights provided contextual explanations—such as inadequate postnatal monitoring, limited emergency readiness during night shifts, and system gaps during the COVID-19 pandemic. Although nearly all mothers had physical access to transportation and facilities, sociocultural barriers and delayed decision-making (Phase I delays) remained key contributors. These findings demonstrate that geographic access alone does not ensure timely or adequate care. A detailed summary of integrated findings is presented in Figure 3.

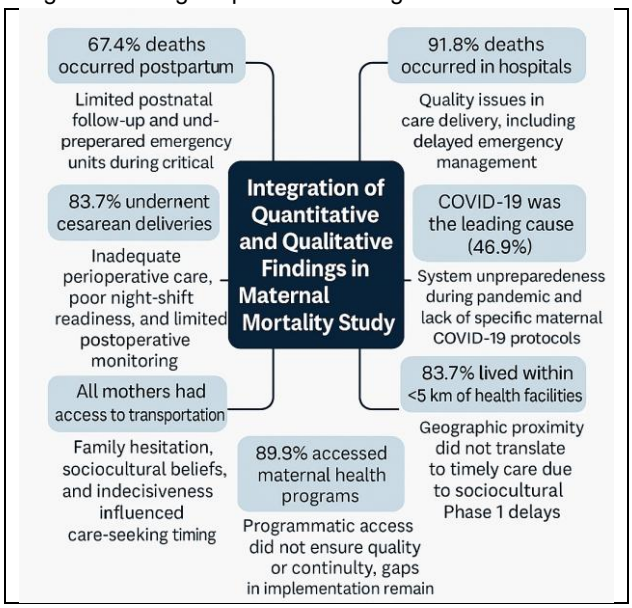

Figure 3. Integration of Quantitative and Qualitative Findings

Table 3. Thematic Summary of Qualitative Findings

Theme	Key Points	Representative Quote
Policy and Program Implementation	Implementation of national maternal health guidelines, including PONED and integrated ANC services.	*"Services in primary care must be optimized—from preconception to postpartum care." (R1)*
Risk Detection and Referral Mechanisms	Routine risk screening, digital-based emergency referrals, and structured referral pathways.	*"Initial ANC visits include comprehensive screening, and referrals are coordinated…" (R2, R5)*
Stakeholder Roles	Involvement of local health authorities and village structures in providing infrastructure and ambulance support (Desa Siaga).	*"Each village has its ambulance." (R4)* *"There is a village health post in every village." (R1)*
Community Empowerment	Involvement of health cadres in education, family accompaniment, early detection, and household monitoring.	*"If the cadres are involved, usually they are during field visits for pregnant women." (R2)* *"We have a health program socialization." (R6)*
Maternal Death Audits and Evaluation	Reporting procedures, internal and external audits, inter-agency follow-up coordination.	*"Special recording of maternal audits... in the form of reporting and recommendations." (R5)*
Barriers and Challenges	Shortages in trained health staff, geographic constraints, sociocultural beliefs, and decision-making delays within families.	*"We're short on midwives and doctors—especially for emergency cases." (R1)* *"We are constrained by the distance; in some areas, it takes us half an hour to get to the nearest hospital." (R1)* *"Lack of knowledge… they want to do their own treatment at home." (R3)* *"Families sometimes hesitate... Most often the family is late in making decisions, resulting in complications." (R6)*
Digital Health Integration	Use of digital tools such as e-Kohort, electronic medical records, P-Care, and BPJS digital systems.	*"We use electronic records and e-Kohort, which help track high-risk pregnancies." (R2, R3, R4)*
Innovation Needs	Demand for an integrated digital system that enables risk alerts, supports education, and improves communication between families and providers.	*"Currently, we still use electronic medical records, but in the future, it would be good if there could be one system that could immediately provide notification if there is a high risk." (R3)* *"We still use the KIA book, and socialization also uses conventional media… maybe there needs to be a platform that can help educate families too." (R2)* *"Now it's good to use e-Kohort, but sometimes it's not directly connected to the referral system. So hopefully in the future there can be innovations that respond faster." (R4)*

DISCUSSION

This mixed-methods study explored the multifactorial causes of maternal mortality in Buleleng District between 2021 and 2023. Most maternal deaths occurred in the postpartum period, within hospital settings, and predominantly after cesarean deliveries. COVID-19 emerged as the leading cause of death. Despite physical proximity to health facilities and availability of transportation, maternal deaths persisted—indicating that structural access alone does not guarantee survival. By integrating quantitative data with qualitative insights from frontline midwives, the study identified critical system-level gaps in emergency preparedness, staffing, postnatal care, and sociocultural decision-making.

The high proportion of postpartum deaths (67.4%) reflects global patterns, where the early postpartum phase poses the greatest risk. Studies report that over half of maternal deaths worldwide occur within the first week postpartum due to insufficient monitoring and delayed intervention.[19,20] In Buleleng, the issue appears rooted not in access, but in the quality of postpartum care and the readiness to manage

complications. The predominance of cesarean deliveries (83.7%) among deaths underscores the dual role of surgical intervention—it can be life-saving, but also carries risks such as hemorrhage, infection, and anesthesia-related complications, especially when perioperative care is inadequate.[21,22] The sharp increase in cesarean rates across Indonesia without concurrent improvements in quality has been documented nationally.[23]

COVID-19 significantly contributed to maternal deaths during the early part of the study. Pregnant women with COVID-19 face elevated risks of thrombotic events, emergency cesarean sections, and poor outcomes, especially with comorbidities like diabetes or obesity.[24–26] Studies from Brazil and Indonesia have shown increased maternal mortality during COVID-19 surges, particularly among cesarean patients.[12,24] Beyond biological vulnerability, the pandemic strained health systems, disrupted antenatal services, and limited family support.[10,13,27]

The study also identified systemic and sociocultural barriers. Midwives reported staff shortages, particularly during night shifts, as a major factor limiting emergency response. This echoes global findings on the importance of adequate human resources and clinical governance.[28] While digital systems like e-Kohort and EMRs were present, their use was inconsistent and often limited by poor integration and lack of provider training. In contrast, other countries have demonstrated improved outcomes with mHealth and digital tools for maternal care.[29–31] Sociocultural norms also influenced the timing of care-seeking. Families often delayed bringing pregnant women to health facilities due to traditional decision-making hierarchies or hesitation to involve male relatives. These dynamics align with findings from Pakistan and Rwanda, where male involvement and household power dynamics significantly influence maternal health decisions.[32–34]

To better understand these delays, the Three Delays Model provides a valuable framework.[14] Although only 4.1% of cases were officially classified as involving care-seeking delays, qualitative findings suggest that Phase 1 delays (decision to seek care) were more widespread—shaped by family hesitation and lack of awareness of danger signs.[33–35] Phase 2 delays (reaching care) were minimal given the district's geographic proximity and transportation infrastructure.[36,37] Most critical were Phase 3 delays—receiving appropriate care at health facilities. Despite being treated by obstetricians and delivering in hospitals, women experienced poor triage, limited monitoring, and delayed emergency response, particularly post-cesarean. These are consistent with studies highlighting how weak facility readiness contributes to preventable deaths.[36,38,39]

In this context, physical access to care was not enough—institutional quality and continuity of care were lacking. While the Three Delays Model is highly applicable in Buleleng, our findings suggest it should be adapted to account for intra-facility and postnatal delays, especially in middle-income rural settings. As Piane and Azubuike argue, access alone is insufficient without robust internal systems.[40]

Based on these insights, several strategies are recommended. Clinically, postpartum protocols must be strengthened through structured follow-up in the first 48 hours, including home visits and community-based monitoring. Facilities need 24/7 emergency staffing, regular emergency drills, and focused training on postpartum hemorrhage and hypertensive disorders. Digital literacy among health workers should be improved for effective use of risk-tracking and referral systems.[30] Policy measures should support rural workforce development, deploy mobile obstetric teams, and enhance maternal death audit systems with feedback loops. Community-level interventions, such as *Desa Siaga*, should extend beyond physical readiness—mobilizing village ambulances, empowering community health workers, and actively engaging families, particularly male decision-makers.[41,42] Integrating mHealth tools and culturally sensitive education may help overcome sociocultural delays and promote timely action.

This study had several limitations. The sample size was limited to 49 maternal deaths, restricting statistical analysis. Qualitative data only included healthcare providers; perspectives from family members or survivors could have added richness to understanding intra-household dynamics. Future studies should incorporate broader samples, mixed stakeholder perspectives, and evaluate the effectiveness of digital interventions longitudinally.

CONCLUSIONS AND RECOMMENDATION

This mixed-methods study demonstrates that maternal mortality in Buleleng District is driven by a complex interplay of clinical, systemic, and sociocultural factors. Most deaths occurred during the postpartum period and followed cesarean deliveries, with COVID-19 emerging as the leading cause. Although physical access to health services was generally adequate, persistent gaps in emergency preparedness, workforce capacity, postnatal monitoring, and digital system integration contributed to preventable deaths. These findings underscore the continued relevance of the Three Delays Model—particularly Phase 3 delays in receiving appropriate care—and highlight the overlooked role of intra-facility and postnatal care quality in maternal survival.

To address these challenges, healthcare providers should prioritize structured postpartum surveillance, enhance obstetric emergency readiness, and institutionalize the use of digital tools such as e-Kohort and electronic referral systems. Policymakers must invest in rural health workforce strengthening, deploy mobile obstetric emergency teams, and ensure that maternal death audits are translated into actionable quality improvement initiatives. Findings highlight the need to strengthen PONED and EmONC services, ensure operational Desa Siaga units, and promote culturally sensitive community interventions involving male family members. At the community level,

culturally sensitive education and family engagement are critical to support timely decision-making and care-seeking.

Future research should assess the longitudinal impact of digital health innovations and incorporate the perspectives of families to better capture sociocultural drivers of delay. Evaluations of postnatal care quality—using clinical audits, direct observation, and user feedback—are also essential to identify and address operational deficiencies. A systems-oriented approach that integrates clinical preparedness, digital innovation, and community empowerment is imperative to reduce preventable maternal deaths and achieve sustainable improvements in maternal health outcomes.

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