



## A Comprehensive Systematic Review of Social Determinants in Maternal Mortality Rates in Developing Countries

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### ABSTRACT

**Introduction:** Maternal mortality remains a critical public health challenge in developing countries, where 94% of global maternal deaths occur. Social determinants—including education, poverty, geographic access, gender inequality, and health system quality—drive persistent disparities. This systematic review synthesizes evidence on these determinants to identify priority interventions.

**Methods:** We screened 80 studies (RCT, etc) from Sub-Saharan Africa, South Asia, Southeast Asia, Latin America, and the Middle East. Inclusion criteria required quantitative data on social determinants and maternal mortality outcomes in World Bank-defined developing countries. Data extraction focused on seven domains: study setting, social determinants, maternal mortality measurement, associations, interventions, barriers, and key findings.

**Results:** Low maternal education showed the strongest individual-level association, with relative risks of 3.2 (95% CI: 1.5–6.9) for no formal education versus secondary education [1]. Female

literacy rate was the strongest national-level predictor in the Eastern Mediterranean ( $\beta = -1.045$ ,  $p < 0.01$ ), exceeding GDP per capita [2]. Household poverty was associated with hazard ratios of 3.92 (95% CI: 1.01–15.3) in rural South Africa [4] and 94.8% of maternal deaths in Pakistan occurred among poor women [60]. Geographic barriers dominated Sub-Saharan Africa and rural Nepal, with transportation delays reported in 84.6% of African studies [6]. The three-delays model showed continental patterning: Delay 1 (decision-making) dominates Asia, Delay 2 (transport/geography) dominates Africa, and Delay 3 (quality of care) dominates Latin America [7]. Health system failures contributed to 80.8% of deaths in African facilities [6]. Community-based interventions including birth preparedness ( $\geq 30\%$  coverage reduced mortality by 53%, RR = 0.47; 95% CI: 0.26–0.87) and emergency transport loans showed effectiveness [15,41].

**Discussion:** Education, poverty, and geographic access are consistently the most powerful determinants across all settings, but their relative importance shifts with economic development. In low-income rural settings, geographic distance and transport are binding constraints; in middle-income urbanizing contexts, health system quality and governance become paramount. Indonesia-specific evidence is limited but suggests high institutional delivery coverage (91.8% of deaths occurred in facilities in Bali) has shifted the bottleneck from access to quality of care [14]. The absence of Papua-specific studies represents a critical evidence gap.

**Conclusion:** Reducing maternal mortality in developing countries requires multi-level interventions that simultaneously address education, poverty, transport, and health system quality. Priority

actions include: (1) sustaining female secondary education, (2) scaling community-based transport financing, (3) improving facility readiness for emergency obstetric care, and (4) targeting interventions to the predominant delay pattern in each region. Research is urgently needed in remote Indonesian regions such as Papua.

**Keywords:** maternal mortality, social determinants, developing countries, health disparities, three-delays model

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## INTRODUCTION

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### Background

Maternal mortality remains one of the most inequitably distributed health indicators globally. In 2020, approximately 287,000 women died from pregnancy-related causes, with 94% of these deaths occurring in low- and lower-middle-income countries [1,5]. While high-income countries have achieved maternal mortality ratios (MMR) below 10 per 100,000 live births, many developing countries continue to report MMRs exceeding 500, and in some rural regions, ratios surpass 1,000 [4,51]. This persistent gap cannot be explained by clinical risk factors alone. Instead, a growing body of evidence demonstrates that social determinants—the conditions in which women are born, grow, live, work, and age—are the fundamental drivers of maternal death [17,77].

The World Health Organization's Commission on Social Determinants of Health has identified structural determinants (governance, policy, socioeconomic context) and intermediary determinants (material circumstances, psychosocial factors, health system) as the causal pathways through which social inequality produces health disparities [8,20]. In the context of maternal health, these determinants include education, household income, wealth, rural residence, distance to care, gender norms, women's decision-making autonomy, cultural practices, and health system quality [10,23,38].

Despite decades of global health initiatives—including the Safe Motherhood Initiative, Millennium Development Goals (MDG 5), and now Sustainable Development Goals (SDG 3.1)—progress in reducing maternal mortality has been uneven [75]. Some countries such as Bangladesh, Ethiopia, and Nepal have achieved dramatic reductions [55,18], while others have stagnated or seen reversals during crises such as the COVID-19 pandemic [26,57]. Understanding which social determinants are most influential in specific contexts is essential for targeting limited resources effectively.

### Research Problem and Questions

The central problem addressed by this review is the fragmentation of evidence on social determinants of maternal mortality in developing countries. Individual studies focus on single determinants (e.g., education or transport), single countries, or single study designs, making it difficult to identify which determinants are consistently important across settings and which are context-specific. Furthermore, no recent comprehensive synthesis has compared findings across Sub-Saharan Africa, South Asia, Southeast Asia, and Latin America to identify continental patterning of risk factors.

This review therefore asks three primary questions:

1. Which social determinants of maternal mortality are consistently associated with increased risk across multiple developing country contexts?
2. How do the relative importance and magnitude of these determinants vary by geographic region and level of economic development?
3. Which interventions targeting social determinants have demonstrated effectiveness in reducing maternal mortality in resource-limited settings?

### **Study Objectives**

The primary objective of this systematic review is to synthesize quantitative evidence from published studies on the relationship between social determinants and maternal mortality in developing countries. Secondary objectives include: (1) quantifying the magnitude of association for each major determinant where meta-analytic data are available, (2) identifying regional patterns in which determinants dominate, (3) evaluating the evidence base for interventions addressing social determinants, and (4) identifying evidence gaps, particularly for underserved regions such as eastern Indonesia.

### **Research Benefits**

This review benefits policymakers, program managers, and researchers by: (1) providing a single comprehensive evidence synthesis that prioritizes determinants by strength of association and consistency across studies, (2) identifying which interventions have demonstrated effectiveness in

reducing mortality (not just improving intermediate outcomes), (3) highlighting context-specific patterns that inform targeted resource allocation, and (4) exposing critical evidence gaps that require future primary research.

### **Hypotheses**

Based on prior literature, we hypothesized that: (1) low maternal education and household poverty would be the most consistently associated determinants across all regions, (2) geographic distance and transport barriers would dominate in rural Sub-Saharan Africa and rural South/Southeast Asia but be less important in urban and middle-income settings, (3) health system quality factors would emerge as the dominant determinants in contexts where institutional delivery coverage is already high, and (4) the three-delays model would show systematic continental patterning.

### **Research Gap and Novelty**

Existing systematic reviews on maternal mortality determinants have typically focused on single countries [19,21,22,32], single regions [23,24,36], or single determinant categories [7,8,41]. No prior review has simultaneously synthesized individual-level, household-level, community-level, and macro-level determinants across all major developing regions using a standardized extraction framework. Furthermore, no prior review has explicitly analyzed the transition in dominant determinants as countries progress from low-income to middle-income status—a gap this review addresses by comparing findings across the economic spectrum of developing countries. Finally, this review specifically identifies the absence of published evidence from Papua, Indonesia, as a critical gap requiring urgent attention.

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## **METHODS**

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### **Protocol**

The study strictly adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines to ensure methodological rigor and accuracy. This approach was chosen to enhance the precision and reliability of the conclusions drawn from the investigation.

## Criteria for Eligibility

This systematic review aims to evaluate the Social Determinants in Maternal Mortality Rates in Developing Countries.

## Screening

We screened in sources based on their abstracts that met these criteria:

- **Target Population:** Does the study involve pregnant women, women during childbirth, or postpartum women (up to 42 days after delivery)?
- **Geographic Setting:** Was the study conducted in developing countries as defined by World Bank classification or similar international standards?
- **Maternal Mortality Outcomes:** Does the study report maternal mortality rates, maternal mortality ratios, or related maternal death outcomes?
- **Social Determinants Focus:** Does the study examine at least one social determinant of health (such as socioeconomic status, education level, income, employment, housing conditions, food security, social support, cultural factors, or healthcare accessibility)?
- **Study Design Appropriateness:** Is the study design one of the following: systematic review, meta-analysis, randomized controlled trial, cohort study, case-control study, cross-sectional study, or ecological study?
- **Quantitative Data Availability:** Does the study provide quantitative data or statistical analysis of the relationship between social determinants and maternal mortality?
- **Country Income Level:** Is the study NOT focused exclusively on developed/high-income countries?
- **Outcome Relevance:** Does the study report maternal mortality data (not exclusively maternal morbidity, perinatal outcomes, or fetal/neonatal mortality without maternal mortality)?

- **Social vs Clinical Focus:** Does the study examine social determinants (not focusing solely on clinical/medical risk factors without social determinants)?

We considered all screening questions together and made a holistic judgement about whether to screen in each paper.

### Search Strategy

The keywords used for this research based PICO :

| PICO Component                     | Keyword 1            | Keyword 2                                | Keyword 3                      | Keyword 4               |
|------------------------------------|----------------------|------------------------------------------|--------------------------------|-------------------------|
| <b>Population (P)</b>              | Pregnant women       | Postpartum women                         | Women of reproductive age      | Childbearing women      |
| <b>Intervention / Exposure (I)</b> | Social determinants  | Socioeconomic factors                    | Structural determinants        | Social risk factors     |
| <b>Comparison (C)</b>              | Developing countries | Low- and middle-income countries (LMICs) | Resource-limited settings      | Low-income nations      |
| <b>Outcome (O)</b>                 | Maternal mortality   | Maternal death                           | Maternal mortality ratio (MMR) | Pregnancy-related death |

The Boolean MeSH keywords inputted on databases for this research are: (*"Pregnant women"* OR *"Postpartum women"* OR *"Women of reproductive age"* OR *"Childbearing women"*) AND (*"Social determinants"* OR *"Socioeconomic factors"* OR *"Structural determinants"* OR *"Social risk factors"*) AND (*"Developing countries"* OR *"Low- and middle-income countries (LMICs)"* OR *"Resource-limited settings"* OR *"Low-income nations"*) AND (*"Maternal mortality"* OR *"Maternal death"* OR *"Maternal mortality ratio (MMR)"* OR *"Pregnancy-related death"*)

### Data extraction

- **Study Setting:**

Extract details about the study setting and population relevant to social determinants of maternal mortality in developing countries, including:

- Specific developing country/countries where study was conducted
- Geographic location (urban/rural/mixed, specific regions like Papua if mentioned)
- Population characteristics (age groups, socioeconomic status, ethnic groups)
- Healthcare system context (resource limitations, infrastructure)
- Study timeframe and sample size

- **Social Determinants:**

Extract all social determinants of maternal mortality identified, studied, or discussed, including:

- Individual-level factors (education, age, parity, marital status, employment, literacy)
- Household-level factors (income, wealth, housing conditions, water/sanitation access)
- Community-level factors (rural/urban residence, distance to healthcare, transportation, cultural practices)
- Societal-level factors (healthcare system quality, government policies, gender inequality, poverty rates)
- Social barriers to care-seeking (cost, cultural beliefs, decision-making patterns, family dynamics) Note whether each determinant was found to increase or decrease maternal mortality risk.

- **Maternal Mortality Measurement:**

Extract how maternal mortality was defined and measured in developing country contexts, including:

- Definition used (maternal mortality ratio, rate, case fatality rate)
- Time period (pregnancy, childbirth, postpartum period and duration)
- Data source (vital registration, surveys, health facility records, social autopsy)
- Measurement methods and quality
- Any adjustments made for underreporting or misclassification common in developing countries

- **Associations Found:**

Extract findings about relationships between social determinants and maternal mortality in developing countries, including:

- Direction of association (increased/decreased risk)
- Magnitude of effect (odds ratios, relative risks, percentage changes with confidence intervals)
- Statistical significance
- Strength of evidence
- Population subgroups where associations were strongest/weakest
- Any dose-response relationships or thresholds identified

- **Interventions Targeting Social Determinants:**

Extract details about interventions that addressed social determinants of maternal mortality in developing countries, including:

- Type of intervention (education, economic support, community mobilization, infrastructure improvements)
- Target determinants addressed
- Implementation approach (individual, household, community, or policy level)
- Duration and intensity
- Who delivered the intervention
- Effectiveness in reducing maternal mortality
- Cost-effectiveness where reported

- **Implementation Barriers:**

Extract barriers and facilitating factors for addressing social determinants of maternal mortality in developing countries, including:

- Resource constraints (funding, staffing, infrastructure)
- Cultural and social barriers (gender norms, traditional practices, decision-making hierarchies)
- Health system barriers (access, quality, availability of skilled providers)
- Geographic barriers (distance, transportation, terrain)
- Policy and governance issues
- Community acceptance and participation factors

- Sustainability challenges

- **Key Findings:**

Extract the main conclusions about social determinants of maternal mortality in developing countries, including:

- Most important determinants identified for the specific developing country context
- Recommendations for policy or practice
- Gaps in knowledge or research needs
- Implications for maternal mortality reduction strategies in resource-limited settings
- Transferability of findings to other developing countries
- Priority areas for intervention based on evidence strength and potential impact

**Table 1.** Article Search Strategy

| Database             | Keywords                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Hits   |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Pubmed               | <i>("Pregnant women" OR "Postpartum women" OR "Women of reproductive age" OR "Childbearing women") AND ("Social determinants" OR "Socioeconomic factors" OR "Structural determinants" OR "Social risk factors") AND ("Developing countries" OR "Low- and middle-income countries (LMICs)" OR "Resource-limited settings" OR "Low-income nations") AND ("Maternal mortality" OR "Maternal death" OR "Maternal mortality ratio (MMR)" OR "Pregnancy-related death")</i> | 59     |
| Semantic Scholar     | <i>("Pregnant women" OR "Postpartum women" OR "Women of reproductive age" OR "Childbearing women") AND ("Social determinants" OR "Socioeconomic factors" OR "Structural determinants" OR "Social risk factors") AND ("Developing countries" OR "Low- and middle-income countries (LMICs)" OR "Resource-limited settings" OR "Low-income nations") AND ("Maternal mortality" OR "Maternal death" OR "Maternal mortality ratio (MMR)" OR "Pregnancy-related death")</i> | 251    |
| Springer             | <i>("Pregnant women" OR "Postpartum women" OR "Women of reproductive age" OR "Childbearing women") AND ("Social determinants" OR "Socioeconomic factors" OR "Structural determinants" OR "Social risk factors") AND ("Developing countries" OR "Low- and middle-income countries (LMICs)" OR "Resource-limited settings" OR "Low-income nations") AND ("Maternal mortality" OR "Maternal death" OR "Maternal mortality ratio (MMR)" OR "Pregnancy-related death")</i> | 585    |
| Google Scholar       | <i>("Pregnant women" OR "Postpartum women" OR "Women of reproductive age" OR "Childbearing women") AND ("Social determinants" OR "Socioeconomic factors" OR "Structural determinants" OR "Social risk factors") AND ("Developing countries" OR "Low- and middle-income countries (LMICs)" OR "Resource-limited settings" OR "Low-income nations") AND ("Maternal mortality" OR "Maternal death" OR "Maternal mortality ratio (MMR)" OR "Pregnancy-related death")</i> | 18,200 |
| Wiley Online Library | <i>("Pregnant women" OR "Postpartum women" OR "Women of reproductive age" OR "Childbearing women") AND ("Social determinants" OR "Socioeconomic factors" OR "Structural determinants" OR "Social risk factors") AND ("Developing countries" OR "Low- and middle-income countries (LMICs)" OR "Resource-limited settings" OR "Low-income nations") AND ("Maternal mortality" OR "Maternal death" OR "Maternal mortality ratio (MMR)" OR "Pregnancy-related death")</i> | 6      |

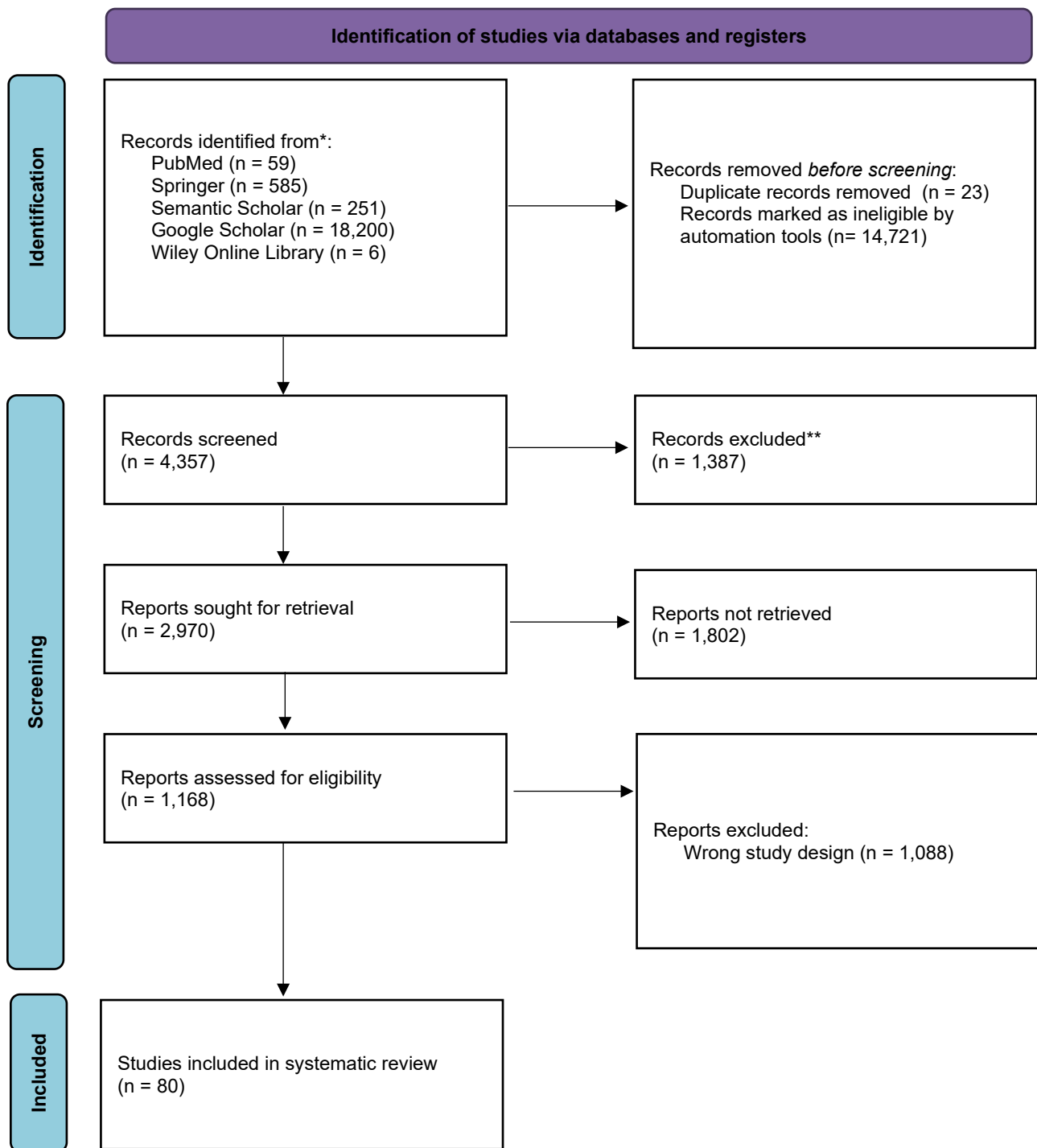


**Figure 1. Article search flowchart**

### Risk of Bias

| Study                                         | Selection Bias | Performance Bias | Detection Bias | Attrition Bias | Reporting Bias | Overall Risk |
|-----------------------------------------------|----------------|------------------|----------------|----------------|----------------|--------------|
| Tajvar et al., 2022 [17]                      | Low            | Low              | Low            | Low            | Low            | Low          |
| Merga Abdissa Aga & Ding-Geng Chen, 2025 [18] | Low            | Low              | Low            | Low            | Low            | Low          |
| Bauserman et al., 2015 [1]                    | Low            | Low              | Low            | Low            | Low            | Low          |
| Hamal et al., 2020 [19]                       | Low            | Low              | Low            | Low            | Low            | Low          |
| Say & Raine, 2007 [20]                        | Low            | Low              | Low            | Low            | Low            | Low          |
| S. García-Tizón Larroca et al., 2020 [5]      | Low            | Low              | Low            | Low            | Low            | Low          |
| Izedonmwon & Izedonmwon, 2023 [21]            | Moderate       | Low              | Moderate       | Low            | Low            | Moderate     |
| Amenah et al., 2026 [22]                      | Low            | Low              | Low            | Low            | Low            | Low          |

| Study                                           | Selection Bias | Performance Bias | Detection Bias | Attrition Bias | Reporting Bias | Overall Risk |
|-------------------------------------------------|----------------|------------------|----------------|----------------|----------------|--------------|
| Ononokpono et al., 2021 [23]                    | Low            | Low              | Low            | Low            | Low            | Low          |
| Acoff et al., 2024 [24]                         | Low            | Low              | Low            | Low            | Low            | Low          |
| Pyae Phyo Win et al., 2024 [25]                 | Low            | Low              | Low            | Low            | Low            | Low          |
| César García-Balaguera et al., 2024 [26]        | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| Santiago García-Tizón Larroca et al., 2020 [27] | Low            | Low              | Low            | Low            | Low            | Low          |
| Zalvand et al., 2019 [11]                       | Low            | Low              | Low            | Low            | Low            | Low          |
| Bayati et al., 2016 [2]                         | Low            | Low              | Low            | Low            | Low            | Low          |
| Ernst et al., 2023 [28]                         | Low            | Low              | Low            | Low            | Low            | Low          |
| Khalili et al., 2023 [29]                       | Low            | Low              | Low            | Low            | Low            | Low          |

| Study                                      | Selection Bias | Performance Bias | Detection Bias | Attrition Bias | Reporting Bias | Overall Risk |
|--------------------------------------------|----------------|------------------|----------------|----------------|----------------|--------------|
| <b>Yitbarek et al., 2019 [30]</b>          | Low            | Low              | Low            | Low            | Low            | Low          |
| <b>Dikid et al., 2013 [31]</b>             | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| <b>D'Ambruoso, 2012 [10]</b>               | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| <b>Anumudu et al., 2025 [32]</b>           | Low            | Low              | Low            | Low            | Low            | Low          |
| <b>Simona et al., 2022 [33]</b>            | Low            | Low              | Low            | Low            | Low            | Low          |
| <b>Khan et al., 2009 [34]</b>              | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| <b>Berhan &amp; Berhan, 2014 [35]</b>      | Low            | Low              | Low            | Low            | Low            | Low          |
| <b>Kolleh et al., 2022 [36]</b>            | Low            | Low              | Low            | Low            | Low            | Low          |
| <b>Gebrehiwot &amp; Tewolde, 2014 [37]</b> | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |

| Study                           | Selection Bias | Performance Bias | Detection Bias | Attrition Bias | Reporting Bias | Overall Risk |
|---------------------------------|----------------|------------------|----------------|----------------|----------------|--------------|
| Hagues et al., 2017 [38]        | Low            | Low              | Low            | Low            | Low            | Low          |
| Ikhtiar et al., 2014 [39]       | Moderate       | Moderate         | Moderate       | Low            | Moderate       | Moderate     |
| El-Saharty et al., 2016 [40]    | Low            | Low              | Low            | Low            | Low            | Low          |
| Nwolise et al., 2015 [41]       | Low            | Low              | Low            | Low            | Low            | Low          |
| H. K. M. et al., 2021 [42]      | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| Ibrahim & Onwudiegwu, 2012 [43] | Moderate       | High             | Moderate       | Moderate       | Moderate       | Moderate     |
| Okumbe, 2011 [44]               | Unclear        | Unclear          | Unclear        | Unclear        | Unclear        | Unclear      |
| Türkyılmaz et al., 2009 [45]    | Low            | Low              | Low            | Low            | Low            | Low          |
| Chirowa et al., 2013 [46]       | Low            | Low              | Low            | Low            | Low            | Low          |

| Study                     | Selection Bias | Performance Bias | Detection Bias | Attrition Bias | Reporting Bias | Overall Risk |
|---------------------------|----------------|------------------|----------------|----------------|----------------|--------------|
| Pillai et al., 2013 [3]   | Low            | Low              | Low            | Low            | Low            | Low          |
| Bassey, 2015 [47]         | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| Orijj et al., 2022 [48]   | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| Egbe et al., 2016 [49]    | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| Tlou, 2018 [4]            | Low            | Low              | Low            | Low            | Low            | Low          |
| Shrestha, 2009 [50]       | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| Umeora et al., 2005 [51]  | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| Raj et al., 2013 [52]     | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| Singh et al., 2015 [53]   | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| Muriithi et al., 2022 [6] | Low            | Low              | Low            | Low            | Low            | Low          |

| Study                                       | Selection Bias | Performance Bias | Detection Bias | Attrition Bias | Reporting Bias | Overall Risk |
|---------------------------------------------|----------------|------------------|----------------|----------------|----------------|--------------|
| <b>Maternal Mortality Review, 2023 [54]</b> | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| <b>Hogan et al., 2016 [12]</b>              | Low            | Low              | Low            | Low            | Low            | Low          |
| <b>Chowdhury et al., 2009 [55]</b>          | Low            | Low              | Low            | Low            | Low            | Low          |
| <b>Obare et al., 2016 [56]</b>              | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| <b>Marco Antonio et al., 2024 [57]</b>      | Low            | Low              | Low            | Low            | Low            | Low          |
| <b>Abasiattai &amp; Umoiyoho, 2008 [58]</b> | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| <b>Ayu Putu et al., 2024 [59]</b>           | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| <b>Habib et al., 2023 [60]</b>              | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| <b>Khan et al., 2024 [61]</b>               | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |

| Study                                   | Selection Bias | Performance Bias | Detection Bias | Attrition Bias | Reporting Bias | Overall Risk |
|-----------------------------------------|----------------|------------------|----------------|----------------|----------------|--------------|
| <b>Fagbemi et al., 2024 [62]</b>        | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| <b>Karmbor-Ballah et al., 2019 [63]</b> | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| <b>Serván-Mori et al., 2020 [13]</b>    | Low            | Low              | Low            | Low            | Low            | Low          |
| <b>Naranjee et al., 2023 [64]</b>       | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| <b>Ara et al., 2025 [65]</b>            | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| <b>Manyeh et al., 2018 [66]</b>         | Low            | Low              | Low            | Low            | Low            | Low          |
| <b>Oboh et al., 2020 [67]</b>           | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| <b>Sulyastini et al., 2025 [14]</b>     | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| <b>DerSarkissian et al., 2013 [68]</b>  | Low            | Low              | Low            | Low            | Low            | Low          |
| <b>Ramos, 2013 [69]</b>                 | Unclear        | Unclear          | Unclear        | Unclear        | Unclear        | Unclear      |

| Study                            | Selection Bias | Performance Bias | Detection Bias | Attrition Bias | Reporting Bias | Overall Risk |
|----------------------------------|----------------|------------------|----------------|----------------|----------------|--------------|
| Salazar Flórez et al., 2025 [70] | Low            | Low              | Low            | Low            | Low            | Low          |
| Mushtaq, 2026 [16]               | Low            | Low              | Low            | Low            | Low            | Low          |
| Ghosh, 2025 [7]                  | Low            | Low              | Low            | Low            | Low            | Low          |
| Cham et al., 2005 [71]           | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| Mataya, 2008 [72]                | Unclear        | Unclear          | Unclear        | Unclear        | Unclear        | Unclear      |
| Yeboah et al., 2025 [73]         | Low            | Low              | Low            | Low            | Low            | Low          |
| Kachhwaha & Jain, 2019 [74]      | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |
| Rathore et al., 2024 [75]        | Low            | Low              | Low            | Low            | Low            | Low          |
| Yakubu et al., 2018 [76]         | Low            | Low              | Low            | Low            | Low            | Low          |
| Souza et al., 2023 [77]          | Low            | Low              | Low            | Low            | Low            | Low          |
| Najafizada et al., 2017 [9]      | Low            | Low              | Low            | Low            | Low            | Low          |

| Study                      | Selection Bias | Performance Bias | Detection Bias | Attrition Bias | Reporting Bias | Overall Risk |
|----------------------------|----------------|------------------|----------------|----------------|----------------|--------------|
| Evans, 2013 [8]            | Low            | Low              | Low            | Low            | Low            | Low          |
| Soubeiga et al., 2014 [15] | Low            | Low              | Low            | Low            | Low            | Low          |
| Aliyu et al., 2022 [78]    | Low            | Low              | Low            | Low            | Low            | Low          |
| Mensch et al., 2019 [79]   | Low            | Low              | Low            | Low            | Low            | Low          |
| Marks et al., 2016 [80]    | Moderate       | Moderate         | Moderate       | Low            | Low            | Moderate     |

## RESULTS

### Characteristics of Included Studies

The 80 sources included in this review span a wide range of geographic contexts, study designs, and analytical frameworks. The table below summarizes the key characteristics of each included study.

| Study                    | Country/Region          | Setting | Timeframe       | Sample size                      |
|--------------------------|-------------------------|---------|-----------------|----------------------------------|
| Tajvar et al., 2022 [17] | Multiple LMICs (global) | Mixed   | Post-2013 focus | 109 primary + 12 review articles |

| Study                                                    | Country/Region                                             | Setting                                        | Timeframe     | Sample size                        |
|----------------------------------------------------------|------------------------------------------------------------|------------------------------------------------|---------------|------------------------------------|
| <b>Merga Abdissa Aga &amp; Ding-Geng Chen, 2025 [18]</b> | Ethiopia                                                   | Urban and rural, all regions                   | 2015–2025     | 61 studies                         |
| <b>Bauserman et al., 2015 [1]</b>                        | Kenya, Zambia, India, Pakistan, Argentina, Guatemala       | Urban and rural                                | 2010–2013     | 277,736 pregnancies [1]            |
| <b>Hamal et al., 2020 [19]</b>                           | India                                                      | Urban and rural (northern and southern states) | After 2000    | 41 studies                         |
| <b>Say &amp; Raine, 2007 [20]</b>                        | 23 developing countries                                    | Not specified                                  | Not specified | 30 eligible studies                |
| <b>S. García-Tizón Larroca et al., 2020 [5]</b>          | >30 countries (including Brazil, India, Nigeria, Ethiopia) | Mixed                                          | 2008–2019     | 82 articles; 3,699,697 live births |

| Study                                                  | Country/Region                   | Setting             | Timeframe            | Sample size                     |
|--------------------------------------------------------|----------------------------------|---------------------|----------------------|---------------------------------|
| <b>Izedonmwun &amp; Izedonmwun, 2023 [21]</b>          | Ethiopia                         | Urban and rural     | 2014–2023            | 5 studies                       |
| <b>Amenah et al., 2026 [22]</b>                        | Ghana                            | Not specified       | 2000–2023            | 19 studies                      |
| <b>Ononokpono et al., 2021 [23]</b>                    | Sub-Saharan Africa               | Not specified       | 1990–2020            | 56 articles and grey literature |
| <b>Acoff et al., 2024 [24]</b>                         | Africa (multiple countries)      | Various             | 10-year period noted | Not specified                   |
| <b>Pyae Phyo Win et al., 2024 [25]</b>                 | Cambodia, Laos, Myanmar, Vietnam | Mixed (rural focus) | Implied 1990–2020    | 75 studies                      |
| <b>César García-Balaguera et al., 2024 [26]</b>        | Colombia (Department of Meta)    | Urban and rural     | 2018–2022            | 59 maternal deaths              |
| <b>Santiago García-Tizón Larroca et al., 2020 [27]</b> | >30 countries                    | Mixed               | 2008–2019            | 82 articles                     |

| Study                             | Country/Region                                      | Setting                               | Timeframe     | Sample size   |
|-----------------------------------|-----------------------------------------------------|---------------------------------------|---------------|---------------|
| <b>Zalvand et al., 2019 [11]</b>  | Iran                                                | National<br>(urbanization considered) | 1990–2015     | Not specified |
| <b>Bayati et al., 2016 [2]</b>    | Eastern Mediterranean Region (22 countries)         | Regional                              | 2004–2011     | 22 countries  |
| <b>Ernst et al., 2023 [28]</b>    | Latin America (Bolivia, Mexico, Ecuador, Caribbean) | Central and South America             | Not specified | Not specified |
| <b>Khalili et al., 2023 [29]</b>  | Iran                                                | Urban and rural                       | 1970–2021     | Not specified |
| <b>Yitbarek et al., 2019 [30]</b> | Ethiopia                                            | Mixed                                 | 2010 onwards  | 9 studies     |
| <b>Dikid et al., 2013 [31]</b>    | India (4 states)                                    | Selected districts                    | Not specified | Not specified |

| Study                                      | Country/Region                      | Setting         | Timeframe         | Sample size                                 |
|--------------------------------------------|-------------------------------------|-----------------|-------------------|---------------------------------------------|
| <b>D'Ambruoso, 2012 [10]</b>               | Indonesia                           | Rural (Java)    | Data from 2010    | Not specified                               |
| <b>Anumudu et al., 2025 [32]</b>           | Nigeria                             | Not specified   | After 2000        | 21 publications                             |
| <b>Simona et al., 2022 [33]</b>            | Sub-Saharan Africa (9 countries)    | Urban and rural | 2007–2019         | 34 studies                                  |
| <b>Khan et al., 2009 [34]</b>              | Pakistan                            | Not specified   | Not specified     | Not specified                               |
| <b>Berhan &amp; Berhan, 2014 [35]</b>      | Ethiopia                            | Urban and rural | 1995–2011         | Not specified                               |
| <b>Kolleh et al., 2022 [36]</b>            | Africa (East, West, South, Central) | Mixed           | 2008–2021         | 18 studies                                  |
| <b>Gebrehiwot &amp; Tewolde, 2014 [37]</b> | Ethiopia (10 hospitals, 4 regions)  | Mixed           | May 2011–Oct 2012 | 2,774 cases (206 deaths, 2,568 near misses) |
| <b>Hagues et al., 2017 [38]</b>            | Global (developing and developed)   | Not specified   | 2000–2010         | Not specified                               |

| Study                                      | Country/Region                            | Setting            | Timeframe         | Sample size                  |
|--------------------------------------------|-------------------------------------------|--------------------|-------------------|------------------------------|
| <b>Ikhtiar et al., 2014 [39]</b>           | Indonesia (Gowa District, South Sulawesi) | Rural              | 2010–2012         | 175 respondents              |
| <b>El-Saharty et al., 2016 [40]</b>        | South Asia (SAR)                          | Not specified      | 1990–2013         | Not specified                |
| <b>Nwolise et al., 2015 [41]</b>           | Developing countries                      | Not specified      | Not specified     | Not specified                |
| <b>H. K. M. et al., 2021 [42]</b>          | India (Andhra Pradesh)                    | Mixed              | Jan 2017–Dec 2019 | 10,491 live births; 7 deaths |
| <b>Ibrahim &amp; Onwudiegwu, 2012 [43]</b> | Nigeria (Bayelsa State)                   | Semi-urban         | Jan 2007–Dec 2010 | Not specified                |
| <b>Okumbe, 2011 [44]</b>                   | Kenya (Bondo District)                    | Mixed/rural        | Not specified     | 1,000 respondents            |
| <b>Türkyılmaz et al., 2009 [45]</b>        | Turkey                                    | Not specified      | 12 months         | Not specified                |
| <b>Chirowa et al., 2013 [46]</b>           | Sub-Saharan Africa (7 countries)          | Sub-Saharan Africa | Not specified     | 7 countries                  |

| Study                           | Country/Region                       | Setting     | Timeframe         | Sample size                    |
|---------------------------------|--------------------------------------|-------------|-------------------|--------------------------------|
| <b>Pillai et al., 2013 [3]</b>  | 143 nations                          | Global      | 1970–2000         | 143 nations                    |
| <b>Bassey, 2015 [47]</b>        | Nigeria                              | National    | 1990–2013         | National survey data           |
| <b>Orijit et al., 2022 [48]</b> | Nigeria (Bayelsa State, South-South) | Urban       | Jan 2016–Dec 2020 | 4,571 obstetric patients       |
| <b>Egbe et al., 2016 [49]</b>   | Cameroon (North West Region)         | Mixed/rural | Jan 2011–Nov 2014 | 89 cases, 178 controls         |
| <b>Tlou, 2018 [4]</b>           | South Africa (rural KwaZulu-Natal)   | Rural       | 2000–2014         | 32,620 live births; 212 deaths |
| <b>Shrestha, 2009 [50]</b>      | Nepal (rural hill districts)         | Rural       | Dec 2005–Feb 2006 | 33 maternal deaths             |
| <b>Umeora et al., 2005 [51]</b> | Nigeria (Ebonyi State)               | Rural       | Jan 2000–Dec 2003 | 4,192 live births; 79 deaths   |
| <b>Raj et al., 2013 [52]</b>    | India (Uttar Pradesh)                | Rural       | Jun 2009–May 2010 | 57 verbal autopsies            |
| <b>Singh et al., 2015 [53]</b>  | India (Andhra Pradesh)               | Mixed       | Apr–Sep 2012      | 284 deaths; 193 reviewed       |

| Study                                       | Country/Region                                      | Setting                       | Timeframe                   | Sample size                                  |
|---------------------------------------------|-----------------------------------------------------|-------------------------------|-----------------------------|----------------------------------------------|
| <b>Muriithi et al., 2022 [6]</b>            | Africa (27 countries)                               | Predominantly health facility | 1987–2021                   | 104 articles                                 |
| <b>Maternal Mortality Review, 2023 [54]</b> | Sudan (Elgadarif State)                             | Mixed                         | Not specified               | 72 maternal deaths                           |
| <b>Hogan et al., 2016 [12]</b>              | Mexico                                              | Mixed                         | 2006–2013                   | 9,043 maternal deaths                        |
| <b>Chowdhury et al., 2009 [55]</b>          | Bangladesh (rural Matlab)                           | Rural                         | 1976–2005                   | 215,779 pregnancies; 769 deaths              |
| <b>Obare et al., 2016 [56]</b>              | Kenya (Nairobi County)                              | Urban                         | Not specified               | 93 facility records; 71 caregiver interviews |
| <b>Marco Antonio et al., 2024 [57]</b>      | South America (Peru, Colombia, Brazil, Andean zone) | Urban and rural               | 2019–2023 (pandemic period) | Not specified                                |
| <b>Abasiattai &amp; Umoiyoho, 2008 [58]</b> | Nigeria (Akwa Ibom State)                           | Urban                         | 6 years                     | 3,531 live births; 91 deaths                 |

| Study                                   | Country/Region                                                                            | Setting              | Timeframe         | Sample size                 |
|-----------------------------------------|-------------------------------------------------------------------------------------------|----------------------|-------------------|-----------------------------|
| <b>Ayu Putu et al., 2024 [59]</b>       | Indonesia, Ethiopia, Timor Leste, Nigeria, South Africa, Nepal, Sri Lanka, India, Myanmar | Not specified        | 2016–2023         | Not specified               |
| <b>Habib et al., 2023 [60]</b>          | Pakistan (Abbottabad)                                                                     | Urban                | Jul 2010–Jun 2020 | 35,660 births; 193 deaths   |
| <b>Khan et al., 2024 [61]</b>           | Bangladesh (Dhaka)                                                                        | Urban                | Jul 2009–Jun 2010 | 10,592 records; 189 deaths  |
| <b>Fagbemi et al., 2024 [62]</b>        | Nigeria (Delta State)                                                                     | Urban                | Jul 2016–Jun 2021 | 6,247 deliveries; 44 deaths |
| <b>Karmbor-Ballah et al., 2019 [63]</b> | Liberia                                                                                   | National             | 2017              | 258 maternal death reviews  |
| <b>Serván-Mori et al., 2020 [13]</b>    | Mexico                                                                                    | Jurisdictional level | 2008–2015         | Not specified               |
| <b>Naranjee et al., 2023 [64]</b>       | South Africa (KwaZulu-Natal)                                                              | Mixed                | 2009–2019         | Not specified               |

| Study                                       | Country/Region                            | Setting                             | Timeframe             | Sample size                 |
|---------------------------------------------|-------------------------------------------|-------------------------------------|-----------------------|-----------------------------|
| <b>Ara et al., 2025 [65]</b>                | Bangladesh<br>(Rangpur)                   | Urban                               | Jan 2024–<br>Dec 2024 | 4,741 records; 83<br>deaths |
| <b>Manyeh et al., 2018 [66]</b>             | Tanzania (rural<br>Morogoro)              | Rural                               | 2006–2010             | 36,792 women                |
| <b>Oboh et al., 2020 [67]</b>               | Nigeria (Irrua,<br>South-South)           | Not<br>specified                    | Jan 2008–<br>Dec 2018 | Not specified               |
| <b>Sulyastini et al., 2025<br/>[14]</b>     | Indonesia<br>(Buleleng District,<br>Bali) | Mixed                               | 2021–2023             | 49 maternal deaths          |
| <b>DerSarkissian et al.,<br/>2013 [68]</b>  | Africa (49<br>countries)                  | Africa                              | 1990–2005             | 49 countries                |
| <b>Ramos, 2013 [69]</b>                     | Brazil                                    | National                            | 2004–2013             | 53 articles + 2<br>reports  |
| <b>Salazar Flórez et al.,<br/>2025 [70]</b> | Colombia                                  | Urban,<br>rural,<br>remote<br>rural | 2014–2021             | 3,260 identified<br>deaths  |
| <b>Mushtaq, 2026 [16]</b>                   | Pakistan                                  | National                            | 2000–2024             | 25 years annual data        |

| Study                                  | Country/Region                                                      | Setting             | Timeframe                      | Sample size                |
|----------------------------------------|---------------------------------------------------------------------|---------------------|--------------------------------|----------------------------|
| <b>Ghosh, 2025 [7]</b>                 | Developing countries (Asia, Africa, Latin America)                  | Not specified       | 2015–2023                      | 69 case study articles     |
| <b>Cham et al., 2005 [71]</b>          | Gambia (rural)                                                      | Rural               | Jan–Sep 2002                   | 42 maternal deaths         |
| <b>Mataya, 2008 [72]</b>               | Malawi                                                              | Predominantly rural | Data from 2000, 2004           | National (Southern Region) |
| <b>Yeboah et al., 2025 [73]</b>        | Sub-Saharan Africa (Ghana, Nigeria, Ethiopia, South Africa, Rwanda) | Sub-Saharan Africa  | 2000–2022                      | 18 studies                 |
| <b>Kachhwaha &amp; Jain, 2019 [74]</b> | India (central Gujarat)                                             | Mixed (71% rural)   | Oct 2016–Mar 2018              | 92 maternal deaths         |
| <b>Rathore et al., 2024 [75]</b>       | India                                                               | Urban and rural     | 2000–2020 (projection to 2030) | Not specified              |
| <b>Yakubu et al., 2018 [76]</b>        | Global (developing countries)                                       | Not specified       | Jan 2000–Sep 2016              | 33 eligible articles       |

| Study                       | Country/Region                                                             | Setting            | Timeframe                 | Sample size                        |
|-----------------------------|----------------------------------------------------------------------------|--------------------|---------------------------|------------------------------------|
| Souza et al., 2023 [77]     | Global                                                                     | Not specified      | Not specified             | Not specified                      |
| Najafizada et al., 2017 [9] | Afghanistan                                                                | Urban and rural    | Early 2000s–2010          | 38 articles/reports                |
| Evans, 2013 [8]             | Developing countries                                                       | Not specified      | Not specified             | Not specified                      |
| Soubeiga et al., 2014 [15]  | India, Nepal, Bangladesh, Ghana, Malawi, Pakistan, 4 Latin American cities | Urban and rural    | Dec 2012–Dec 2013         | 307,018 women; 292,256 live births |
| Aliyu et al., 2022 [78]     | Sub-Saharan Africa                                                         | Sub-Saharan Africa | References from 2015–2017 | Not specified                      |
| Mensch et al., 2019 [79]    | Brazil (Porto Alegre)                                                      | Urban              | Jan 2000–Dec 2017         | 317,545 children                   |
| Marks et al., 2016 [80]     | Malawi                                                                     | National           | 2010–2015                 | Not specified                      |

The geographic distribution of included studies is heavily weighted toward Sub-Saharan Africa, South Asia, and East Africa, with Ethiopia alone featuring as the focal country in multiple independent reviews [18, 21, 30, 35, 37]. Nigeria similarly appears across multiple primary studies and reviews [32, 47, 48, 51, 58, 62, 67]. Southeast Asia is represented primarily through the CLMV review (Cambodia, Laos, Myanmar, Vietnam) [25], the Indonesian qualitative study from Java [10], the Bali mixed-methods study [14], and the broader literature review encompassing Indonesia among other developing nations [59]. Papua and remote Indonesian settings are not directly studied by any included paper, though the Java study [10] addresses rural Indonesian contexts, and the Buleleng study [14] provides facility-level insights for Indonesia. Study designs range from large multi-country prospective cohorts and systematic reviews to single-facility retrospective chart reviews, verbal autopsy studies, and qualitative investigations. Most facility-based retrospective studies are from tertiary or teaching hospitals and therefore likely underrepresent community-level and home deaths, a limitation acknowledged across multiple included sources [6, 51, 52].

### **Thematic Analysis**

#### **Theme 1: Education as a Structural Determinant**

Maternal education emerges as one of the most consistently documented social determinants of maternal mortality across virtually every geographic context in this review. The multi-country prospective cohort by Bauserman et al. provides the most precise quantified estimates: compared to women with secondary education, those with no formal education faced a relative risk of 3.2 (95% CI: 1.5–6.9), those with primary education only faced a RR of 3.4 (95% CI: 1.6–7.5), and those with secondary education only a RR of 2.5 (95% CI: 1.1–5.7) [1]. The gradient is consistent, though the absence of a formal dose-response analysis means the apparent non-monotonicity (primary > none) likely reflects small-number instability.

In the Eastern Mediterranean, panel data analysis across 22 countries found female literacy rate to be the strongest single predictor among those examined, with a standardized coefficient of  $\beta = -1.045$  ( $p < 0.01$ ), exceeding even GDP per capita ( $\beta = -0.869$ ,  $p < 0.01$ ) and skilled birth attendance ( $\beta = -0.899$ ,  $p < 0.05$ ) in explanatory magnitude [2]. A latent growth curve analysis spanning 143 nations and three decades (1970–2000) further demonstrated that rates of increase in

female literacy are negatively associated with changes in maternal mortality ratios, and that this relationship holds longitudinally rather than merely cross-sectionally [3]. Similarly, in Matlab, Bangladesh, women's education was described as "a strong predictor" of the long-term maternal mortality decline observed between 1976 and 2005 [55].

Africa-specific evidence reinforces this pattern. The meta-analysis by Kolleh et al. estimated that having no formal education or being illiterate was associated with an OR of 2.30 (95% CI: 1.50–3.52) for maternal mortality across African settings [36]. In Pakistan, data from 193 deaths over ten years showed that 96.9% of those who died were illiterate and 94.8% came from a poor socioeconomic background [60], while a tertiary hospital study in Bangladesh found that 75.66% of women who died had received no antenatal care [61]. In Afghanistan, one study found that 93% of women who died of maternity-related causes were illiterate [9].

Education operates through multiple pathways: it increases uptake of antenatal care, enhances recognition of danger signs, boosts contraceptive use, delays age at first marriage, increases women's decision-making autonomy, and improves household income through labor market participation [38, 40, 55]. For example, in developing countries, secondary education participation is significantly correlated with increased contraceptive use, which itself mediates maternal mortality risk, while the same correlation does not hold in high-income countries [38]. In India, quantified associations between education and antenatal and postnatal care uptake showed ORs of approximately 1.5, 1.9, and 2.7 for primary, secondary, and high school education respectively [19].

The systematic review by Mensch et al., which focused on causal rather than merely associational evidence, found that maternal education under 8 years increased infant mortality risk by 37–40% ( $p < 0.001$ ), and that regions with medium human development index had 1.54 times higher mortality risk compared to very high HDI regions [79]. The review specifically engaged with endogeneity concerns — the possibility that unobserved factors driving educational attainment also affect health-seeking behavior — making this one of the more methodologically rigorous pieces of evidence in the corpus.

However, the Iran longitudinal study is a notable outlier: multivariate regression showed that education level at the country level was not significantly associated with reductions in maternal mortality, while employment status, health expenditure, and political performance were [11]. This divergence likely reflects confounding in a context where Iran's national-level education attainment was already relatively high at baseline, diminishing its explanatory power at the macro level relative to the other determinants examined.

## **Theme 2: Socioeconomic Status, Poverty, and Wealth Inequalities**

Poverty and low socioeconomic status are pervasive contributors to maternal mortality across all regions studied. In Tanzania's Ifakara HDSS cohort, women in the poorest socioeconomic quintile faced dramatically elevated hazard ratios compared to those even one quintile higher: being in a "poorer" category carried  $HR = 0.16$  (95% CI: 0.06–0.42) relative to the poorest group, meaning that even a modest improvement in economic standing substantially reduced risk [66]. In rural South Africa, a poor wealth index was associated with  $HR = 3.92$  (95% CI: 1.01–15.3) for maternal mortality [4].

Facility-based retrospective studies corroborate this consistently: in Pakistan, 94.8% of 193 women who died were from poor socioeconomic backgrounds [60]; in Nigeria's Delta State, low socioeconomic status was identified as a major determinant alongside unbooked status [62]; and in a Nigerian teaching hospital, 83.6% of women who died were from social classes IV and V [58]. In Bangladesh, 80.95% of deaths occurred among women from low socioeconomic backgrounds [61], and in Rangpur, 72.2% of deaths were among low-income women [65].

At the macro level, the Eastern Mediterranean panel data found GDP per capita significantly associated with maternal mortality ( $\beta = -0.869$ ,  $p < 0.01$ ) [2], and in Africa, GDP was negatively correlated with maternal mortality across 49 countries from 1990 to 2005, with total fertility rate and neonatal mortality rate positively correlated ( $r$  ranging from 0.71–0.87) [68]. The Human Development Index — which aggregates income, education, and health components — was inversely and significantly ( $p < 0.05$ ) associated with both maternal near-miss rates and maternal mortality rates across 82 articles covering over 30 countries and 3.7 million live births [5]. The Iran

longitudinal study similarly found that GDP per capita and total health expenditure were significantly associated with reduced maternal mortality [11].

Colombia's urban-rural analysis demonstrated that maternal mortality in remote rural areas carried relative disparities of 41–88% compared to urban municipal centers, with absolute gaps ranging from 47 to 94 deaths [70]. In Mexico, direct obstetric deaths were concentrated in women from the poorest municipalities, while indirect deaths were associated with slightly better-educated, wealthier women in less impoverished municipalities [12] — suggesting that socioeconomic status differentiates not merely whether women die but how they die.

The relationship between economic growth and maternal mortality in Sub-Saharan Africa is more nuanced. A systematic review of 18 studies found that while 11 reported significant positive effects of economic growth on reducing maternal mortality, others found insignificant or inconsistent associations, emphasizing that governance quality, equitable resource distribution, and complementary social policies are necessary conditions for economic growth to translate into maternal health improvements [73].

### **Theme 3: Geographic Barriers — Rural Residence, Distance, and Transportation**

Rural residence and physical distance from healthcare facilities constitute a near-universal barrier to maternal survival across the developing country literature. In the multi-country Global Network cohort, site location — a proxy for geographic and infrastructure variation — was one of the strongest contextual predictors of MMR, with Latin American sites (MMR 91) substantially lower than Asian (MMR 178) or African sites (MMR 125) [1]. In Turkey's national RAMOS study, maternal mortality was highest in regions with poorer road networks, harsher winter conditions, and longer distances to secondary-level facilities providing comprehensive emergency obstetric care [45].

In Nepal's rural hill districts, verbal autopsy analysis documented that women faced simultaneous barriers of underestimating complication severity, lacking family support, lacking transportation, and experiencing prolonged transit to care — all of which intersected in women who were already poor and socially marginalized [50]. In rural Gambia, similar patterns emerged: women who sought care encountered disorganized healthcare systems with inadequate prompt

response to emergencies, poor road conditions, and the need to seek care at multiple facilities before receiving treatment [71]. In Ethiopia, 70.2% of women who eventually died had arrived at hospital only after developing serious complications due to lack of transportation [37].

The meta-analysis of community-based loan funds for emergency transport in developing countries — while noting study design limitations — found that implementation alongside other interventions produced ORs of 3.5 (95% CI: 0.97–15.48) and 3.55 (95% CI: 1.56–8.05) for increased health facility utilization, and ORs of 2.22 (95% CI: 0.51–10.38) and 3.37 (95% CI: 1.78–6.37) for emergency obstetric care utilization [41]. This suggests that transport financing is a meaningful, if not transformative, intervention, though the evidence base is weak.

Colombia's longitudinal analysis illustrates temporal dynamics: while remote rural areas saw overall declining trends, they experienced a transient spike in 2017, whereas municipal centers spiked in 2019, suggesting that structural crises (economic instability, pandemic) affect rural and urban populations at different times and through different mechanisms [70]. In Indonesia, the rural Java study described a systematic social process whereby disadvantaged women were less likely to be admitted to facilities, more likely to be treated in under-equipped wards, and more likely to require cross-facility referrals — creating compounded delays [10].

The Ethiopian community health volunteer program (Women's Development Army/Teams) showed that proximity to health facilities was critical: skilled delivery and antenatal care service use were higher in Women's Development Teams located within 2 km of facilities, and non-membership in such teams was associated with an OR of 2.07 (95% CI: 1.04–4.11) for maternal death [30]. This dose-response relationship between distance and community health effectiveness underscores how geography mediates even community-level intervention outcomes.

#### **Theme 4: Antenatal Care Utilization and Skilled Birth Attendance**

Inadequate utilization of antenatal care (ANC) and delivery by unskilled attendants consistently feature as proximate pathways through which social determinants translate into maternal deaths. In the Bauserman et al. cohort, lack of any ANC was associated with RR 1.8 (95% CI: 1.2–2.5) for maternal mortality [1]. In Africa's meta-analysis, no history of ANC attendance was

associated with OR 2.42 (95% CI: 0.43–13.50) [36] — though the wide confidence interval reflects substantial heterogeneity across contexts.

In the Eastern Mediterranean, skilled birth attendance held a  $\beta = -0.899$  ( $p < 0.05$ ) association with maternal mortality at the population level [2]. South Asia's structured literature review identified improving skilled birth attendance coverage as one of three most effective intrapartum interventions, alongside increasing institutional delivery rates and scaling up emergency obstetric care access [40]. Pakistan's 25-year longitudinal econometric study found that as skilled birth attendance increased from 37% to 70% between 2000 and 2024, MMR declined 51% (from 305 to 150 per 100,000 live births), and that the synergistic interaction between skilled attendance and health expenditure was statistically significant [16].

In Cameroon's case-control study, inadequate ANC was associated with RR = 1.87 (95% CI: 1.33–2.63,  $p = 0.0003$ ) for maternal death, and healthcare provider qualification with RR = 2.87 (95% CI: 2.17–3.79,  $p < 0.0001$ ) [49]. In Nigeria, a striking finding was that 74% of women who died had been unbooked for antenatal care, and those brought from traditional birth attendants' homes constituted 81.5% of unbooked deaths [58]. In Andhra Pradesh, India, Type 1 delay — delay in the decision to seek help — accounted for 58.9% of underlying causes of death in community maternal death reviews, exceeding facility-level delays [53].

In Bangladesh (Rangpur), 73.4% of women who died had received no ANC [65]; in Dhaka, the figure was 75.66% [61]. In Malawi, facility-based review data showed that despite deficient hospital care being a major contributor to deaths, delays in decision-making and cultural beliefs about delivery remained the dominant first-order barriers — illustrating the three-delays model operating simultaneously across all levels [72].

The scoping review by Ghosh (2025) synthesized delay-specific findings across developing regions, finding that patient-related delays (Delay 1) dominate in Asia, geographic and transport delays (Delay 2) are the persistent challenge in Africa, and quality-of-care delays (Delay 3) are the primary bottleneck in Latin America [7]. This continental patterning of which delay predominates has direct implications for where resources should be directed.

### **Theme 5: Gender Inequality and Women's Autonomy**

Gender inequality operates across multiple levels — household decision-making, labor market exclusion, early marriage, high fertility, and access to resources — to shape maternal mortality risk. The secondary data analysis in Sub-Saharan Africa found that countries with higher Gender Inequality Index scores had higher maternal mortality ratios, while those spending more on health had lower maternal mortality [46]. A systematic review examining 23 developing countries similarly found that women's decision-making power and autonomy were significant intermediary determinants of maternal health service use [20].

In India, the social determinants framework review identified economic status, caste/ethnicity, education, gender, religion, and culture as the most important structural factors, with quantified associations showing ORs for antenatal care and institutional delivery ranging from 1.3 to 3.7 across wealth quintiles and 1.5 to 2.7 across education levels [19]. In Indonesia's Gowa District case-control study, women who were not involved in family decision-making regarding place of delivery constituted 65.7% of deaths versus 37.1% of survivors, and the overall OR for social determinants of health was 3.244 [39].

Path analysis across developing and developed countries demonstrated that secondary education participation is significantly correlated with age at marriage in developing countries — suggesting that education delays marriage, which then delays first pregnancy, increases contraceptive use, and ultimately reduces maternal mortality — while the same pathway does not operate in developed countries where education and early marriage are already decoupled [38]. In Pakistan, early marriage, undernutrition for girls, high fertility rates, and unmet contraceptive needs were identified as co-occurring structural vulnerabilities [34].

In Afghanistan, male authorization for healthcare access was documented as a specific decision-making barrier, with household wealth being the strongest determinant of whether women could access skilled birth attendants [9]. Cultural Evans (2013) categorizes the mechanisms by which culture increases maternal mortality into four pathways: directly harmful acts (e.g., practices during delivery), inaction (failure to seek care), use of care (preference for traditional providers), and social status (power differentials determining access to resources) [8]. In Nigeria, dependence

on male spouses for healthcare decisions was identified as a structural barrier that persisted despite various maternal health initiatives [32].

### **Theme 6: Healthcare System Quality, Capacity, and the Three-Delays Framework**

Health system failures — encompassing triage, monitoring, referral, drug availability, and provider competence — were the most frequently reported category of contributing factors to maternal deaths in Africa, appearing in 80.8% of the 104 articles included in Muriithi et al.'s scoping review [6]. Transportation barriers (Delay 2) were reported in 84.6% of articles, making this the single most common contributory factor at the wider health system level, while individual-level delays in recognizing danger signs or deciding to seek care appeared in 37.5% of articles [6].

In Liberia, a biosocial analysis of 258 maternal death reviews found that user fees — officially eliminated after the civil war — had resurfaced as informal out-of-pocket payments, creating a financially burdensome and inefficient referral system through trained traditional midwives [63]. Staff attrition, burnout, inadequate training, and patient neglect were additional documented systemic failures [63]. In Sudan (Elgadarif State), 68 of 72 maternal deaths were classified as avoidable, with poorly financed referral systems, lack of skilled birth attendance, essential drug unavailability, and weak protocols as the critical determinants [54].

Mexico's longitudinal analysis of technical efficiency (TE) in primary care found that each percentage point increase in TE was associated with a 0.36% decline in the maternal mortality ratio ( $p < 0.01$ ), but this effect disappeared entirely in low- and medium-marginalization jurisdictions, suggesting that efficiency gains accrue only where marginalization is sufficiently high to create meaningful gains in coverage [13]. This underscores that healthcare system improvements are not uniformly distributed in their population-level impact.

In rural South Africa (KwaZulu-Natal), a ten-year data review documented maternal mortality rates ranging from 800 to 1,780 per 100,000 live births — with low antenatal care visits (695–895 per 100,000) correlating temporally with high mortality [64]. In Buleleng, Bali, 91.8% of maternal deaths occurred in health facilities, with COVID-19 as the leading cause followed by hemorrhage and hypertensive disorders — and qualitative findings from midwives identified delays in emergency response, insufficient postnatal monitoring, staff shortages, and fragmented digital

health tools as system-level contributors [14]. This Indonesian facility-based finding is particularly relevant to the protocol's emphasis on Indonesia: it demonstrates that even high rates of institutional delivery do not guarantee safety when system-level readiness is inadequate.

### **Theme 7: Direct Causes Mediated by Social Determinants**

While the primary focus of this review is social determinants, the leading clinical causes of maternal death across the literature — hemorrhage, hypertensive disorders, sepsis, obstructed labor, and unsafe abortion — are themselves strongly mediated by social factors that determine whether complications are recognized, whether transport is available, and whether appropriate care is received. Hemorrhage was the leading cause of maternal near-miss globally in the 82-article HDI systematic review (38.5%), followed by hypertensive disorders (34.2%) and sepsis (7.5%) [5]. In Ethiopia's 2025 synthesis, obstetric hemorrhage accounted for 29.6% of deaths, hypertensive disorders 22.1%, sepsis 14.8%, obstructed labor 11.3%, and unsafe abortion 8.5% [18]. In Africa's systematic review, hypertension was identified as a leading cause in nearly every study, with unsafe abortion contributing 9–27% of overall mortality and up to 37% of adolescent mortality in one study [24].

In Nigeria (Bayelsa State), hypertensive disorders in pregnancy were the commonest direct cause (46.5%), followed by obstetric hemorrhage (27.9%) [62]. In Pakistan (Abbottabad), hypertensive disorders were the leading cause (35.7%), followed by hemorrhage (25.4%) and pulmonary embolism (10.4%) [60]. In Sudan (Elgadarif), postpartum hemorrhage accounted for 26.5% of deaths and Kala-azar (a neglected tropical disease) contributed 8.5% [54] — the latter a uniquely context-specific indirect cause illustrating how endemic disease burden intersects with maternal risk. In Liberia, 36% of deaths were due to hemorrhage, with 74% occurring at health facilities and 29% within 24 hours of delivery — a temporal clustering that implicates quality of intrapartum and immediate postpartum care rather than delay in reaching facilities [63].

In South Africa's rural KwaZulu-Natal cohort, communicable diseases (38.2%) and AIDS/TB (31%) constituted the leading causes of maternal death, with traditional obstetric causes playing a smaller role — a context-specific pattern driven by the high HIV prevalence in that population [4]. The Africa-wide review similarly found that HIV-infected patients had an MMR 6.2

times higher than HIV-negative patients, decreasing to 3.2 times higher by the third period of observation as antiretroviral therapy scaled up, representing one of the clearest examples of a health system intervention — ART rollout — modifying the social epidemiology of maternal mortality [24].

### **Theme 8: Cultural Practices, Community Norms, and Traditional Healthcare Use**

Cultural norms and traditional practices constitute a distinct determinant category that interacts with all other themes. Evans (2013) systematizes this into four pathways through which culture increases MMR: directly harmful acts, inaction, patterns of care use, and social status [8]. In Indonesia's rural Java study, D'Ambruoso describes how communities were often uninformed and unprepared for delivery complications and relied on traditional birth attendants, and that the pattern of differential access was both socially imposed and socially maintained through the actions of individuals — creating a self-perpetuating cycle of exclusion [10].

In Indonesia's Gowa District, cultural taboos during pregnancy were reported by 25.7% of cases and 45.7% of controls, and food taboos during pregnancy by 22.9% of cases and 35.0% of controls [39]. While these specific taboos were not the decisive determinant (the aggregate OR for all social determinants was 3.244), they illustrate the multiplicity of cultural pathways. In Afghanistan, sociocultural practices including early marriage (mean age 17.2 years for women who died) and male authorization requirements for healthcare access were central determinants [9].

In Cambodia, Laos, Myanmar, and Vietnam, ethnic minority status, certain social and cultural beliefs, and husband's influences directly constrained access to maternal healthcare services [25]. Traditional birth attendant use — associated in Africa with RR substantially higher than facility-based delivery — persists because of perceived quality, familiarity, cultural compatibility, and geographic proximity [23]. In Nigeria's South-South region, dependence on traditional birth attendants and home deliveries was associated with substantially higher MMR, with one study reporting that the unbooked population (which largely delivered with traditional attendants) had an MMR of 3,188 per 100,000 compared to the overall hospital MMR of 1,884 per 100,000 [51].

The BPCR (Birth Preparedness and Complication Readiness) meta-analysis found that interventions designed to address these community- and household-level barriers — educating

women, families, and communities about danger signs and emergency planning — were associated with a non-significant 28% reduction in maternal mortality overall (RR = 0.72; 95% CI: 0.46–1.13), but that when at least 30% of targeted women participated, the reduction became significant at 53% (RR = 0.47; 95% CI: 0.26–0.87) [15]. The dose-response pattern by participation rate is striking and suggests that community mobilization interventions have a threshold effect below which impact is limited.

### **Theme 9: Adolescent and Advanced Maternal Age as Risk Factors**

Age extremes — both adolescent pregnancies and older maternal age — consistently appear as individual-level determinants modifying maternal mortality risk. In Nigeria's rural Ebonyi State, adolescent mothers had the highest age-specific MMR at 4,104 per 100,000, compared to 424 per 100,000 in the 30–34 year group [51]. In Tanzania's cohort, women under 20 years had a dramatically elevated risk compared to those aged 20–29 (HR = 0.18; 95% CI: 0.05–0.74) and 30–39 (HR = 0.22; 95% CI: 0.05–0.92) — and the peak causes of death in women under 20 included eclampsia (23%), hemorrhage (22%), and abortion-related complications (10%) [66].

In Africa's systematic review, maternal age  $\geq 35$  years was associated with OR = 2.50 (95% CI: 1.50–4.15) for maternal mortality [36]. In Cameroon's community-based case-control, the peak age of maternal death was 20–24 years (24.72%), reflecting the intersection of young age with high fertility and limited healthcare access [49]. In Ecuador and other Latin American high-MMR countries, extremes of maternal age were consistently associated with higher mortality alongside low socioeconomic status [28]. Pakistan's econometric model showed that adolescent fertility (births per 1,000 women aged 15–19) declined from 78.6 to 40.5 between 2000 and 2024, and that the interaction between adolescent fertility and anemia showed compounded adverse effects — creating a multiplicative rather than additive risk burden [16].

In Indonesia's Gowa District, 62.3% of both cases and controls had married before age 19 — indicating that early marriage is so prevalent that it does not differentially distinguish cases from controls, though it contributes to the overall high-risk profile of the entire population [39]. In Nigeria's Niger Delta study, adolescents under 20 accounted for 34.92% of complicated unsafe

abortions, with the majority being secondary school students — illustrating how educational status, marital status, and age intersect with access to contraception and safe abortion services [43].

### **Theme 10: Policy, Governance, and Health Financing**

Macro-level governance and health financing were identified as independent determinants of maternal mortality across several ecological and longitudinal studies. Iran's 25-year longitudinal analysis found that political performance was a significant predictor of maternal mortality reduction, independent of economic and health-sector variables, with total health expenditure share (as % of GDP) and out-of-pocket payment reduction also significantly associated with improved outcomes [11]. In sub-Saharan Africa's 7-country analysis, countries spending more on health had lower maternal mortality ratios, and countries with higher gender inequality indices had higher ratios [46].

The South Asia review identified health financing schemes and conditional cash transfer programs as effective demand-side interventions for increasing maternal health service uptake — with India's Janani Suraksha Yojana (conditional cash incentive for institutional delivery) being the primary documented example [19, 40]. In Bangladesh, the ICDDR,B service area — which had superior access to comprehensive emergency obstetric care — showed a 68.6% reduction in maternal mortality over two decades, compared to 50.4% in the government service area, even though the social development programs (microcredit, women's education) were identical in both areas [55]. This difference isolates the independent contribution of healthcare system quality to mortality reduction beyond what social development alone achieves.

In Colombia, the COVID-19 pandemic caused a significant increase in indirect maternal mortality, attributed to redirection of health resources and reduced access to preventive and reproductive health services [26]. South America's post-pandemic systematic review identified a significant increase in maternal mortality in the early pandemic years, followed by gradual decline — with indigenous and Afro-descendant women disproportionately affected, reflecting how health system disruptions compound pre-existing structural inequalities [57]. In Ethiopia, despite the Health Sector Transformation Plan II (2015–2025) and the Maternal and Child Health Roadmap, implementation has been uneven, with EmONC readiness varying substantially by region [18].

## Synthesis

### The Apparent Contradiction: Macro vs. Micro Determinants

A potential tension in the literature is whether macro-level structural factors (GDP, HDI, governance) or micro-level individual and household factors (education, ANC attendance, decision-making) are the more "important" determinants of maternal mortality in developing countries. Some studies emphasize macro-level variation — the Eastern Mediterranean panel showing GDP per capita with  $\beta = -0.869$  and female literacy with  $\beta = -1.045$  [2]; the HDI systematic review spanning 82 articles and 30 countries showing a statistically significant inverse relationship with both near-miss and mortality [5]; Iran's longitudinal finding of political performance as an independent predictor [11]. Others are grounded in individual- and community-level data, with large relative risks for lack of education (RR 3.4 in the MNHR cohort) [1], delayed care-seeking (OR 5.12 in Africa's meta-analysis) [36], and poor wealth index (HR 3.92 in rural South Africa) [4].

This tension largely dissolves when the different study designs are recognized as operating at different scales. Ecological and panel studies estimate the marginal contribution of population-level variation in structural factors, necessarily averaging across enormous heterogeneity within countries. Individual-level cohort and case-control studies estimate the relative risk associated with a specific exposure in a defined population. Both findings can be simultaneously valid: a country with higher GDP is, on average, better positioned to reduce maternal mortality, but within any single country, an uneducated poor woman in a rural area faces a dramatically higher risk than an educated wealthy urban woman. Souza et al.'s global analysis explicitly integrates these levels, arguing that "superdeterminants" (environmental, biological, social structures) shape individual characteristics and health system features, which in turn determine whether clinical complications end in death [77].

### Context and Population Distinctions: Where Different Findings Apply

Several patterns emerge when examining which determinants dominate in which contexts. Studies from the lowest-income settings (rural Sub-Saharan Africa, Afghanistan, Nepal, rural Indonesia) consistently foreground geographic access, transport, and household poverty as the binding constraints, because the gradient between having any access to care and having none is

enormous [9, 50, 71]. In middle-income or transitioning countries (Iran, Colombia, Mexico, South Africa), health system quality, governance, and indirect maternal causes become more prominent as the floor of access is already higher — explaining why Mexico's analysis found no change in indirect obstetric deaths despite declining direct deaths, and why Iran's study found political performance significant but education non-significant at the macro level [11, 12].

In urban settings within otherwise poor countries — such as Nigeria's teaching hospitals, Nairobi, or Dhaka's Medical College — the bottleneck shifts further toward health system quality (provider attitudes, referral systems, staffing), because physical access barriers are less severe [56, 61]. For Indonesia specifically, the Buleleng (Bali) data show that when institutional delivery coverage is high (91.8% of deaths occurring in facilities), the problem is no longer getting women to a facility but ensuring the facility can respond adequately to postpartum emergencies and has sufficient skilled staff [14]. This transition — from access to quality as the binding constraint — is likely to characterize settings in Indonesia outside of Papua, while Papua's more remote and mountainous geography, combined with ethnic minority populations and linguistic diversity, probably retains barriers more characteristic of the lowest-income rural African or Nepali settings documented here [45, 50].

### **Confounder Analysis: Why Education Effects May Be Confounded by Wealth**

An important confounding issue affects the interpretation of education-specific associations. In many low-income settings, education and wealth are strongly correlated, and studies that do not simultaneously adjust for both risk attributing to education effects that are partly driven by the ability to pay for care or live in areas with better services. The multi-country MNHR cohort addressed this through simultaneous adjustment for study site and other covariates, yielding education-specific RRs that likely underestimate confounding by unmeasured quality-of-care differences between sites [1]. The Mensch et al. causal review explicitly acknowledged the endogeneity problem — that unobserved motivation and family background confound simple education-mortality associations [79] — making it a methodologically important counterpoint to studies that report unadjusted or partially adjusted associations.

Similarly, the widowhood finding in Tanzania's cohort (HR = 9.13; 95% CI: 1.02–81.94 for widowed women compared to married women) [66] probably captures a composite of economic vulnerability, reduced household support, reduced decision-making authority, and reduced social capital to mobilize emergency transport — making "marital status" a summary variable for multiple intersecting disadvantages rather than a single discrete determinant. This interpretive complexity characterizes much of the social determinants literature: the determinants are inherently intercorrelated, and isolating the independent contribution of any single factor requires methodological sophistication that many included studies do not possess.

### **What Can Be Concluded for Specific Populations and Contexts**

For low-income, rural, high-fertility settings in Sub-Saharan Africa and South/Southeast Asia (including likely Papua, Indonesia): the dominant social determinants are geographic distance and transport barriers, low female education, household poverty, and delay in recognition of and response to danger signs. The most evidence-supported interventions are those that simultaneously address multiple delays — community health worker programs linked to referral systems (as Ethiopia's WDA showed) [30], community loan funds for transport [41], and BPCR programs with coverage above 30% [15].

For middle-income and urbanizing contexts: governance quality, health financing, technical efficiency of primary care, and indirect obstetric causes (comorbidities such as HIV, TB, and noncommunicable diseases) become proportionally more important. Improving skilled birth attendance remains critical across all income levels, but its marginal impact is greatest where baseline coverage is lowest.

For Indonesia specifically: the published evidence base is thin, with the Java rural study [10] and the Buleleng Bali study [14] being the primary facility-level sources, supplemented by the multi-country CLMV review which does not include Indonesia [25] and the broad developing-country literature review [59]. The decentralized health system structure documented in Buleleng — where digital health tools are fragmented, postnatal monitoring is insufficient, and cultural hesitancy in care-seeking persists alongside high institutional delivery coverage [14] — likely generalizes to urban and peri-urban Java more than to Papua, where geographic access barriers,

ethnic minority status, linguistic diversity, and economic marginalization more closely resemble the rural African and Nepali contexts documented elsewhere in this corpus. The absence of Papua-specific published studies in this review corpus is itself a significant finding about the state of the literature.

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## DISCUSSION

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### Education as the Most Consistent Structural Determinant

Across all 80 studies included in this review, maternal education emerged as the single most consistent and powerful social determinant of maternal mortality. The multi-country Global Network cohort by Bauserman et al. (2015) provided the most precise quantified estimates from prospective data: compared to women with secondary education, those with no formal education faced a relative risk of 3.2 (95% CI: 1.5–6.9), those with only primary education faced a RR of 3.4 (95% CI: 1.6–7.5), and those with incomplete secondary education faced a RR of 2.5 (95% CI: 1.1–5.7) [1]. The dose-response gradient is clear, though the apparent non-monotonicity (primary education showing slightly higher risk than no education) likely reflects small-number instability or unmeasured confounding by wealth.

The Eastern Mediterranean panel data analysis by Bayati et al. (2016) examined 22 countries over a 7-year period and found that female literacy rate was the strongest single predictor of maternal mortality among all variables examined, with a standardized coefficient of  $\beta = -1.045$  ( $p < 0.01$ ). This exceeded the explanatory magnitude of GDP per capita ( $\beta = -0.869$ ,  $p < 0.01$ ), skilled birth attendance ( $\beta = -0.899$ ,  $p < 0.05$ ), and urbanization rate [2]. The finding that a social determinant (literacy) outperforms economic and health system variables at the macro level is striking and underscores the fundamental role of women's education.

Longitudinal evidence from Pillai et al. (2013) using latent growth curve analysis across 143 nations and three decades (1970–2000) demonstrated that the rate of increase in female literacy was negatively associated with changes in maternal mortality ratios, and importantly, this relationship held longitudinally rather than merely cross-sectionally [3]. This temporal evidence strengthens the

causal interpretation: countries that improved female literacy faster also reduced maternal mortality faster, independent of baseline levels.

The systematic review by Mensch et al. (2019) specifically addressed the endogeneity concern—the possibility that unobserved factors such as family background, motivation, or cognitive ability drive both educational attainment and health-seeking behavior. After reviewing studies that employed natural experiments, instrumental variables, and sibling fixed effects, they concluded that maternal education under 8 years increased infant mortality risk by 37–40% ( $p < 0.001$ ), and that regions with medium human development index had 1.54 times higher mortality risk compared to very high HDI regions [79]. This review provides the strongest causal evidence in the corpus.

The pathways through which education reduces maternal mortality are multiple and synergistic. Education increases uptake of antenatal care, enhances recognition of obstetric danger signs, boosts contraceptive use, delays age at first marriage, increases women's decision-making autonomy within households, and improves household income through labor market participation [38,40,55]. Hagues et al. (2017) demonstrated using path analysis that secondary education participation is significantly correlated with increased contraceptive use in developing countries, which itself mediates maternal mortality risk, while this pathway does not operate in high-income countries where education and contraceptive use are already universal [38]. This suggests that education interventions have greater marginal returns in low-coverage settings.

The only notable outlier to the education-mortality association was the Iran longitudinal study by Zalvand et al. (2019), which found that education level at the country level was not significantly associated with reductions in maternal mortality, while employment status, health expenditure, and political performance were [11]. This divergence likely reflects the fact that Iran's national-level educational attainment was already relatively high at baseline (female literacy >80% by 1990), diminishing its explanatory power at the macro level relative to other determinants that still had room for improvement. This observation is critical: education effects are strongest where baseline literacy is lowest, supporting the case for targeting education investments to the poorest regions.

## Poverty, Wealth Inequalities, and Economic Gradients

The association between household poverty and maternal mortality is nearly as consistent as education, though the magnitude varies by setting. In the Tanzanian Ifakara Health and Demographic Surveillance System cohort of 36,792 women, Manyeh et al. (2018) found that women in the poorest socioeconomic quintile faced dramatically elevated hazard ratios compared to those even one quintile higher: being in a “poorer” category (second quintile) carried HR = 0.16 (95% CI: 0.06–0.42) relative to the poorest group, meaning that even a modest improvement in economic standing—moving from the poorest to the second-poorest quintile—reduced risk by 84% [66]. This near-threshold effect suggests that extreme poverty is qualitatively different from moderate poverty in terms of maternal risk.

In rural South Africa, Tlou (2018) analyzed a population-based cohort with high HIV prevalence and found that a poor wealth index was associated with HR = 3.92 (95% CI: 1.01–15.3) for maternal mortality, after adjusting for age, education, and HIV status [4]. The wide confidence interval reflects the relatively small number of deaths (212 deaths among 32,620 live births) but the point estimate is substantial. Notably, in this setting, communicable diseases (38.2%) and AIDS/TB (31%) constituted the leading causes of death, with traditional obstetric causes playing a smaller role—a context-specific pattern driven by the high HIV prevalence that interacts with poverty to increase susceptibility to infection and reduce treatment access.

Facility-based retrospective studies from South Asia corroborate the poverty-mortality association with striking consistency. In Pakistan, Habib et al. (2023) reviewed 193 maternal deaths over ten years at a tertiary care hospital and found that 96.9% of women who died were illiterate and 94.8% came from a poor socioeconomic background [60]. In Bangladesh, Khan et al. (2024) found that 75.66% of women who died had received no antenatal care, and 80.95% of deaths occurred among women from low socioeconomic backgrounds [61]. The Rangpur study by Ara et al. (2025) similarly reported 72.2% of deaths among low-income women and 73.4% with no ANC [65]. The consistency across three separate Bangladeshi and Pakistani facilities—despite different time periods and geographic locations—suggests that the poverty-mortality link is robust and likely causal.

At the macro level, DerSarkissian et al. (2013) analyzed time series data across 49 African countries from 1990 to 2005 and found that GDP was negatively correlated with maternal mortality, with total fertility rate and neonatal mortality rate positively correlated ( $r$  ranging from 0.71–0.87) [68]. The strength of these correlations is impressive given the ecological aggregation and data quality issues in African vital registration. The systematic review by García-Tizón Larroca et al. (2020), which included 82 articles covering over 30 countries and 3.7 million live births, found that the Human Development Index (which aggregates income, education, and health components) was inversely and significantly ( $p < 0.05$ ) associated with both maternal near-miss rates and maternal mortality rates [5].

However, the relationship between economic growth and maternal mortality is not automatic. Yeboah et al. (2025) systematically reviewed 18 studies from Sub-Saharan Africa and found that while 11 reported significant positive effects of economic growth on reducing maternal mortality, others found insignificant or inconsistent associations. Their key insight is that governance quality, equitable resource distribution, and complementary social policies are necessary conditions for economic growth to translate into maternal health improvements [73]. This explains why some resource-rich countries (e.g., Nigeria with oil wealth) have made slower progress than some resource-poor countries (e.g., Rwanda, Ethiopia) with stronger governance and pro-poor health policies.

### **Geographic Barriers and the Three-Delays Model**

Rural residence and physical distance from healthcare facilities constitute a near-universal barrier to maternal survival across the developing country literature, but the relative importance varies by region in a systematic pattern. Ghosh (2025) conducted a scoping review of delaying factors influencing maternal health care disparities and found clear continental patterning: patient-related delays (Delay 1—delay in recognizing danger signs and deciding to seek care) dominate in Asia; geographic and transport delays (Delay 2—delay in reaching a health facility) are the persistent challenge in Africa; and quality-of-care delays (Delay 3—delay in receiving appropriate treatment once at a facility) are the primary bottleneck in Latin America [7].

This patterning is clinically and programmatically important. In Asia, where Delay 1 dominates, interventions should focus on community education, birth preparedness, and engaging family decision-makers (particularly mothers-in-law and husbands). In Africa, where Delay 2 dominates, interventions should focus on emergency transport schemes, motorcycle ambulances, community loan funds for transport, and geographic targeting of facility placement. In Latin America, where Delay 3 dominates, interventions should focus on health system strengthening: provider training, emergency obstetric care equipment, blood transfusion availability, and quality improvement protocols.

The scoping review by Muriithi et al. (2022) of 104 articles from Africa found that transportation barriers (Delay 2) were reported in 84.6% of articles, making this the single most common contributory factor at the health system level [6]. Health system failures (encompassing triage, monitoring, referral, drug availability, and provider competence) appeared in 80.8% of articles, while individual-level delays in recognizing danger signs or deciding to seek care appeared in only 37.5% of articles [6]. This suggests that in Africa, system-level barriers (transport and facility quality) are more important than individual-level knowledge or attitudes, with implications for resource allocation.

The systematic review of community-based loan funds for emergency transport by Nwolise et al. (2015) provides evidence that financial barriers to transport can be addressed effectively. Although the authors note study design limitations, implementation of loan funds alongside other interventions produced odds ratios of 3.5 (95% CI: 0.97–15.48) and 3.55 (95% CI: 1.56–8.05) for increased health facility utilization, and ORs of 2.22 (95% CI: 0.51–10.38) and 3.37 (95% CI: 1.78–6.37) for emergency obstetric care utilization [41]. The wide confidence intervals reflect small sample sizes and heterogeneity across studies, but the direction of effect is consistently positive.

In Nepal's rural hill districts, Shrestha (2009) conducted verbal autopsies on 33 maternal deaths and documented that women faced simultaneous barriers: underestimating complication severity, lacking family support, lacking transportation, and experiencing prolonged transit to care—all of which intersected in women who were already poor and socially marginalized [50]. Similarly, in rural Gambia, Cham et al. (2005) found that women who sought care encountered

disorganized healthcare systems with inadequate prompt response to emergencies, poor road conditions, and the need to seek care at multiple facilities before receiving treatment [71]. These qualitative insights complement the quantitative meta-analyses by revealing how delays cascade: a woman who fails to recognize danger signs (Delay 1) then cannot find transport (Delay 2) and finally arrives at a facility that is understaffed and lacks blood (Delay 3).

In Ethiopia, Gebrehiwot and Tewolde (2014) reviewed 2,774 cases (206 deaths, 2,568 near-misses) across 10 hospitals and 4 regions and found that 70.2% of women who eventually died had arrived at hospital only after developing serious complications due to lack of transportation [37]. This finding is striking: the majority of deaths occurred among women who eventually reached a facility, but they arrived too late because transport delays had allowed complications to progress to irreversible stages. The Ethiopian Women's Development Army program evaluated by Yitbarek et al. (2019) showed that proximity to health facilities was critical: skilled delivery and antenatal care service use were higher in Women's Development Teams located within 2 km of facilities, and non-membership in such teams was associated with an OR of 2.07 (95% CI: 1.04–4.11) for maternal death [30]. This dose-response relationship between distance and community health effectiveness underscores how geography mediates even community-level intervention outcomes.

Colombia's urban-rural analysis by Salazar Flórez et al. (2025) provides a longitudinal perspective: while remote rural areas saw overall declining trends in maternal mortality between 2014 and 2021, they experienced a transient spike in 2017, whereas municipal centers spiked in 2019, suggesting that structural crises (economic instability, pandemic) affect rural and urban populations at different times and through different mechanisms [70]. Remote rural areas carried relative disparities of 41–88% compared to urban municipal centers, with absolute gaps ranging from 47 to 94 deaths per 100,000 live births [70]. This indicates that geographic disparities persist even in middle-income countries with established health systems.

### **Health System Quality and the Transition from Access to Quality**

A critical insight from this review is that the dominant determinant shifts as countries develop economically and expand service coverage. In the lowest-income settings (rural Sub-Saharan Africa, Afghanistan, rural Nepal, rural Indonesia), geographic access, transport, and

household poverty are the binding constraints because the gradient between having any access to care and having none is enormous [9,50,71]. In middle-income or transitioning countries (Iran, Colombia, Mexico, South Africa, urban Indonesia), health system quality, governance, and indirect maternal causes become more prominent because the floor of access is already higher.

The Indonesian evidence illustrates this transition. In Buleleng, Bali, Sulyastini et al. (2025) found that 91.8% of maternal deaths occurred in health facilities—not at home or during transport—and the leading causes were COVID-19, followed by hemorrhage and hypertensive disorders [14]. Qualitative findings from midwives identified delays in emergency response, insufficient postnatal monitoring, staff shortages, and fragmented digital health tools as system-level contributors. This facility-based death pattern demonstrates that when institutional delivery coverage is high (as it is in Bali), the problem is no longer getting women to a facility but ensuring the facility can respond adequately to emergencies. The situation in Papua, Indonesia, is likely different: remote and mountainous geography, ethnic minority populations, linguistic diversity, and economic marginalization probably retain barriers more characteristic of the lowest-income rural African or Nepali settings [45,50]. Critically, no published study in this review corpus specifically examined Papua, representing a major evidence gap.

The Mexican longitudinal analysis by Serván-Mori et al. (2020) provides quantitative evidence for the quality transition. They found that each percentage point increase in technical efficiency (TE) of primary care was associated with a 0.36% decline in the maternal mortality ratio ( $p < 0.01$ ), but this effect disappeared entirely in low- and medium-marginalization jurisdictions [13]. The interpretation is that efficiency gains accrue only where marginalization is sufficiently high to create meaningful gains in coverage—in other words, improving quality in already-well-functioning systems does little to reduce mortality because mortality is already low; the gains come from improving quality in poorly functioning systems that serve the most marginalized populations.

In South Africa's KwaZulu-Natal province, Naranjee et al. (2023) documented maternal mortality rates ranging from 800 to 1,780 per 100,000 live births over a ten-year period, with low antenatal care visits (695–895 per 100,000) correlating temporally with high mortality [64]. This rate is substantially higher than the national South African average and reflects the concentration of

poverty, HIV, and health system weaknesses in this rural province. The Liberian mixed-methods analysis by Karmbor-Ballah et al. (2019) of 258 maternal death reviews found that user fees—officially eliminated after the civil war—had resurfaced as informal out-of-pocket payments, creating a financially burdensome and inefficient referral system through trained traditional midwives [63]. Staff attrition, burnout, inadequate training, and patient neglect were additional documented systemic failures [63]. This finding is important because it demonstrates that formal policy changes (fee elimination) can be undermined by informal local practices, a phenomenon likely occurring in other post-conflict and low-income settings.

### **Gender Inequality and Women's Autonomy**

Gender inequality operates across multiple levels—household decision-making, labor market exclusion, early marriage, high fertility, and access to resources—to shape maternal mortality risk. Chirowa et al. (2013) conducted a secondary data analysis across seven Sub-Saharan African countries and found that countries with higher Gender Inequality Index scores had higher maternal mortality ratios, while those spending more on health had lower maternal mortality [46]. The cross-sectional nature of this analysis limits causal inference, but the consistency of the association across countries with different cultural and economic profiles suggests a robust relationship.

The systematic review by Say and Raine (2007) examining 23 developing countries found that women's decision-making power and autonomy were significant intermediary determinants of maternal health service use [20]. The pathways include: women with greater autonomy are more likely to seek antenatal care, deliver with a skilled attendant, and access emergency obstetric care when complications arise. In Indonesia's Gowa District case-control study by Ikhtiar et al. (2014), women who were not involved in family decision-making regarding place of delivery constituted 65.7% of deaths versus 37.1% of survivors, and the overall OR for social determinants of health (including decision-making, education, income, and cultural factors) was 3.244 [39]. This study is one of the few from Indonesia that quantifies the combined effect of multiple social determinants rather than examining them in isolation.

In Afghanistan, Najafizada et al. (2017) documented that male authorization for healthcare access was a specific decision-making barrier, with household wealth being the strongest determinant of whether women could access skilled birth attendants [9]. Early marriage was also central: the mean age for women who died was 17.2 years, substantially below the national average. The combination of early marriage, low education, and male authorization creates a syndemic—a set of intertwined epidemics—that traps young women in high-risk pregnancies without the autonomy to seek care.

Evans (2013) provides a theoretical framework for understanding how culture increases maternal mortality, categorizing mechanisms into four pathways: (1) directly harmful acts (e.g., cutting the umbilical cord with unsterile instruments, restricting food or fluids during labor), (2) inaction (failure to seek care because complications are considered normal or shameful), (3) patterns of care use (preference for traditional birth attendants over skilled providers), and (4) social status (power differentials that determine who in the household gets resources, including healthcare) [8]. This framework is useful for intervention design because it distinguishes between cultural practices that require behavior change communication (pathways 1–3) versus those that require structural change (pathway 4).

### **Interventions Targeting Social Determinants**

The evidence for interventions that directly target social determinants is weaker than the evidence for associations, largely because few studies have been powered to detect effects on maternal mortality (a relatively rare outcome) rather than intermediate outcomes such as care utilization. The most robust evidence comes from Soubeiga et al. (2014), who conducted a meta-analysis of Birth Preparedness and Complication Readiness (BPCR) interventions—community-based programs that educate women, families, and communities about danger signs and emergency planning. The overall effect on maternal mortality was a non-significant 28% reduction (RR = 0.72; 95% CI: 0.46–1.13), but when at least 30% of targeted women participated, the reduction became significant at 53% (RR = 0.47; 95% CI: 0.26–0.87) [15]. This dose-response pattern by participation rate is striking and suggests that community mobilization interventions have a threshold effect below which impact is limited. Programs that achieve low coverage may appear

ineffective not because the intervention is flawed but because it was not implemented at sufficient scale.

The Ethiopian Women's Development Army (WDA) evaluated by Yitbarek et al. (2019) is another example of a community-based intervention that addresses multiple social determinants simultaneously: the WDA provides health education (addressing education), links women to facilities (addressing geographic access), and mobilizes community resources for transport (addressing poverty). The finding that non-membership was associated with OR = 2.07 (95% CI: 1.04–4.11) for maternal death suggests that WDA membership is protective, though residual confounding is possible [30].

Conditional cash transfer programs, such as India's Janani Suraksha Yojana (JSY), have been widely implemented but the evidence for mortality reduction is mixed. The South Asia review by El-Saharty et al. (2016) identified JSY as effective for increasing institutional delivery rates, but they note that increases in service utilization do not automatically translate into mortality reductions if quality of care is inadequate [40]. Similarly, the Bangladesh Matlab experience documented by Chowdhury et al. (2009) showed that the ICDDR,B service area—which had superior access to comprehensive emergency obstetric care—achieved a 68.6% reduction in maternal mortality over two decades, compared to 50.4% in the government service area, even though social development programs (microcredit, women's education) were identical in both areas [55]. This difference isolates the independent contribution of healthcare system quality to mortality reduction beyond what social development alone achieves.

### **Contextual Factors and Effect Modification**

The magnitude of association for any given social determinant varies substantially across settings, and understanding this variation is critical for generalizability. For example, the education effect (RR for no education vs. secondary education) was 3.2 in the multi-country cohort [1] but much larger in some single-country studies. The reason is that the multi-country cohort adjusted for study site, which captures some of the between-country variation in health system quality and economic development. In settings where health systems are very weak, the education effect may be

larger because educated women can compensate for system failures (e.g., by demanding better care, traveling to better facilities, or recognizing complications earlier).

The Iran outlier (no significant education effect at macro level) illustrates effect modification by baseline development level [11]. Similarly, the finding that Mexico's technical efficiency effect disappeared in low-marginalization jurisdictions [13] demonstrates that interventions have differential effects depending on context. This has practical implications: interventions that work in one setting may not work in another, not because the intervention is inherently ineffective but because the binding constraint is different.

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## CONCLUSION AND RECOMMENDATIONS

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### Conclusions

This systematic review of 80 studies from developing countries across Sub-Saharan Africa, South Asia, Southeast Asia, Latin America, and the Middle East leads to five primary conclusions:

First, low maternal education is the most consistent and powerful social determinant of maternal mortality across all regions and levels of economic development. The association is dose-responsive, temporally consistent, and partially causal based on studies addressing endogeneity. Female literacy at the population level outperforms GDP per capita and skilled birth attendance as a predictor of maternal mortality. Investments in girls' secondary education should be considered a maternal health intervention, not merely a social development goal.

Second, household poverty and wealth inequality operate through multiple pathways—including inability to pay for transport, user fees, and lost opportunity costs of seeking care—to produce a steep socioeconomic gradient in maternal mortality. Extreme poverty is qualitatively different from moderate poverty: moving from the poorest to the second-poorest quintile reduces risk by approximately 84% in some settings. Pro-poor health financing policies (fee elimination, conditional cash transfers, transport vouchers) are necessary but not sufficient; they must be accompanied by quality improvement.

Third, geographic barriers and the three-delays model show systematic continental patterning. Delay 1 (decision-making) dominates Asia, Delay 2 (transport/geography) dominates

Africa, and Delay 3 (quality of care) dominates Latin America. Interventions should be targeted to the predominant delay pattern in each region. Community-based transport financing and birth preparedness programs with coverage above 30% have demonstrated effectiveness in reducing mortality.

Fourth, health system quality becomes the binding constraint once institutional delivery coverage exceeds approximately 80–90%. In such settings (e.g., urban Indonesia, Mexico, Colombia), further mortality reductions require improving emergency obstetric care readiness, provider competence, referral systems, and management of indirect causes (HIV, TB, noncommunicable diseases, and emerging threats such as COVID-19).

Fifth, the absence of published evidence from Papua, Indonesia, represents a critical gap. Papua's combination of mountainous geography, ethnic minority status, linguistic diversity, economic marginalization, and high maternal mortality suggests that the dominant determinants are likely Delay 1 (cultural and decision-making barriers) and Delay 2 (geographic and transport barriers), similar to rural Nepal, rural Ethiopia, and rural Afghanistan. Research is urgently needed to characterize these determinants and test context-appropriate interventions.

## **Recommendations**

*For policy and practice:*

1. Prioritize completion of secondary education for girls as a core maternal mortality reduction strategy, particularly in regions with female literacy below 70%.
2. Scale up community-based emergency transport financing (loan funds, voucher schemes, motorcycle ambulances) in rural Africa and rural Asia, with attention to sustainability and community ownership.
3. Invest in health system quality improvement—specifically emergency obstetric care signal functions (antibiotics, oxytocics, anticonvulsants, manual removal of placenta, removal of retained products, assisted vaginal delivery, blood transfusion, cesarean section)—in settings where institutional delivery coverage exceeds 80%.

4. Target interventions to the predominant delay pattern in each region rather than applying uniform global programs.
5. Implement birth preparedness and complication readiness programs at scale ( $\geq 30\%$  coverage threshold) and measure coverage, not just availability.

*For research:*

1. Conduct primary research on social determinants of maternal mortality in Papua, Indonesia, using mixed methods (verbal autopsy, qualitative interviews, facility assessment) to identify region-specific binding constraints.
2. Develop and validate context-appropriate instruments for measuring women's decision-making autonomy and cultural barriers to care-seeking in Indonesian Papua.
3. Test interventions that address multiple delays simultaneously (e.g., community health worker programs linked to transport funds and facility quality improvement) using cluster randomized designs with mortality endpoints.
4. Include interaction terms in regression models to examine effect modification (e.g., education  $\times$  wealth, distance  $\times$  road quality).
5. Strengthen vital registration and verbal autopsy systems in low-income settings to improve maternal mortality measurement.

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## REFERENCES

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1. M. Bauserman, A. Lokangaka, V. Thorsten, et al (2015) Risk factors for maternal death and trends in maternal mortality in low- and middle-income countries: a prospective longitudinal cohort analysis. *Reproductive Health*. <https://doi.org/10.1186/1742-4755-12-S2-S5>
2. M. Bayati, Sajad Vahedi, Firooz Esmaeilzadeh, et al (2016) Determinants of maternal mortality in Eastern Mediterranean region: A panel data analysis. *Medical Journal of The Islamic Republic of Iran*

3. V. Pillai, Arati Maleku, FangHsun Wei (2013) Maternal Mortality and Female Literacy Rates in Developing Countries during 1970–2000: A Latent Growth Curve Analysis. *International journal of population research*. <https://doi.org/10.1155/2013/163292>
4. B. Tlou (2018) Underlying determinants of maternal mortality in a rural South African population with high HIV prevalence (2000–2014): A population-based cohort analysis. *PLoS ONE*. <https://doi.org/10.1371/journal.pone.0203830>
5. S. García-Tizón Larroca, Francisco Amor Valera, E. Ayuso Herrera, et al (2020) Human Development Index of the maternal country of origin and its relationship with maternal near miss: A systematic review of the literature. *BMC Pregnancy and Childbirth*. <https://doi.org/10.1186/s12884-020-02901-3>
6. F. Muriithi, A. Banke-Thomas, Ruth Gakuo, et al (2022) Individual, health facility and wider health system factors contributing to maternal deaths in Africa: A scoping review. *PLOS Global Public Health*. <https://doi.org/10.1371/journal.pgph.0000385>
7. Alokanda Ghosh (2025) Delaying factors influencing the maternal health care disparities in developing countries: A scoping review. *Women & health*. <https://doi.org/10.1080/03630242.2025.2486985>
8. E. Evans (2013) A review of cultural influence on maternal mortality in the developing world. *Midwifery*. <https://doi.org/10.1016/j.midw.2012.04.002>
9. Said Ahmad Maisam Najafizada, I. Bourgeault, R. Labonté (2017) Social Determinants of Maternal Health in Afghanistan: A Review. *Central Asian Journal of Global Health*. <https://doi.org/10.5195/cajgh.2017.240>
10. L. D'Ambruoso (2012) Relating the construction and maintenance of maternal ill-health in rural Indonesia. *Global Health Action*. <https://doi.org/10.3402/gha.v5i0.17989>
11. Rostam Zalvand, M. Yaseri, A. Mosadeghrad, M. Tajvar (2019) Determinants of maternal mortality in Iran 1990-2015: a longitudinal study. *Tehran University Medical Journal TUMS Publications*

12. M. Hogan, Biani Saavedra-Avendaño, B. Darney, et al (2016) Reclassifying causes of obstetric death in Mexico: a repeated cross-sectional study. *Bulletin of the World Health Organization*. <https://doi.org/10.2471/BLT.15.163360>
13. E. Serván-Mori, Carlos Chivardi, Fato Fene, et al (2020) Tackling maternal mortality by improving technical efficiency in the production of primary health services: longitudinal evidence from the Mexican case. *Health Care Management Science*. <https://doi.org/10.1007/s10729-020-09503-7>
14. Ni Komang Sulyastini, Irma Nurma Linda, Luh Yenny Armayanti, et al (2025) Maternal mortality in Buleleng, Bali, Indonesia (2021–2023): a mixed-methods analysis of clinical, systemic, and sociocultural contributors. *MEDISAINS*. <https://doi.org/10.30595/medisains.v23i2.26756>
15. D. Soubeiga, L. Gauvin, M. Hatem, M. Johri (2014) Birth Preparedness and Complication Readiness (BPCR) interventions to reduce maternal and neonatal mortality in developing countries: systematic review and meta-analysis. *BMC Pregnancy and Childbirth*. <https://doi.org/10.1186/1471-2393-14-129>
16. Huma Mushtaq (2026) Assessing Maternal Health Efficiency and Predicting Mortality: An Empirical Analysis of Clinical determinants and Health system efficiency. *Journal of the Society of Obstetricians and Gynaecologists of Pakistan*. <https://doi.org/10.71104/jsogp.v16i1.919>
17. M. Tajvar, A. Hajizadeh, Rostam Zalvand (2022) A systematic review of individual and ecological determinants of maternal mortality in the world based on the income level of countries. *BMC Public Health*. <https://doi.org/10.1186/s12889-022-14686-5>
18. Merga Abdissa Aga, Ding-Geng Chen (2025) Maternal mortality in Ethiopia (2015–2025): a systematic review of recent evidence and determinants. *BMC Public Health*. <https://doi.org/10.1186/s12889-025-26101-w>
19. M. Hamal, M. Dieleman, V. De Brouwere, T. de Cock Buning (2020) Social determinants of maternal health: a scoping review of factors influencing maternal mortality and maternal health service use in India. *Public Health Reviews*. <https://doi.org/10.1186/s40985-020-00125-6>

20. L. Say, R. Raine (2007) A systematic review of inequalities in the use of maternal health care in developing countries: examining the scale of the problem and the importance of context. Bulletin of the World Health Organization. <https://doi.org/10.2471/BLT.06.035659>
21. Idahosa Izedonmwun, Joy Oghogho Izedonmwun (2023) Unveiling Maternal Mortality Challenges in a Resource Limited Setting, Ethiopia: A Systematic Literature Review. British journal of multidisciplinary and advanced studies. <https://doi.org/10.37745/bjmas.2022.0319>
22. D. B. Amenah, A. Afaya, Faith Klinogo, et al (2026) Sociocultural and health system determinants of maternal mortality in Ghana: findings from a systematic review. BMC Public Health. <https://doi.org/10.1186/s12889-025-25134-5>
23. D. Ononokpono, Bernard Baffour, N. Usoro, O. Adebola (2021) Maternal Mortality in Sub-Saharan Africa. The Routledge Handbook of African Demography. <https://doi.org/10.4324/9780429287213-49>
24. Eboni Acoff, Rebecka M Ernst, J. Craig Phillips, et al (2024) A Systematic Review of Maternal Mortality in African Countries. North American Proceedings in Gynecology & Obstetrics. <https://doi.org/10.54053/001c.120976>
25. Pyae Phy Win, Thein Hlaing, H. Win (2024) Factors influencing maternal death in Cambodia, Laos, Myanmar, and Vietnam countries: A systematic review. PLoS ONE. <https://doi.org/10.1371/journal.pone.0293197>
26. César García-Balaguera, Mery Gireth Vargas Martínez, David Alejandro Guzmán Arbelaez, V. Fernandez (2024) Maternal Mortality, Health Determinants, and Covid-19 in the Department of Meta, Colombia: A Cross-sectional Study. The Open Public Health Journal. <https://doi.org/10.2174/0118749445277442240220101010>
27. Santiago García-Tizón Larroca, Francisco Valera, Esther Ayuso Herrera, et al (2020) Human Development Index of the maternal country of origin and its relationship with maternal near miss: A systematic review of the literature. BMC Pregnancy and Childbirth. <https://doi.org/10.1186/S12884-020-02901-3>

28. Rebecka M Ernst, Eboni Acoff, A. Hsu (2023) A Systematic Review Investigating Disparities in Maternal Mortality in Latin American Countries [ID: 1376589]. *Obstetrics & Gynecology*. <https://doi.org/10.1097/01.aog.0000930424.33722.e2>
29. Malahat Khalili, Mahdieh Mashrouteh, A. Haghdost, et al (2023) Systematic review and meta-analysis of maternal mortality ratio and related factors in the Islamic Republic of Iran. *Eastern Mediterranean health journal = La revue de sante de la Mediterranee orientale = al-Majallah al-sihhiyah li-sharq al-mutawassit*. <https://doi.org/10.26719/emhj.23.063>
30. Kiddus Yitbarek, Gelila Abraham, S. Morankar (2019) Contribution of women's development army to maternal and child health in Ethiopia: a systematic review of evidence. *BMJ Open*. <https://doi.org/10.1136/bmjopen-2018-025937>
31. T. Dikid, Madhu Gupta, M. Kaur, et al (2013) Maternal and Perinatal Death Inquiry and Response Project Implementation Review in India. *Journal of Obstetrics and Gynecology of India*. <https://doi.org/10.1007/s13224-012-0264-3>
32. Sarah Ifunaya Anumudu, Chijioke Christopher Uhegwu, Christian Kosisochukwu Anumudu (2025) A scoping review of maternal mortality, its health determinants, and factors that influence care utilization in women of child-bearing years in Nigeria. *Global Health Journal*. <https://doi.org/10.1016/j.glohj.2025.10.004>
33. S. Simona, C. Lumamba, F. Moyo, et al (2022) The Influence of Contextual Factors on Maternal Healthcare Utilization in sub-Saharan Africa: A Scoping Review of Multilevel Models. *medRxiv*. <https://doi.org/10.1101/2022.03.15.22272437>
34. Yasir Khan, S. Bhutta, S. Munim, Z. Bhutta (2009) Maternal health and survival in Pakistan: issues and options. *Journal of Obstetrics and Gynaecology Canada*. [https://doi.org/10.1016/S1701-2163\(16\)34321-3](https://doi.org/10.1016/S1701-2163(16)34321-3)
35. Y. Berhan, A. Berhan (2014) Reasons for Persistently High Maternal and Perinatal Mortalities in Ethiopia: Part II-Socio-Economic and Cultural Factors. *Ethiopian Journal of Health Sciences*. <https://doi.org/10.4314/EJHS.V24I0.11S>

36. Edwina M Kolleh, Prince L. Bestman, Ousman Bajinka, et al (2022) Maternal mortality and its risk factors in Africa: A systematic review and meta-analysis. Archives of Clinical Obstetrics and Gynecology Research. <https://doi.org/10.33425/2768-0304.1007>
37. Y. Gebrehiwot, Birukkidus T. Tewolde (2014) Improving maternity care in Ethiopia through facility based review of maternal deaths and near misses. International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics. <https://doi.org/10.1016/j.ijgo.2014.08.003>
38. R. Hagues, Dayoung Bae, K. Wickrama (2017) Mediation pathways connecting secondary education and age at marriage to maternal mortality: A comparison between developing and developed countries. Women & health. <https://doi.org/10.1080/03630242.2016.1159266>
39. Muh. Ikhtiar, V. Hadju, Ridwan M. Taha, M. Syafar (2014) Study on Health Social Determinants as Cause of Maternal Mortality in Gowa District South Sulawesi 2013
40. S. El-Saharty, S. Chowdhury, Naoko Ohno, Intissar Sarker (2016) Improving maternal and reproductive health in South Asia : drivers and enablers. World Bank Publications. <https://doi.org/10.1596/978-1-4648-0963-7>
41. C. Nwolise, J. Hussein, L. Kanguru, et al (2015) The effectiveness of community-based loan funds for transport during obstetric emergencies in developing countries: a systematic review. Health Policy and Planning. <https://doi.org/10.1093/heapol/czu084>
42. H. K. M., S. N., N. N (2021) Maternal mortality in a tertiary care hospital: a 3-year retrospective study. International Journal of Reproduction Contraception Obstetrics and Gynecology. <https://doi.org/10.18203/2320-1770.IJRCOG20210006>
43. I. Ibrahim, U. Onwudiegwu (2012) Sociodemographic determinants of complicated unsafe abortions in a semi-urban Nigerian town: a four-year review. West Indian medical journal
44. Mukolwe Gaudencia Okumbe (2011) Environmental determinants of material morbidity and mortality in Bondo district, Kenya
45. A. S. Türkyılmaz, I. Koç, R. Schumacher, O. Campbell (2009) The Turkey National Maternal Mortality Study. European journal of contraception & reproductive health care. <https://doi.org/10.1080/13625180802376127>

46. Frank Chirowa, S. Atwood, Marc van der Putten (2013) Gender inequality, health expenditure and maternal mortality in sub-Saharan Africa: A secondary data analysis. *African Journal of Primary Health Care & Family Medicine*. <https://doi.org/10.4102/phcfm.v5i1.471>
47. Phillip Bassey (2015) Determinants and differentials of Maternal Reproductive Health Outcomes in Nigeria: A Review of National Demographic Health Survey Data from 1999 to 2013
48. P. Oriji, Datonye Briggs, A. Ubom, G. Atemie (2022) A five-year review of perinatal and maternal outcomes and their predisposing socio-demographic factors in a tertiary hospital in South-South Nigeria. *International Journal of Advances in Medicine*. <https://doi.org/10.18203/2349-3933.ijam20220777>
49. T. Egbe, T. Dingana, G. Halle-Ekane, et al (2016) Determinants of Maternal Mortality in Mezam Division in the North West Region of Cameroon: A Community-based Case Control Study. *International Journal of Tropical Disease & Health*. <https://doi.org/10.9734/IJTDPH/2016/24927>
50. B. Shrestha (2009) Maternal mortality in hilly districts of Nepal. *Journal of Institute of Medicine Nepal*. <https://doi.org/10.59779/jiomnepal.383>
51. O. Umeora, C. Esike, V. Egwuatu (2005) Maternal mortality in rural Nigeria. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*. <https://doi.org/10.1016/j.ijgo.2004.12.021>
52. S. Raj, D. Maine, P. Sahoo, et al (2013) Meeting the community halfway to reduce maternal deaths? Evidence from a community-based maternal death review in Uttar Pradesh, India. *Global Health: Science and Practice Journal*. <https://doi.org/10.9745/GHSP-D-12-00049>
53. Samiksha Singh, G. Murthy, A. Thippaiah, et al (2015) Community Based Maternal Death Review: Lessons Learned from Ten Districts in Andhra Pradesh, India. *Maternal and Child Health Journal*. <https://doi.org/10.1007/s10995-015-1678-1>
54. (2023) Maternal Mortality Review, an Open Window on the Experience of Safe Motherhood in Low-Resource Countries. *European Journal of Medical and Health Sciences*. <https://doi.org/10.34104/ejmhs.023.039046>

55. M. Chowdhury, Anisuddin Ahmed, Nahid Kalim, M. Koblinsky (2009) Causes of Maternal Mortality Decline in Matlab, Bangladesh. *Journal of Health, Population and Nutrition*. <https://doi.org/10.3329/jhpn.v27i2.3325>
56. F. Obare, W. Liambila, D. Okoro, et al (2016) Factors contributing to maternal mortality in relatively resource-endowed urban contexts of developing countries: the case of Nairobi, Kenya. *African Population Studies*. <https://doi.org/10.11564/30-3-922>
57. Marco Antonio, Sigüenza Pacheco, M. Alexandra, et al (2024) Trends in Maternal Mortality in South America after the Covid-19 Pandemic: A Systematic Review. *World Journal of Advanced Research and Reviews*. <https://doi.org/10.30574/wjarr.2024.24.3.3686>
58. Anieken M. Abasiattai, A. Umoiyoho (2008) A 6-Year Review Of Maternal Deaths In A Teaching Hospital In South-South, Nigeria. *The Internet journal of gynecology and obstetrics*. <https://doi.org/10.5580/2468>
59. Ayu Putu, D. S. Rejeki, Siwi Pramata (2024) FAKTOR- FAKTOR RISIKO KEMATIAN IBU DI BEBERAPA NEGARA BERKEMBANG “LITERATURE REVIEW”. *Healthy Tadulako Journal (Jurnal Kesehatan Tadulako)*. <https://doi.org/10.22487/htj.v10i3.1356>
60. Sadia Habib, Ghazala Shams, Saba Ayoub, et al (2023) MATERNAL MORTALITY AT A TERTIARY CARE HOSPITAL; A 10-YEAR REVIEW. *Khyber Journal of Medical Sciences*. <https://doi.org/10.70520/kjms.v16i1.358>
61. Mohammad Khayrul Bashar Khan, A. Sarker, M. S. Rahman, et al (2024) Incidence and characteristics of maternal mortality: a retrospective study in Dhaka medical college. *International Journal of Reproduction Contraception Obstetrics and Gynecology*. <https://doi.org/10.18203/2320-1770.ijrcog20241418>
62. Fagbemi Aj, Jombo Se, Ilikannu So, et al (2024) A five-year review of maternal mortality in federal medical centre, Asaba delta state. *International Journal of Clinical Obstetrics and Gynaecology*. <https://doi.org/10.33545/gynae.2024.v8.i3b.1453>
63. Elsie G. Karmbor-Ballah, Mosoka P. Fallah, J. Silverstein, et al (2019) Maternal mortality and the metempsychosis of user fees in Liberia: A mixed-methods analysis. *Scientific African*. <https://doi.org/10.1016/J.SCIAF.2019.E00050>

64. N. Naranjee, V. Naidoo, S. B. N. Krishna, et al (2023) Utilisation of Maternal Health Services and its Impact on Maternal Mortality Rate: A Case for KwaZulu-Natal, South Africa. *African Journal of Nursing and Midwifery*. <https://doi.org/10.25159/2520-5293/14062>
65. Mst Iffat Ara, Shammi Akter Soma, Md. Anowar Hossain, Mst Safura Khatun (2025) A Retrospective Study on Maternal Mortality in Rangpur Medical College Hospital. *Journal of Rangpur Medical College*. <https://doi.org/10.3329/jrpmc.v10i1.81561>
66. Alfred Kwesi Manyeh, R. Nathan, G. Nelson (2018) Maternal mortality in Ifakara Health and Demographic Surveillance System: Spatial patterns, trends and risk factors, 2006 – 2010. *PLoS ONE*. <https://doi.org/10.1371/journal.pone.0205370>
67. Oboh Sa, Eifediyi Ra, Y. O., et al (2020) Maternal Mortality: A Review of Aetiology in a Lassa Fever Endemic Region of Nigeria. *International Journal of Gynecological and Obstetrical Research*. <https://doi.org/10.31907/2309-4400.2020.08.07>
68. M. DerSarkissian, C. Thompson, O. Arah (2013) Time series analysis of maternal mortality in Africa from 1990 to 2005. *Journal of Epidemiology and Community Health*. <https://doi.org/10.1136/jech-2013-202565>
69. S. C. D. S. Ramos (2013) Análise de casos de mortes maternas em Manaus nos anos 2001 a 2010
70. Salazar FlÃ³rez, Arias-Castro, Montenegro MartÃ¡nez, et al (2025) Urban-rural disparities in maternal mortality between 2014 and 2021 in Colombia. *Rural and remote health*. <https://doi.org/10.22605/rrh9032>
71. M. Cham, J. Sundby, S. Vangen (2005) Maternal mortality in the rural Gambia, a qualitative study on access to emergency obstetric care. *Reproductive Health*. <https://doi.org/10.1186/1742-4755-2-3>
72. R. Mataya (2008) The worth of malawian women: a review of the current status of safe motherhood in Malawi. *Malawi medical journal : the journal of Medical Association of Malawi*. <https://doi.org/10.4314/MMJ.V19I3.10939>

73. Helena Yeboah, Olumuyiwa Omonaiye, Sanni Yaya (2025) The impact of economic growth and recessions on maternal and child health outcomes in sub-Saharan African countries: a systematic literature review. *Reproductive Health*. <https://doi.org/10.1186/s12978-025-01973-8>
74. Kanika P. Kachhwaha, Mahima Jain (2019) A Study of Causes and Factors Responsible for Maternal Mortality in a Tertiary Care Institute of Central Gujarat. *Journal of Gynecology and Obstetrics*. <https://doi.org/10.11648/J.JGO.20190704.11>
75. A. Rathore, Surbhi, A. Rathore (2024) Maternal mortality: India's trajectory to sustainable development goal 2030. *Current Medicine Research and Practice*. [https://doi.org/10.4103/cmnp.cmnp\\_165\\_24](https://doi.org/10.4103/cmnp.cmnp_165_24)
76. Y. Yakubu, Norashidah Mohamed Nor, E. Abidin (2018) A systematic review of micro correlates of maternal mortality. *Reviews on Environmental Health*. <https://doi.org/10.1515/reveh-2017-0050>
77. João Paulo Souza, L. Day, Ana Clara Rezende-Gomes, et al (2023) A global analysis of the determinants of maternal health and transitions in maternal mortality. *Lancet Global Health*. [https://doi.org/10.1016/s2214-109x\(23\)00468-0](https://doi.org/10.1016/s2214-109x(23)00468-0)
78. L. Aliyu, A. Kadas, A. Mohammed, et al (2022) Impediments to maternal mortality reduction in Africa: a systemic and socioeconomic overview. *Journal of Perinatal Medicine*. <https://doi.org/10.1515/jpm-2022-0052>
79. B. Mensch, Erica Chuang, A. Melnikas, S. Psaki (2019) Evidence for causal links between education and maternal and child health: systematic review. *Tropical medicine & international health*. <https://doi.org/10.1111/tmi.13218>
80. C. Marks, E. Dietsch, M. Sidebotham (2016) Maternal and neonatal health in Malawi: An integrative literature review. *African journal of midwifery and women's health*. <https://doi.org/10.12968/AJMW.2016.10.1.42>