BRIDGING THE GAP OF PREVENTABLE MATERNAL MORTALITY AND MORBIDITY (PMMM) IN LAO PDR

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June, 2025

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Preface

Maternal health remains a significant public health priority in the Lao People's Democratic Republic (Lao PDR), where disparities in access to quality maternal care continue to contribute to preventable deaths and morbidities. While national efforts have resulted in improvements in maternal mortality indicators, critical gaps persist—particularly in rural and hard-to-reach areas—where health system limitations, socio-cultural barriers, and economic constraints undermine progress.

This study seeks to bridge the gap in the Prevention of Maternal Mortality and Morbidity (PMMR) by examining systemic challenges, assessing the effectiveness of existing interventions, and proposing evidence-based strategies that align with national policy and international commitments, including the Sustainable Development Goals. Anchored in public health and health systems research, the study draws on both quantitative data and qualitative insights to inform policy reforms and programmatic strengthening.

The findings aim to inform national policies, enhance surveillance and response systems, and contribute to more equitable and effective maternal health services aligned with Sustainable Development Goal 3.1: reducing global maternal mortality to fewer than 70 per 100,000 live births by 2030.

Through collaboration with local health authorities, frontline providers, and community stakeholders, this study contributes to the ongoing discourse on maternal health equity and health system resilience. The findings are intended to inform national strategies and support policymakers, practitioners, and partners in designing more inclusive, effective, and sustainable interventions.

We hope this research will serve not only as a foundation for bridging the maternal mortality gap in Lao PDR but also as a catalyst for continued commitment to safeguarding the health and rights of all women, regardless of geography or socioeconomic status.

Acknowledgement

We extend our deepest gratitude to all individuals and institutions whose invaluable contributions made the successful completion of the project, *Bridging the Gap of Preventable Maternal Mortality and Morbidity (PMMM) in Lao PDR*, possible.

First and foremost, we sincerely thank the healthcare workers who generously shared their experiences and participated in case narrative reviews of maternal death audits. Your openness, courage, and commitment to improving maternal health have been instrumental in advancing our understanding of the causes and prevention of maternal mortality and morbidity in Lao PDR.

Our heartfelt appreciation goes to the research team and collaborators for their unwavering dedication, rigorous analysis, and adherence to ethical research practices. This study would not have been possible without your expertise and tireless efforts.

We gratefully acknowledge the institutional and financial support of the Asian-Pacific Resource & Research Centre for Women (ARROW). Their commitment to supporting evidence-based research, along with their financial and logistical assistance, played a crucial role in enabling this study. We also appreciate ARROW's continued advocacy for strengthening health systems and advancing public health policy in the region.

We are also thankful to the community leaders and local advocacy organizations in Bokeo Province for their ongoing efforts to improve reproductive health access and outcomes. Your grassroots leadership and commitment to maternal health are vital in the movement to eliminate preventable maternal deaths in Lao PDR.

This study is a testament to our collective efforts to address the systemic, behavioral, and structural determinants of maternal mortality. We hope it serves as a meaningful contribution to evidence-based policy and improved healthcare practices for the future.

Thank you all for your invaluable support and partnership.

Executive Summary

Maternal mortality and morbidity persist as critical public health challenges in the Lao People's Democratic Republic (Lao PDR), with disproportionate impacts on rural and ethnically marginalized populations. Despite national efforts and policy commitments, maternal mortality and morbidity remain significant public health concerns in the Lao People's Democratic Republic (Lao PDR), disproportionately affecting rural and ethnically marginalized populations. Many maternal deaths are preventable and stem from structural, behavioral, and health system barriers that hinder timely and quality obstetric care.

This study, *Bridging the Gap of Preventable Maternal Mortality and Morbidity (PMMM) in Lao PDR*, aims to inform national strategies by examining the root causes of maternal deaths through the lens of the "Three Delays" model (Thaddeus & Maine, 1994). It pursues four key objectives: (1) analyze policy implementation gaps using Framework Analysis; (2) assess maternal mortality trends from 2000 to 2023; (3) evaluate disparities in access to antenatal, delivery, and postnatal care; and (4) investigate the impact of delays in care-seeking, access, and service provision, with particular attention to unsafe abortion and other preventable causes.

A mixed-methods approach was employed, including desk review of national policies and health data (DHIS2, MDSR), quantitative analysis of trends and coverage inequities, and qualitative insights from maternal death audits and community interviews in Savannakhet and Luang Prabang—provinces selected for their high maternal mortality burdens and ethnic diversity.

Findings reveal notable progress in maternal health coverage. ANC1 rose from 33% in 2000 to 90% in 2023, while ANC4 reached 70%, though dropout between visits remains a challenge. Skilled birth attendance improved from 16.7% to 90%, but coverage remains uneven across wealth and geographic lines. Postnatal care increased from 47.1% in 2017 to 64.2% in 2023, yet still falls short of national targets.

Policy initiatives such as the RMNCH Strategy, Free MCH Services Policy, and the Midwifery Improvement Plan have expanded service access and workforce training. However, implementation gaps persist, particularly in rural service delivery, midwife retention, and health infrastructure. Emergency obstetric care (EmOC) capacity remains weak, with cesarean section rates below 1% and inconsistent availability of lifesaving interventions.

Maternal death surveillance systems (DHIS2 and MDSR) provide critical data but suffer from underreporting and fragmentation. The upcoming rollout of Maternal and Perinatal Death Surveillance and Response (MPDSR) guidelines in 2025 offers an opportunity to improve audit processes and system accountability. Although the maternal mortality ratio declined from 283.6 to 126.1 per 100,000 live births between 2010 and 2021, projections suggest further reductions will be modest without targeted interventions.

Case studies from rural Luang Prabang highlight how the three delays contribute to poor outcomes: Delay 1 (decision to seek care) was implicated in 61% of cases, Delay 2 (reaching care) in 17%, and Delay 3 (receiving care) in over 80%. Adolescent and adult women alike face low health literacy, cultural barriers, long distances, and inadequate facility readiness, including absence of blood transfusion and surgical services.

In conclusion, this study underscores the need for strengthened health system responsiveness, equity-focused strategies, and actionable reforms to accelerate progress toward SDG 3.1. Bridging the gap in maternal mortality requires not only policy commitment but also localized, evidence-

based solutions that ensure no woman is left behind. These findings emphasize the imperative for targeted interventions to strengthen risk-based referral systems, enhance community engagement and maternal health literacy, expand emergency obstetric care capacity, and improve blood supply chain management and critical care infrastructure. The preventable nature of these deaths highlights systemic inequities and service delivery gaps that must be addressed through coordinated policy, programmatic, and community-based approaches. Ultimately, accelerating progress toward SDG 3.1 in Lao PDR will require sustained investment in equity-focused, quality maternal health services, ensuring that no woman's death is avoidable.

Bridging the Gap of Preventable Maternal Mortality and Morbidity (PMMM) in Lao PDR

1. Introduction

As of 2024, the population of the Lao People's Democratic Republic (Lao PDR) is estimated at approximately 7.77 million, with an annual growth rate of 1.34%. Women account for nearly half of the population, which remains relatively young. The median age has slightly increased to 24.6 years, and nearly 30% of the population is under the age of 15 (United Nations, 2022; UN DESA, 2024).

Despite national commitments and global alignment with the Sustainable Development Goal (SDG) Target 3.1—to reduce the global maternal mortality ratio (MMR) to fewer than 70 deaths per 100,000 live births by 2030—Lao PDR continues to face significant challenges in reducing maternal deaths. As of 2025, the national MMR is estimated at 116 deaths per 100,000 live births, placing Lao PDR among the countries with the highest maternal mortality in Southeast Asia (Ministry of Health [MoH], 2025).

Persistent maternal mortality in Lao PDR is driven by a complex combination of structural, socio-cultural, and systemic factors. Key barriers include limited access to skilled birth attendants, delays in referrals due to poor road infrastructure, inadequate health facility readiness, and sociocultural norms that hinder timely care-seeking. The "Three Delays" model provides a useful conceptual framework for understanding these factors: (1) delay in the decision to seek care, (2) delay in reaching care, and (3) delay in receiving appropriate care upon arrival (Thaddeus & Maine, 1994). Preventable causes of maternal deaths, including complications from unsafe abortion, lack of awareness of danger signs, and limited availability of comprehensive emergency obstetric care (EmOC), further compound the problem (World Health Organization [WHO], 2023; United Nations Population Fund [UNFPA], 2022).

This study aims to examine MMR trends from 2000 to 2023 and investigate the socio-economic and health system determinants contributing to preventable maternal mortality and morbidity (PMMM) in Lao PDR. By identifying context-specific drivers, barriers, and opportunities, the study will inform the design of evidence-based policies and targeted interventions. Ultimately, the goal is to support national efforts toward achieving SDG 3.1 and ensuring equitable maternal health outcomes for all women in Lao PDR.

Target Audiences for Advocacy

The study targets a broad range of stakeholders across governmental, international, and community levels to support evidence-based advocacy and policy influence. National actors include the Department of Hygiene and Health Promotion, the Maternal and Child Health (MCH) Center, the Lao Obstetric and Gynecology Association, and the Lao Midwifery Association, all of which are instrumental in shaping maternal health policies and service delivery strategies.

International development partners such as UNFPA and WHO play a crucial role in aligning national maternal health goals with global frameworks, providing technical assistance, and mobilizing funding. Civil society organizations, including the Lao Family Health Association, the International Planned Parenthood Federation (IPPF), the Lao Youth Union, and local women's associations, are central to grassroots implementation, community mobilization, and health education. Community leaders and advocates are also critical for promoting health-seeking behaviors, especially among rural and ethnically diverse populations.

Objectives

This study seeks to strengthen national efforts to reduce preventable maternal mortality and morbidity in Lao PDR by addressing the structural, behavioral, and policy-level determinants of maternal health and three delay models. The specific objectives are:

1. To analyze key national maternal health policies using a framework analysis approach to identify implementation and policy gaps.
2. To assess the trends of maternal mortality in Lao PDR from 2000 to 2023.
3. To examine changes in socio-demographic and economic inequalities in access to antenatal care (ANC), institutional delivery, and postnatal care (PNC) between 2006–2012 and 2012–2023.
4. To analyze how the "Three Delays" model—particularly delays in accessing emergency obstetric care—affects maternal mortality, with a focus on unsafe abortion and other preventable causes.

Research Questions

1. What are the existing gaps in Lao PDR's national maternal health policies?
2. What are the trends of maternal mortality in Lao PDR from 2000 to 2023?
3. What are the key social, economic, and health system determinants contributing to maternal mortality?
4. How do delays in accessing emergency obstetric care affect maternal mortality, particularly in relation to unsafe abortion in southern Lao PDR?

2. Research Methodology

This study employed a mixed-methods research design to comprehensively investigate the determinants of preventable maternal mortality and morbidity (PMMM) in rural and ethnically diverse communities of Savannakhet and Luangprabang Provinces, Lao PDR. By integrating desk review, quantitative analysis, and qualitative inquiry, the study aimed to capture both macro-level insights from policies and health system structures, and micro-level understandings of maternal health experiences from affected communities.

2.1 Desk Review:

A comprehensive desk review was conducted to synthesize existing evidence on maternal health in Lao PDR. This included analysis of:

- National health statistics from the District Health Information System2 (DHIS2) and Maternal Death Surveillance and Response (MDSR) reports,
- Policy and programmatic documents from the Ministry of Health (MoH),
- Reports and datasets from international agencies such as the World Health Organization (WHO) and United Nations Population Fund (UNFPA),
- Peer-reviewed academic literature on maternal health in low- and middle-income countries (LMICs).

The desk review established the current knowledge base, highlighted policy gaps, and informed the design and focus of primary data collection activities.

2.2 Quantitative Data

Quantitative data sourced from existing databases, including DHIS2 and MDSR reports, to examine trends in maternal mortality, service coverage, and obstetric care access. These data provided contextual background and support triangulation with qualitative findings.

2.3. Qualitative Data

Qualitative data were derived from maternal death review reports (2020–2024) and medical records of hospital-based maternal deaths in 2024. Maternal death reviews in Lao PDR employed multiple qualitative sources to analyze causation and contextual factors. Verbal autopsies were conducted with bereaved family members and community health workers identified socio-cultural and access barriers, while facility-based reviews examined clinical records and provider interviews to assess care quality, systemic delays, and resource gaps. Community and family interviews further elucidated socio-economic determinants, including poverty, transportation limitations, and traditional practices influencing outcomes.

2.4 Study sites

Field research was conducted in selected rural and ethnically diverse communities within Luangprabang and Savannakhet provinces, which were chosen due to their disproportionately high maternal mortality burdens, geographic remoteness, and ethnic heterogeneity. These provinces also hold strategic importance for national health policy scaling. The data collection phase was conducted over a three-month period: April to May (fieldwork) with four bereaved families, June to July (data analysis and report writing), and August to September (advocacy and dissemination).

2.4.2 Conceptual Framework

Three Delays Model

Delay 1: Deciding to Seek Care

Delay 1 occurs when women or families hesitate to seek medical care due to socio-cultural, economic, or perceptual barriers. Delayed factor 1 included late or no antenatal care (Limited access to or avoidance of prenatal visits), Socio-cultural barriers (Religious beliefs, reliance on traditional medicine, or lack of awareness about pregnancy risks), Financial and social constraints (Poverty, spouse's influence, or substance use (alcohol, smoking, drugs) and High-risk behaviors (Forced abortion or unsafe practices delaying medical care) (Thaddeus, Maiine, 1994; Win et al., 2024; Sk MIK, 2019; Lassi et al., 2019).

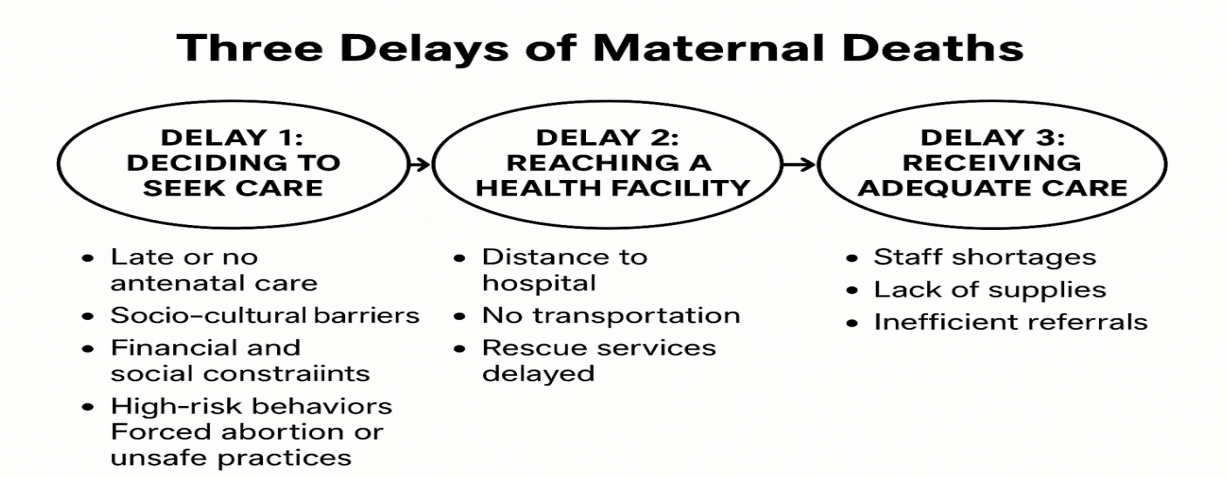
Delay 2: Reaching a Health Facility

Geographical and logistical challenges hinder access to care, especially in rural areas. Delayed factor 2 included distance of home to hospital (poor road conditions and remoted locations), no transportation (lack of available vehicles, especially ambulances or emergency transport), rescue services, when available, may not arrive quickly enough (Atuoye et al., 2015; Mayangitan et al., 2022).

Delay 3: Receiving Adequate Care

Even after reaching a facility, women face delays due to staff shortages, lack of supplies, and poor infrastructure (Thaddeus, Maiine, 1994; Knight et al., 2013; Ziraba et al., 2009; Mgawadere et al., 2017). Inefficient referrals, untrained staff, and administrative hurdles (e.g., pre-payment requirements) further delay critical interventions (Mgawadere et al., 2017; Alobo et al., 2021; Hussein et al., 2016; Geleto et al., 2018). These systemic failures increase maternal mortality risks.

Figure 1: "Three Delays of Maternal Deaths" by categorizing factors that impede timely maternal care



Source: Three Delays Model by Thaddeus, Maiine, 1994

2.4.3 Analysis

Quantitative Data Analysis

The quantitative component of this studynvolved the systematic analysis of maternal mortality data obtained from two key national health information systems in Lao PDR: the District Health Information System 2 (DHIS2) and the Maternal Death Surveillance and Response (MDSR) system. These datasets were compared and triangulated to assess data quality, reporting completeness, and epidemiological trends in maternal mortality across geographical, ethnic, and service delivery dimensions.

Comparative Analysis of DHIS2 and MDSR Data

DHIS2 contains aggregated facility-based data on maternal health service utilization, while the MDSR system provides case-based surveillance of maternal deaths, including their causes, timing, and contributing factors. Through the comparative analysis of these systems:

- Discrepancies in reported the number of maternal deaths were identified.
- Differences in data coverage and reporting quality across districts and facility types were examined to evaluate the robustness of the national maternal mortality surveillance infrastructure.

Disaggregation and Trend Analysis

Maternal mortality data were disaggregated by province to explore geographic inequities and inform region-specific policy responses. Where longitudinal data were available, temporal trends over the past five years were analyzed to assess progress toward Sustainable Development Goal (SDG) Target 3.1.

The integration of these analytical components enabled a comprehensive understanding of the epidemiological landscape and health system bottlenecks contributing to maternal mortality in Lao PDR.

Qualitative Data Analysis

Qualitative data were analyzed using thematic analysis as outlined by Braun and Clarke (2006). Two independent researchers read all transcripts and conducted open coding to identify recurring patterns, such as “delays in care-seeking,” “cultural barriers,” and “health system gaps.” These codes were then grouped into broader themes—such as “Three Delays Model factors”—through axial coding. Thematic refinement was carried out through iterative discussions with local researchers to ensure contextual relevance and validity.

A comparative case narrative review of maternal death audits was conducted using the Critical Incident Technique (Flanagan, 1954). Each case was analyzed to trace the care-seeking pathway from symptom onset to arrival at a health facility, with the aim of identifying recurring systemic failures, such as lack of transport or shortages of skilled health workers. Triangulation was employed by comparing interview data with facility records and community reports to enhance the credibility and accuracy of the findings.

2.4.4 Policy and Desk Review Analysis

The desk review and policy analysis employed a Framework Analysis (Ritchie & Spencer, 1994) to identify gaps in national maternal health policies, such as underfunding of emergency obstetric

services or inconsistencies in workforce distribution. These findings were then mapped against empirical data collected from the field. The final recommendations were synthesized using the WHO Health Systems Framework (WHO, 2007), with a focus on aligning proposed interventions with SDG 3.1 targets and national health priorities.

3. Results

3.1 Desk Review

3.1.1 Government Policy on Maternal Health Care

Lao People's Democratic Republic (Lao PDR) has made notable strides in advancing maternal and child health, positioning the country closer to achieving its Millennium Development Goals (MDGs), particularly MDG 4 (reducing child mortality) and MDG 5a (reducing maternal mortality) (Do et al., 2018; UN Lao PDR, 2015; UN Lao PDR, 2018). These efforts continue under the framework of Sustainable Development Goal (SDG) 3, which aims to ensure healthy lives and promote well-being for all at all ages. Specifically, SDG Target 3.1 seeks to reduce the global maternal mortality ratio (MMR) to fewer than 70 deaths per 100,000 live births by 2030. In alignment with this target, Lao PDR committed to reducing its MMR to 160 per 100,000 live births by 2020 (Ministry of Health [MoH], 2016), although current estimates remain higher than desired. Since 2012, the government has launched several strategic policies and programs to enhance maternal health service delivery, improve access for vulnerable populations, and address both financial and non-financial barriers to care. Key initiatives include the National Reproductive, Maternal, Newborn, and Child Health (RMNCH) Strategy (2016–2025)**,** the Free Maternal and Child Health Services Policy, the Midwifery Improvement Plan (2016–2020). Additionally, critical systems such as the Maternal Death Surveillance and Response (MDSR) and District Health Information System 2 (DHIS2) have been deployed to strengthen data-driven maternal health governance.

A. National Reproductive, Maternal, Newborn, and Child Health (RMNCH) Strategy (2016–2025)

The RMNCH Strategy (2016–2025) represents the central policy framework for improving maternal and child health outcomes in Lao PDR. It aims to reduce maternal mortality by increasing the proportion of facility-based deliveries attended by skilled birth attendants from 41.5% to 80%, expanding antenatal care (ANC) coverage for four or more visits from 37% to 80%, and ensuring that all comprehensive emergency obstetric care (EmOC) facilities are equipped to provide essential services, including cesarean sections (MoH, 2016).

Despite measurable progress, the implementation of the RMNCH strategy faces considerable challenges. Rural-urban disparities remain pronounced. Only 40% of rural births are attended by skilled personnel, compared to 80% in urban areas, largely due to the concentration of 70% of midwives in cities and a continued reliance on traditional birth attendants in remote communities (World Health Organization [WHO], 2020). EmOC services are underfunded, with only 30% of needs being met in rural areas, particularly in terms of blood transfusion services and surgical capacity. Moreover, adolescent pregnancy rates remain high, contributing to increased maternal risk.

Applying Ritchie and Spencer's (1994) Framework Analysis, the strategy demonstrates strength in setting measurable targets, yet implementation gaps persist across financing, infrastructure, and community engagement. Maternal health services receive only 15% of the national health budget, and dependence on external donors raises concerns about long-term sustainability (World Bank, 2022). Logistical barriers such as poor road conditions and lack of ambulance services further delay emergency referrals. The policy framework also lacks effective mechanisms for addressing

health workforce imbalances. There are no national incentives or requirements for rural service postings, resulting in persistent service gaps in underserved areas.

Community engagement also remains weak. Only 35% of women complete the recommended four ANC visits, often due to low awareness and cultural practices. To address these systemic constraints, the RMNCH Strategy requires enhanced financing, targeted rural workforce deployment, strengthened EmOC infrastructure, and greater community mobilization through village health workers. Moreover, integration with robust monitoring systems, such as MDSR and DHIS2, is crucial for tracking progress and ensuring accountability. Without addressing these foundational issues, Lao PDR risks stagnation in its maternal health outcomes, despite having a comprehensive and well-articulated strategic framework.

B. Free Maternal and Child Health (MCH) Services Policy

The Free Maternal and Child Health (MCH) Services Policy in Lao PDR represents a key strategy to reduce financial barriers to healthcare access for pregnant women and children under five, with the overarching goal of decreasing the maternal mortality ratio (MMR). Introduced under the framework of the National Reproductive, Maternal, Newborn, and Child Health (RMNCH) Strategy (2016–2025), the policy ensures that essential services—such as antenatal care (ANC), facility-based deliveries, emergency obstetric care (EmOC), and postnatal care (PNC)—are provided free of charge at public health facilities (Ministry of Health [MoH], Lao PDR, 2016). By eliminating user fees, the policy aims to promote institutional deliveries and increase skilled birth attendance (SBA), both of which are critical to preventing maternal deaths due to hemorrhage, sepsis, and hypertensive disorders (World Health Organization [WHO], 2020).

Despite these achievements, implementation challenges persist, particularly in rural and remote areas where health infrastructure is limited. A 2018 program evaluation reported a 15% increase in facility-based deliveries in targeted provinces; however, inequalities in access remain due to indirect costs such as transportation and deep-rooted cultural preferences for home births (United Nations Population Fund [UNFPA], 2019). Furthermore, frequent stockouts of essential drugs and equipment, as well as the unequal distribution of trained health personnel—particularly midwives—continue to constrain the policy's impact on reducing maternal deaths (World Bank, 2022).

To enhance its effectiveness, the policy has been integrated with other equity-focused initiatives, including the Health Equity Fund (HEF) for the most economically disadvantaged households and community-based health education programs. Nevertheless, achieving Sustainable Development Goal (SDG) 3.1—to reduce MMR to fewer than 70 deaths per 100,000 live births by 2030—requires addressing critical systemic barriers. These include: (1) expanding midwife coverage, as only 40% of rural health centers were staffed with a skilled birth attendant as of 2023; (2) ensuring uninterrupted availability of essential EmOC supplies such as oxytocin and blood transfusion capabilities; and (3) strengthening referral systems for high-risk pregnancies (UNFPA, 2023).
Using Ritchie and Spencer’s (1994) framework methodology for policy analysis, this study evaluates the effectiveness of the Free MCH Services Policy in reducing maternal mortality in Lao PDR. Since its implementation in 2013, the policy has contributed to a decline in MMR from 357 to 185 deaths per 100,000 live births between 2012 and 2022 (MoH & WHO, 2023). However, the framework analysis highlights several critical gaps in policy execution. However, there are geographic disparities between urban and rural areas, with the rural rate estimated to be 3.4 times

higher than the urban rate (Sakamoto, 2023).–Furthermore, 70% of trained midwives are concentrated in urban health facilities, leaving rural areas significantly underserved (UNFPA, 2023). Frequent stockouts of essential maternal health supplies, including uterotonics like oxytocin, continue to undermine service quality (WHO, 2020). The policy's long-term viability is also challenged by its dependence on external donor funding and insufficient national budget allocation (World Bank, 2022).

C. Midwifery Improvement Plan (2016–2020)

The Midwifery Improvement Plan (MIP) 2016–2020, launched by the Ministry of Health (MoH) in 2015, aimed to enhance maternal and newborn health in Lao PDR by strengthening the midwifery profession. The MIP focused on five strategic areas: (1) improving planning and management of the midwifery workforce; (2) strengthening the regulatory framework for midwifery; (3) enhancing midwifery education; (4) creating an enabling working environment for midwives; and (5) increasing community access to and utilization of professional midwifery services (UNFPA, 2016). A key outcome of the focus on education was the accreditation, in early 2023, of three midwifery education institutions—Champasak, Xiengkhouang, and Luang Prabang Colleges of Health—as centers of excellence by the International Confederation of Midwives (ICM) (UNFPA, 2023). Despite these advancements, not all objectives of the MIP were fully achieved. The focus of the initiative has since shifted toward improving the quality of midwifery services, emphasizing deployment, retention, quality assurance, and continuing professional development (CPD) (MOH Lao PDR, 2020).

The MIP contributed to the standardization of the national midwifery curriculum in accordance with international competency frameworks, the training of more than 1,200 midwives, and the introduction of a national licensing system to ensure the quality and accountability of midwifery care (UNFPA, 2016; JICA, 2018). To address inequitable workforce distribution, the plan introduced financial and non-financial incentives to support rural deployment and expanded emergency obstetric care (EmOC) infrastructure. These efforts contributed to a significant increase in skilled birth attendance, rising from 38% to 64% during the implementation period (World Bank, 2021; MOH Lao PDR, 2020). Nevertheless, challenges persisted, particularly with the retention of midwives in rural areas, where vacancy rates reached up to 30% (MOH Lao PDR, 2020). To support monitoring and performance evaluation, the MIP established data systems through the District Health Information Software 2 (DHIS2) and linked midwifery service delivery to maternal death surveillance and response mechanisms (WHO, 2019; UNICEF, 2020). Although the initiative made considerable progress in strengthening and professionalizing the midwifery workforce, ongoing challenges underscore the need for sustained investments and adaptive strategies to ensure equitable access to quality maternal health services across the country.

D. Emergency Obstetric Care & PPH Management

In Lao PDR, Earlier assessments highlighted substantial gaps in the availability and qualityof Emergency Obstetric Care (EmOC) in Laos. A hospital-based survey conducted in 2008 across three provinces found that fewer than half of district and provincial hospitals met United Nations standards for EmOC, with limited provision of both basic and comprehensive services. At that time, only a small proportion of births occurred in EmOC-equipped facilities, cesarean section rates were far below internationally recommended thresholds, and several key signal functions—such as assisted vaginal delivery—were frequently unavailable (Rima Jolivet et al., 2012).

Efforts to improve provider capacity have included training midwives and health workers in emergency obstetric skills. In 2019, the Ministry of Health, in collaboration with UNFPA, implemented the "Helping Mothers Survive" (HMS) program, which focused on managing PPH and pre-eclampsia/eclampsia. The program employed a low-dose, high-frequency (LDHF) training approach, creating a network of master trainers and local champions to ensure the cascade of skills across various levels of the health system, especially targeting rural and district facilities without doctors (UNFPA Lao PDR, 2019). More recently, in 2024, the Ministry of Health and UNFPA have scaled up Basic Emergency Obstetric and Newborn Care (BEmONC) training in collaboration with midwifery schools. These trainings, aligned with the national Reproductive, Maternal, Newborn, Child and Adolescent Health (RMNCAH) Strategy (2021–2025), aim to strengthen frontline workers' ability to manage obstetric emergencies, including PPH (UNFPA Lao PDR, 2024).

Overall, Lao PDR has taken meaningful steps to address maternal mortality through improved EmOC services and targeted interventions for PPH prevention and management. However, challenges persist in ensuring equitable access, especially in rural and remote areas. Continued investment in infrastructure, provider training, community-based interventions, and supportive policies will be essential to sustain progress toward reducing maternal deaths in line with SDG 3.1.

E. Maternal Death Surveillance and Response (MDSR) System & DHIS2

In Lao PDR, the Maternal Death Surveillance and Response (MDSR) system and the District Health Information Software 2 (DHIS2) serve as the primary mechanisms for reporting and analyzing maternal mortality data. The Maternal Death Surveillance and Response (MDSR) system and District Health Information Software 2 (DHIS2) were established in Lao PDR at different times to improve maternal mortality reporting. DHIS2 was first piloted in 2012 and officially implemented nationwide by 2015 as part of the Lao Health Information System reform, primarily capturing facility-based maternal deaths. The MDSR system was introduced later in 2016 following WHO guidelines, with support from UNFPA, UNICEF, and WHO, to address gaps in community-based death reporting that DHIS2 could not capture. Initial implementation of both systems faced challenges: DHIS2 struggled with low reporting compliance from rural health facilities due to limited technical capacity, while MDSR experienced significant underreporting of home-based deaths. Although MDSR was initially rolled out in priority provinces, full nationwide coverage remains incomplete. Since 2020, efforts have been made to strengthen interoperability between the two systems and expand community-based reporting, though persistent gaps in data completeness and integration continue to affect the accuracy of maternal mortality ratio (MMR) estimates in Lao PDR (Ministry of Health Lao PDR, 2015, 2018, 2023; UNFPA, 2017, 2019; WHO, 2016, 2020).

Despite their complementary roles, both systems face challenges in ensuring complete and accurate MMR reporting. MDSR suffers from underreporting, with only 50% of expected maternal deaths being notified, and just half of those undergoing review (UNFPA, 2021). As a result, MDSR reviews cover only 29% of estimated maternal deaths, leaving significant gaps in data (UNICEF & WHO, 2023). Additionally, weak death registration systems and a lack of medically certified causes of death contribute to misclassification. DHIS2**,** meanwhile, is limited by its exclusion of community-based deaths and inconsistent data quality due to variations in health facility reporting compliance (World Bank, 2021). The lack of full integration between

MDSR and DHIS2 further complicates efforts to produce a unified national MMR estimate. To further institutionalize and strengthen the MPDSR system, the MPDSR Guideline was finalized by the Ministry of Health. Its formal endorsement and nationwide dissemination, scheduled for early 2025, will equip health providers with standardized protocols to systematically review and respond to maternal deaths, reinforcing maternal and newborn health systems across the country (UNFPA, 2024).

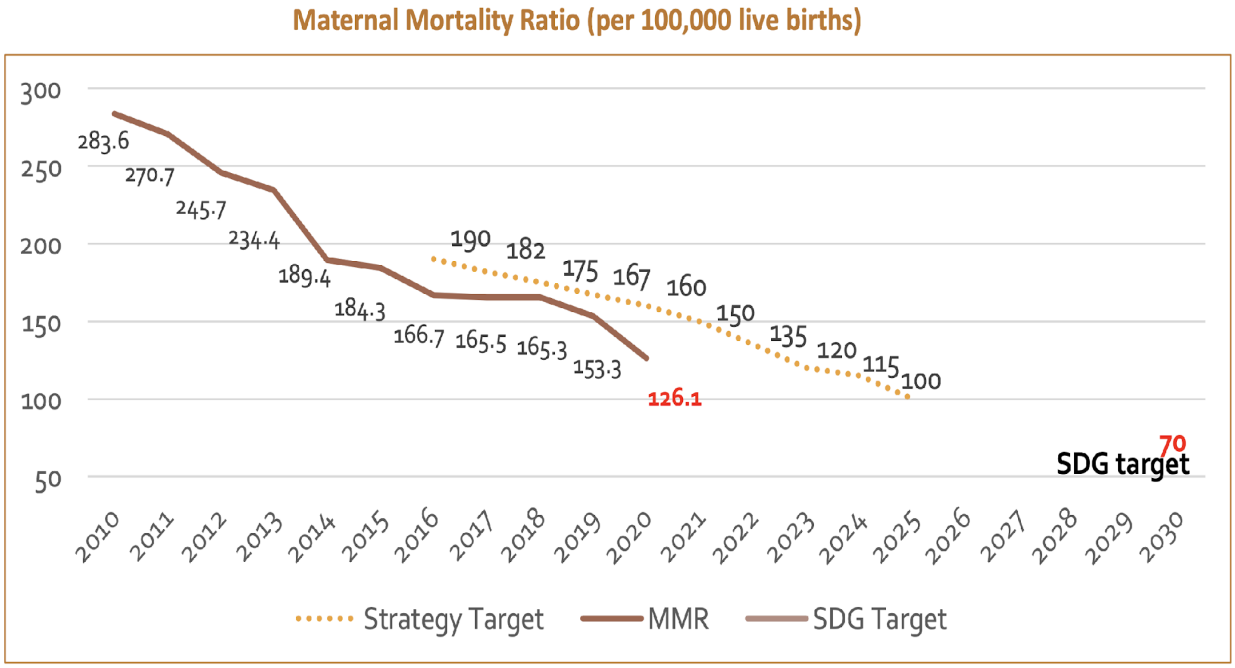
3.2 Quantitative Data

3.2.1 Trends and Current Situation of MMR

Between 2010 and 2021, Lao PDR made significant progress in reducing the maternal mortality ratio (MMR), decreasing from 283.6 to 126.1 deaths per 100,000 live births (Figure 2). This steady decline reflects improvements in maternal health services, including increased access to skilled birth attendance and antenatal care. However, when comparing national targets with the Sustainable Development Goal (SDG) 3.1—which aims to reduce the MMR to less than 70 by 2030—it becomes evident that the current trajectory falls short. The national strategy targets project an MMR of 100 by 2030, indicating a substantial gap of 30 points from the SDG target. While the downward trend is promising, achieving the SDG goal will require accelerated efforts, including expanded service coverage, enhanced quality of care, and targeted interventions for high-risk populations.

Despite this progress, the MMR in Lao PDR remains higher than the regional average **f**or East Asia and the Pacific, and disparities persist—particularly among women with low education, those living in rural or remote areas, and those from lower socioeconomic backgrounds. In Southeast Asia, the Lao People's Democratic Republic (Lao PDR) remains one of the countries with the highest numbers of maternal deaths (WHO, 2023; UNFPA, 2023).

Figure 2: Trends MMR from 2010-2021, Lao PDR



Source: UNFPA Lao PDR. (2023). *Maternal Health Thematic Brief: Strengthening Emergency Obstetric and Newborn Care (EmONC) in Lao PDR*. Vientiane: United Nations Population Fund.

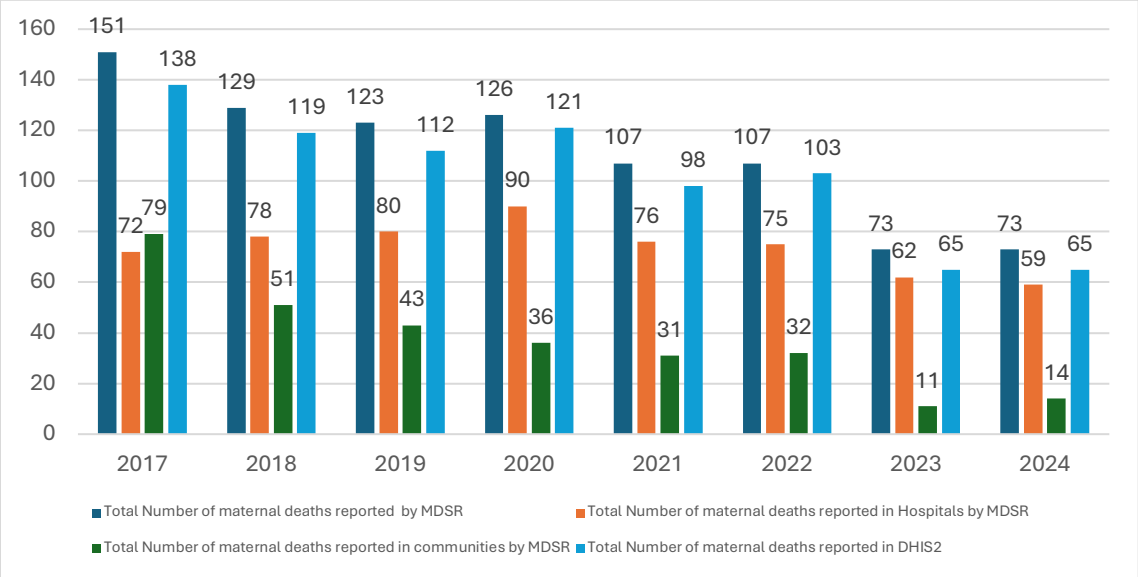
World Health Organization (WHO). (2023). *Trends in maternal mortality 2000 to 2020: Estimates by WHO, UNICEF, UNFPA, World Bank Group, and UNDESA/Population Division*. Geneva: WHO.

Comparative Analysis of Number of Maternal Deaths by MDSR in Hospitals and Communities

The figure 3 compares maternal deaths in Lao PDR (2017–2024) reported by two systems: Maternal Death Surveillance and Response system (MDSR), which tracks deaths in both hospitals and communities, and DHIS2, which records only hospital-based deaths. From 2017 to 2019, there was a gradual decline in the absolute total number of maternal deaths reported, from 151 in 2017 to 123 in 2019. This was followed by a slight increase to 126 in 2020, and a further decline to 107 in both 2021 and 2022**,** stabilizing during this period. In 2023, the absolute number maternal deaths dropped to 73, however, the number of notified maternal deaths was the same in 2023 and 2024, with 73 deaths recorded in each year. The figures reported were absolute numbers of notified maternal deaths from the national MDSR/HMIS system. During the study period, we did not have reliable data on the denominator (number of live births) corresponding to these notifications. Lao PDR does not yet have a complete birth and death registration system, and available live-birth data are either modelled estimates or incomplete facility-based figures, which would not provide an accurate denominator for calculating a maternal mortality ratio for our study population.

The notified absolute number of maternal deaths in hospitals varied over time, with 72 deaths recorded in 2017, a peak of 90 in 2020, and 59 in 2024. The notified absolute number of maternal deaths in communities also changed over the period, from 79 in 2017 to 14 in 2024. However, because reliable data on the number of live births (denominator) during the study period were not available and Lao PDR does not yet have complete birth and death registration, these figures can only be interpreted as reported counts; they cannot be used to infer an improvement or decline in maternal mortality risk over time.

Figure 3: Total number of maternal deaths from 20217-2024 reported by MDSR and DHIS2 from 2017-2024

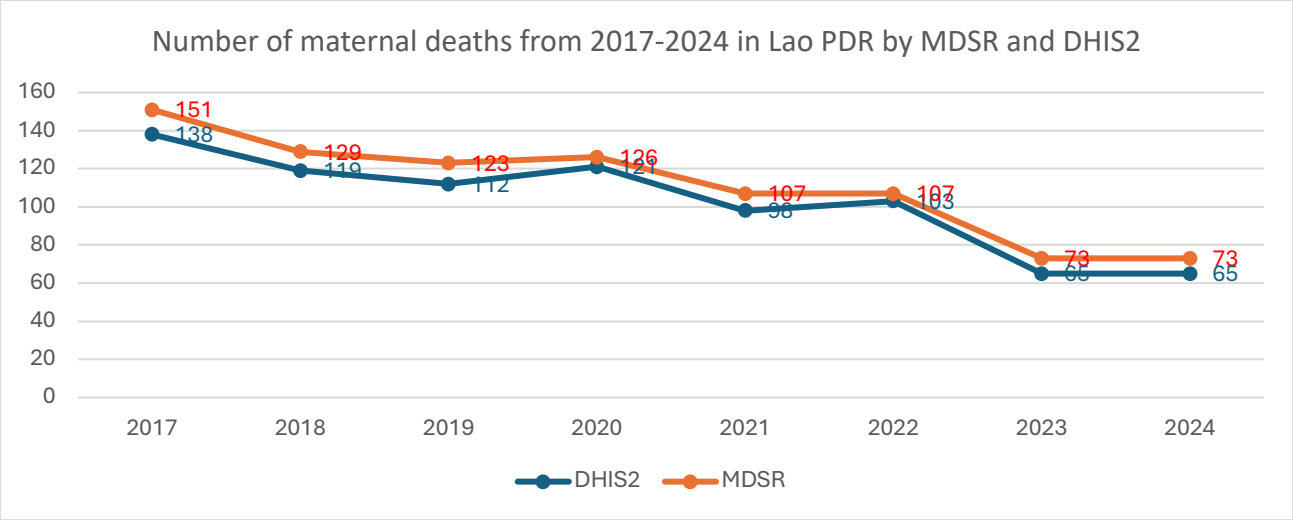


Source: Data from MDSR and DHIS2 from 20217-2024

Comparison of the reported number of Maternal Deaths between MDSR and DHIS2 from 2017–2024

Figure 4 compares the notified absolute number of maternal deaths reported in DHIS2 and in MDSR for each year**.** MDSR consistently reports higher numbers than DHIS2, reflecting its broader coverage. For example, in 2017, MDSR documented 151 deaths compared to DHIS2's 138. Both systems show a general decline over time, though with fluctuations—such as a rise in MDSR-reported deaths in 2023 (126). The persistent gap between the datasets highlights differences in reporting scope, with MDSR capturing a more comprehensive picture. Despite variations, the downward trend in both systems suggests progress in reducing maternal mortality, though MDSR's higher figures emphasize the importance of institutional deaths in maternal health monitoring. Clarifying each system's methodology would further explain these disparities.

Figure 4: Comparison of the reported number of Maternal Deaths between MDSR and DHIS2



Source: Data from DHIS2 and MDSR

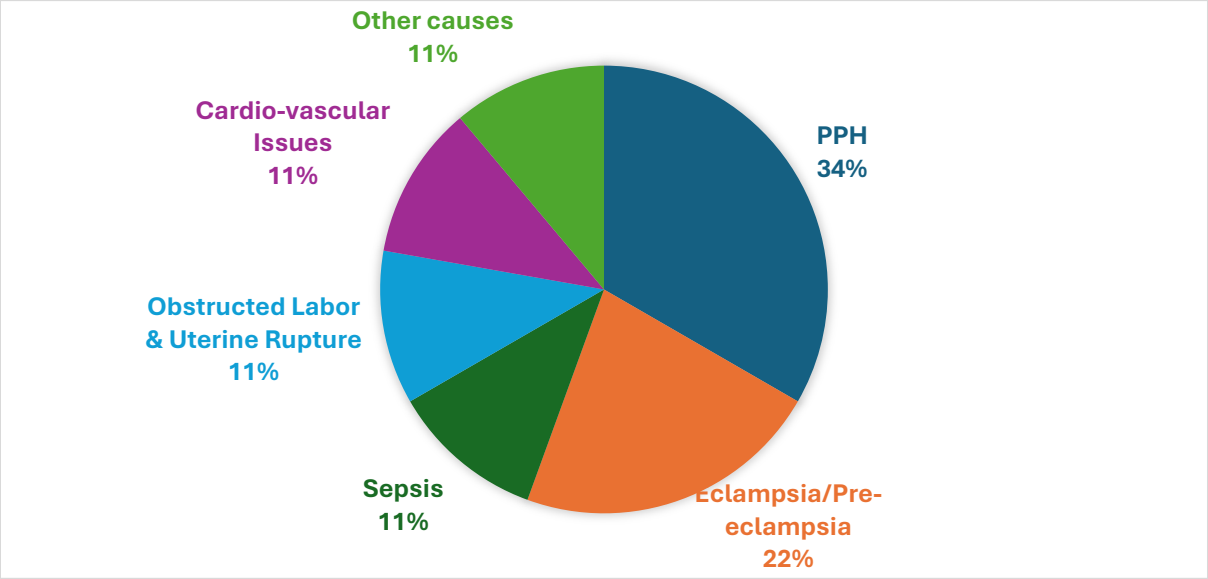
3.2.3 Causes of MMR in Lao PDR

The WHO's ICD-11 (introduced in 2012, implemented in 2022) provides updated codes to classify maternal deaths, helping distinguish direct, indirect, and non-obstetric causes for better-targeted interventions.

- **Direct Obstetric Causes**: Result from pregnancy or delivery complications (e.g., hemorrhage, eclampsia, sepsis, abortion-related issues, obstructed labor, embolism) or medical errors during care.
- **Indirect Obstetric Causes**: Pre-existing or pregnancy-aggravated conditions (e.g., heart disease, respiratory illness, gestational diabetes, HIV, malaria).
- **Non-Obstetric Causes**: Deaths unrelated to pregnancy but occurring during it or within 42 days postpartum (e.g., accidents, suicide, violence, appendicitis, substance abuse).

Figure 5 identified postpartum hemorrhage (34%), eclampsia (22%) and sepsis (11%) and Obstructed labor (11%) as the leading causes of maternal deaths. In response, the Ministry of Health, with technical support from UNFPA, has swiftly implemented new measures to address these preventable causes, ensuring that evidence-driven interventions are executed practice without delay. This could be due in large part to poorly equipped and poorly financed health services and insufficient knowledge about reproductive health among women (RMCAH, 2020).

Figure 5: Causes of Maternal Mortality, Lao PDR



Source: UNFPA Lao PDR. (2023). *Maternal Health Thematic Brief: Strengthening Emergency Obstetric and Newborn Care (EmONC) in Lao PDR*. Vientiane: United Nations Population Fund.

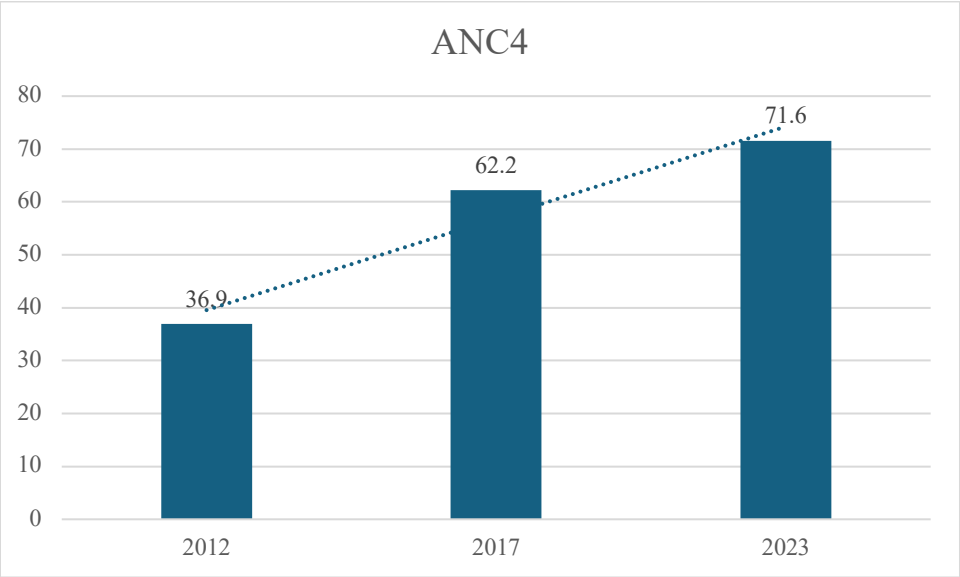
3.2.4 Accessibility and utilization of maternal health services

Trends of Antenatal Care coverage in Lao PDR between the years 2012, 2017 and 2023

Antenatal Care (ANC) among pregnant women is an important factor in reducing maternal morbidity and mortality. Unfortunately, many women in developing countries do not receive such care (Yang, et al., 2010; Simkhada et al., 2008). In Lao PDR, there were significant improvements in ANC4 coverage, in which ANC4 rose by 34.7% (from 36.9% to 71.6%) between 2012-2023.

The increasing coverage of at least four antenatal care visit (ANC4 in Lao PDR from 2012 to 2023 demonstrates significant progress toward achieving Sustainable Development Goal 3.1, which aims to reduce the global maternal mortality ratio (Figure 6). This progress is particularly meaningful in reducing maternal deaths linked to preventable complications. Additionally, the narrowing gap in ANC4 coverage between rural and urban populations indicates progress in addressing health equity, ensuring that women in disadvantaged and remote areas have better access to essential maternal health services (Phommachanh et al., 2019; Ahissou et al., 2023).

Figure 6: Trends of Pregnant Women Receiving ANC4 (%) from 2012 to 2023, Lao PDR



Source: Data from LSIS, 2012, 2017 and 2023

Use of at least 1 ANC by sociodemographic and economic factors in the years 2006, 2011–12, and 2017 and 2023

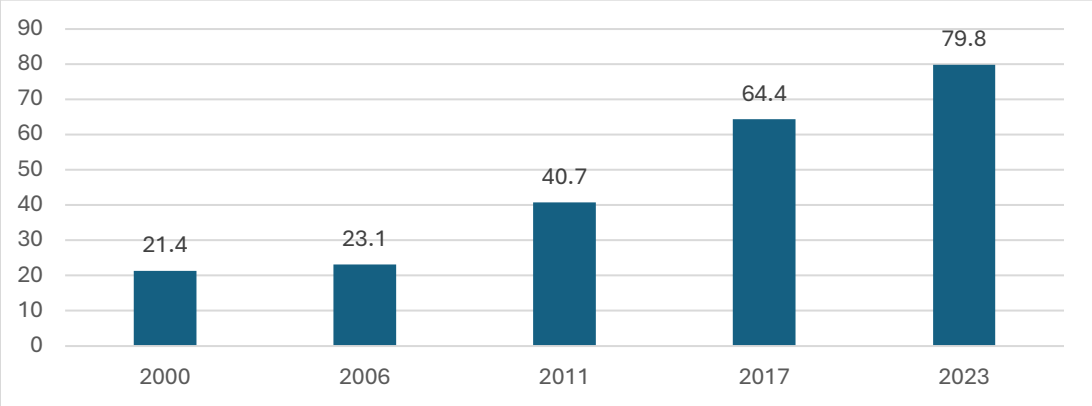
Between 2011–12 and 2017, the use of antenatal care (ANC) provided by skilled personnel increased across all socio-demographic groups in Lao PDR. By 2017, at least 70.3% of women accessed skilled ANC regardless of age, and at least 60.4% among all ethnicities. ANC coverage was highest among women with secondary education or higher (92.2%), those in urban areas (93.3%), Lao ethnicity (89.4%), and the richest quintile (97.3%). The most significant improvements were seen among disadvantaged groups: Hmong women (+37.1%), rural women (+36.1%), and poor women (+31.1%). As expected, absolute gains were larger among groups with lower baseline coverage (Hmong, rural and poor women), indicating some narrowing of inequalities compared with Lao and better-off women, although important gaps remain. There are notable disparities in ANC access based on area, wealth, and education, indicating a need for targeted interventions to improve early and complete ANC among disadvantaged groups (Table 1, annex 2).

Trends of Delivery by Skill birth attendants in Lao PDR between the years 2000-2023

The indicator on proportion of births attended by skilled birth health personnel is critical as it has a significant association with MMR. From 2000 to 2023, Lao PDR achieved significant progress in improving skilled birth attendance (SBA), rising from 16.7% in 2000 to an estimated 80% by 2023. Early in the 2000s, access to skilled personnel during delivery was limited, especially in rural and remote areas. However, from 2006 onward, a series of health reforms particularly the expansion of free maternal and child health services and the scale-up of midwifery programs led to marked improvements. By 2012, SBA coverage had reached 40.1%, increasing further to 64.4%

in 2017, as reported in national surveys such as MICS and LSIS. This upward trend continued through 2023, supported by improved infrastructure, better-trained health personnel, and broader health financing reforms such as national health insurance. These gains demonstrate Lao PDR's strong progress toward Sustainable Development Goal 3.1, which aims to reduce maternal mortality, and reflect significant strides in health system equity, with increased access to skilled delivery care among poorer and rural populations.

Figure 6: Trends of Pregnant women delivered assisted by Skilled Birth Attendants from 2000 to 2023, Lao PDR



Data from MICs, 2000, 2006 and LSIS, 2012, 2017 and 2023

Sociodemographic and economic inequalities in institutional delivery in Lao PDR between the years 2011–12, 2017 and 2023

Institutional deliveries in Lao PDR increased significantly from 23.1% in 2006 to 78.2% in 2023, reflecting steady progress across all sociodemographic and economic groups. Institutional deliveries among younger mothers increased markedly, from 25.1% to 75.0% among women aged 15–19 years and from 23.3% to around 70% among those aged 25–34 years, representing large gains of approximately 47–50 percentage points in both age groups."

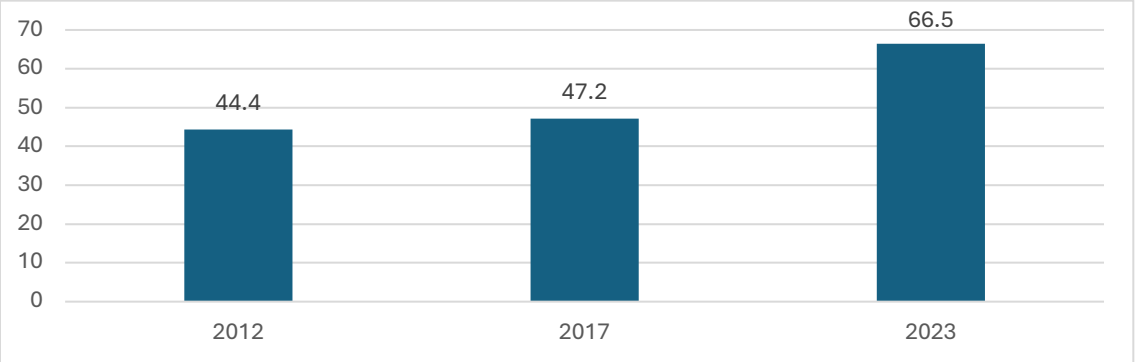
The rate for women with no education increased from 11.9% to 53.1%**,** while those with secondary or higher education reached 94.6% in 2023. Significant improvements were seen among Hmong (9.7% to 68.9%) and Khmu (10.9% to 67.9%). Lao women consistently had higher rates, reaching 88.8% in 2023.While disparities remain, the poorest quintile improved from 12.8% to 53.1%**,** and the richest from 75.9% to 98.7%. Overall, these trends indicate major strides in improving access to institutional deliveries, though gaps remain among the poorest, least educated, and those in remote areas. Targeted equity-focused interventions are still required (Table 2, annex 3).

Trends of PNC within 2 days in Lao PDR between the years 2000- 2023

Post-Natal Care (PNC) within 48 hours of delivery is crucial because a significant proportion of maternal and new born deaths occur during delivery or in the post-partum period. PNC is important for both the mother and the child, not only to treat complications arising from the delivery, but also to provide the mother with important information on how to care for herself and her child. PNC within two days after delivery is improved from 47.1% (2017) to 64.2% (2023), but still off-

track from the 2025 target of 80%; requires more concerted efforts. For the timing of PNC checks, 63.7% occurred at the time of birth (facility or home). The most notable PNC improvement was 68.5% among women with secondary or higher education, with the highest coverage at just 94.7% among the wealthiest women in 2023 (Lao Statistical Bureau, 2023) (Table 3, annex 4). Overall, the data indicate significant progress in early postnatal care coverage, particularly among marginalized groups. However, disparities persist, especially by residence and socioeconomic status, warranting continued targeted interventions to have better PNC.

Figure 7: Trends of Pregnant Women Receiving Postnatal Care (%) within 2 days from 2012-2023



3.3 Maternal Death Review

3.3.1 Storytelling Narrative of Maternal Death

A Young Life Lost: The Story of a 15-Year-Old Mother in Nam Bak

In the quiet hills of Ban Phonsawanh, a remote village in Nam Bak District, Luang Prabang Province, lived a 15-year-old Hmong girl. She was pregnant with her second child, despite still being a child herself. Like many girls her age in this area, she had limited education, no stable income, and little access to quality healthcare.

For several days, she had been in pain—abdominal cramps that wouldn't go away. Her family watched helplessly as her discomfort worsened. On April 6, 2025, at 3:00 PM, they brought her to Nam Thuam Health Center. It was her fifth antenatal visit during this pregnancy. Though previous check-ups had shown no warning signs, the pain this time was different.

She was 40 weeks pregnant. The health center monitored her through the night, and by the following day, labor had clearly begun. At 5:00 PM on April 7, her cervix was already 7 cm dilated, her contractions stronger. She was scared. She was in pain. And she was still just a girl.

One hour later, she gave birth to a baby boy, weighing 2.9 kilograms. His Apgar score was 6 out of 10—he needed support, but he was alive. The cord was quickly cut, and the baby rushed to the emergency room. The young mother, now weak and bleeding, was left behind—smiling faintly, unaware of what would come next.

Minutes after birth, the health team noticed heavy bleeding. A cervical tear was found. Her uterus was soft, bleeding continued. Oxytocin was given. Pressure dressings applied. But the bleeding wouldn't stop. Her body was becoming colder. Her lips turned pale.

By the time she was referred to the district hospital, she had already lost more than a liter of blood. The journey was long, the roads rough. She arrived at 8:50 PM, barely conscious. Her blood pressure had plummeted to 68/30. Her oxygen levels were dangerously low.

Doctors worked urgently. Intravenous fluids, antibiotics, tranexamic acid, and vitamin K were given. Her body showed signs of collapse, urinary retention, vaginal swelling, and another large gush of bright red blood. At 9:00 PM, senior doctors were called in. They examined her and informed her family: her condition was critical. She might not survive. Tearfully, her relatives signed the consent for emergency care.

At 9:08 PM, a tear in her cervix was stitched. But the bleeding wouldn't stop. She remained unconscious. Blood was urgently requested from the provincial blood center. Five units of A+ blood were dispatched but the blood didn't arrive in time.

At 2:00 AM, her heart stopped. The health team performed CPR for 30 minutes. But there was no response. At 2:10 AM on April 7, 2025, the 15-year-old mother was pronounced dead.
Her baby survived. She did not.

Why Did She Die?

Her death was not just due to bleeding. It was the result of three fatal delays:

1. Delay in deciding to seek care – Her family did not fully understand the danger. She was a high-risk pregnancy: too young, a prior miscarriage, previous bleeding—but no proper risk counseling was given.
2. Delay in reaching care – The journey to the district hospital was slow and difficult. Roads were bad. Transportation was limited. She lost time—and blood—along the way.
3. Delay in receiving quality care – The health center lacked capacity to manage high-risk births. The district hospital lacked emergency blood, surgical readiness, and intensive care. Even after her condition deteriorated, life-saving blood never arrived.

The Story of Mrs. Sommai: A Life Lost in Labor

In the quiet village of Muang Ngoi Kao, Ngoy district, nestled in the mountainous reaches of Luang Prabang Province, 28-year-old Mrs. Sommai was awaiting the birth of her second child. A housewife with a history of thyroid surgery, she had followed her pregnancy carefully—attending thirteen antenatal care visits in Vientiane Capital before continuing her check-ups in the local district health system.

As her due date approached, her journey became one of increasing caution. On 29 January 2024, she was seen at Wongsai Health Center with no signs of concern. By early February, the health staff had begun gently insisting that, due to her thyroid history and the anticipated risks of labor, she should deliver at the provincial hospital. The message was clear: she needed higher-level care. Despite these recommendations, Mrs. Sommai and her family hesitated. Cultural preferences, fear of surgery, and a desire to stay near home and her mother-in-law—who was gravely ill—overrode

medical advice. On 1 March, with contractions beginning and abdominal pain becoming more frequent, she finally sought care at Muang Ngoi Hospital. Initial findings suggested early labor; she was 1 cm dilated and the fetus in a head-down position. Once again, referral was recommended. Once again, she chose to return home.

That night, the pain became more intense. She returned to the hospital just before 9 PM. She was admitted for labor monitoring. By 3:00 AM on 2 March, her labor had progressed. Fetal heart rate was normal, contractions were strengthening, and she was 4 cm dilated. Her medical team closely monitored her through the early hours, reassuring her that everything was proceeding normally.
By 8:00 AM, labor had reached its final stage. She was fully dilated, the baby in position. Her vital signs remained stable. The amniotic sac was ruptured artificially, and the fluid was green but odorless—a sign of potential fetal distress. The staff prepared for delivery.
Ten minutes later, tragedy began to unfold.

The baby's heart rate plummeted to 40 beats per minute. Mrs. Sommai pushed, and by 8:40 AM, the baby boy was delivered—but limp, pale, and unresponsive. The umbilical cord had been tightly wrapped around his neck. Resuscitation efforts failed. He was stillborn.

The grief of losing her son was compounded by a sudden and severe postpartum hemorrhage. The uterus failed to contract. Massive bleeding followed. The medical team worked urgently: uterine massage, oxytocin injections, fluid resuscitation, misoprostol. Her condition remained critical. Her hemoglobin was dangerously low 5.2 g/dL, with signs of coagulopathy and thrombocytopenia. The local hospital had no capacity for blood transfusion.

A decision was made for emergency referral to Nam Bak District Hospital. By 9:30 AM, she was on her way, accompanied by the full medical team. Despite two IV lines and oxygen, her blood pressure fell to 70/40 mmHg. Her pulse climbed to 125 bpm. Still, she was alert—asking after her siblings, perhaps hoping to see them again. She arrived at Nam Bak at 9:55 AM, her condition now grave. Despite rapid intervention, the hemorrhage could not be controlled. She went into shock. At 10:10 AM, Mrs. Sommai passed away.

Mrs. Sommai's death was not inevitable. Her labor had begun without apparent complications, asn she had attended recommended antenatal care appointments.. Although the stillbirth was a tragic outcome, the mother's life could likely have been saved with timely access to emergency obstetric care, particularly a prompt caesarean section**.** But the absence of blood transfusion services at the community level, delays in referral, decision-making shaped by fear, limited information, and cultural preferences prevented timely surgical intervention and ultimately contributed to her death.

In her final moments, she was surrounded by healthcare providers who fought for her life, and her last thoughts were for her family.
This maternal death highlights a devastating truth: even when care is available, it cannot save lives without timely access, functional referral systems, and trust in medical recommendations.

A Life Cut Short: The Story of a 14-Year-Old Mother
In the remote highlands of northern Laos, nestled among steep hills and quiet fields, lived a 14-year-old Hmong girl named Mai*—a bright yet soft-spoken girl with only a primary school

education. Like many young girls in her village, she had grown up quickly. At just 14, she was already pregnant with her first child.

Mai's pregnancy was not monitored closely. She had only attended a single antenatal care (ANC) visit at 24 weeks gestation. At the time, the check-up revealed no concerning signs, and she continued her pregnancy under the watchful eyes of her family and traditional practices. No one suspected what would come next.

On February 6, 2024, Mai was 38 weeks pregnant when her family noticed something terrifying she began having seizures. It started with one convulsion around noon, but as the day progressed, the seizures became more frequent and severe. Her family, unfamiliar with the signs of eclampsia, tried traditional remedies—piercing her joints with needles, believing it might help "stimulate her spirit" or release illness. But Mai did not get better. She soon lost consciousness.

By 7:30 PM, with no signs of improvement, her family brought her to the nearest hospital.
When she arrived, Mai was unconscious, seizing uncontrollably. Her blood pressure was dangerously high 144/99 mmHg and her pulse raced at 100 beats per minute. She had no urine output. The fetal heart rate fluctuated between 80–110 bpm, indicating fetal distress. The attending medical team immediately began emergency interventions: oxygen therapy, rapid administration of magnesium sulfate, and urinary catheterization.

Recognizing the urgency of the situation, the surgical team was mobilized, and her family gave consent for an emergency cesarean section. At 7:49 PM, a vertical incision was made. Just one minute later, at 7:50 PM, Mai gave birth to a baby boy weighing 2,800 grams. He was alive but in poor condition his Apgar score was 1 at 1 minute, 3 at 5 minutes, and 5 at 10 minutes. He was transferred to the ICU for neonatal support. The surgery ended at 8:15 PM. But Mai's ordeal was far from over.

Post-surgery, she remained unresponsive. Despite continued seizure control measures—including additional magnesium sulfate and diazepam—her condition did not improve. Intubation was attempted to support her breathing but was unsuccessful.

In the early hours of February 7, about 30 hours postpartum, her condition deteriorated suddenly. Her breathing slowed. Her pupils became unresponsive to light. Her blood pressure dropped to 96/31 mmHg, and her oxygen levels fell. Though doctors administered dopamine to raise her blood pressure, her body could no longer cope. At 6:10 AM, Mai went into cardiac arrest. Resuscitation efforts failed. She was pronounced dead at 6:20 AM.

3.3.3 Results of the Study Using the Three Delays Model

This study examines three tragic cases of maternal mortality in Luang Prabang Province, Lao PDR, involving adolescent and adult women from rural and ethnically diverse communities. The objective was to identify contributing factors to these deaths through the lens of the Three Delays Model (Thaddeus & Maine, 1994), which categorizes the phases in which delays occur: (1) deciding to seek care, (2) reaching care, and (3) receiving adequate care. The aim is to understand systemic failures and recommend actionable improvements in maternal health services.

Analysis by Delay Categories

Delay 1: Delay in Deciding to Seek Care

This delay relates to the failure to recognize the severity of complications and the timely decision to seek medical attention. All three cases demonstrated factors contributing to Delay 1:

- Inadequate antenatal care or counseling: Case 3 attended only one ANC visit. In Case 1, although multiple visits were recorded, there was no evidence of proper risk classification or counseling on danger signs.
- Low awareness and cultural barriers: In Case 2, the patient and her family delayed hospital delivery despite health worker advice due to fear of surgical intervention and preference to stay near family.
- Reliance on traditional practices: In Case 3, the family attempted spiritual and physical home remedies (e.g., joint piercing) before seeking formal care.

These findings underscore the influence of low maternal health literacy, adolescent vulnerability, and cultural norms as major determinants of Delay 1 (Lassi et al., 2019; Win et al., 2024).

Delay 2: Delay in Reaching a Health Facility

Access to timely care was obstructed in all cases due to geographical and infrastructural limitations:

- Remote location and poor road conditions: The 15-year-old in Case 1 was referred late from the health center, and the difficult terrain delayed her arrival to the district hospital.
- Absence of emergency transport: Both Cases 1 and 2 lacked rapid ambulance support, delaying transfer during critical windows.
- Initial refusal to be referred: In Case 2, Mrs. Sommai was advised early to deliver at a provincial hospital but chose to remain in a lower-level facility, which lacked emergency services.

These findings are consistent with studies showing that poor infrastructure, terrain, and limited transport availability impede maternal survival in rural settings (Atuoye et al., 2015; Mayangitan et al., 2022).

Delay 3: Delay in Receiving Adequate Care

After arrival at health facilities, all three women experienced care delays due to systemic and logistical deficiencies:

- Inadequate emergency response: In Case 1, postpartum hemorrhage was not controlled due to lack of blood transfusion and surgical intervention capacity. The requested blood supply arrived too late.
- Lack of critical services: In Case 2, the absence of blood transfusion services and low-level facility limitations directly contributed to the patient's death.
- Poor management of obstetric emergencies: In Case 3, post-cesarean care was insufficient, and the lack of ventilatory support or intensive care contributed to the death following eclampsia.

These delays reflect poor referral systems, under-resourced facilities, and limited emergency obstetric care (EmOC), increasing the risk of preventable maternal mortality (Mgawadere et al., 2017; Hussein et al., 2016; Geleto et al., 2018).

Table 4 Cross-Case Summary Table

Delay Category	Key Contributing Factors	Cases Affected
Delay 1: Seeking Care	Lack of ANC, low awareness of danger signs, reliance on traditional beliefs, fear of referral	All
Delay 2: Reaching Care	Remote villages, poor road access, lack of emergency transport, initial refusal to transfer	All
Delay 3: Receiving Care	No blood transfusion, insufficient EmOC services, inadequate post-op care, delayed treatment of hemorrhage/eclampsia	All (

The analysis of these three maternal deaths through the Three Delays Model reveals that all deaths were preventable and resulted from multi-layered systemic failures. Although the women differed in age and obstetric history, they shared common risks due to late decision-making, poor access, and inadequate emergency care. Adolescents faced unique vulnerabilities, including underreporting, lack of knowledge, and social constraints.

To prevent future maternal deaths, urgent reforms are required at all levels:

1. Community-based health education and adolescent SRHR programs to prevent teenage pregnancy, and improve early care-seeking.
2. Strengthening referral systems and emergency transportation, particularly in mountainous and remote regions.
3. Improving facility readiness for obstetric emergencies, including the decentralization of blood banks, training for skilled birth attendants, and availability of emergency surgical and ICU services.

The deaths of these women are tragic reminders that timely, accessible, and quality care is not yet guaranteed in rural Lao PDR. Immediate action is required to bridge these gaps and uphold every woman's right to survive childbirth.

4. Discussion

Lao PDR has shown consistent political and policy commitment to improving maternal and child health outcomes, as evidenced by the implementation of the Reproductive, Maternal, Newborn, and Child Health (RMNCH) Strategy 2016–2025 and the Free Maternal and Child Health (MCH) Services Policy. These initiatives align with global health goals, including Millennium Development Goal 5 (MDG 5) and Sustainable Development Goal 3.1 (SDG 3.1), which calls for reducing the maternal mortality ratio (MMR) to fewer than 70 per 100,000 live births by 2030. While significant progress has been made, particularly in expanding coverage of skilled birth attendance and antenatal care persistent systemic and structural barriers continue to hinder equitable access to high-quality maternal health services, especially among marginalized and rural populations.

Policy Achievements and Coverage Gains

The RMNCH Strategy set ambitious goals for expanding access to skilled birth attendance and antenatal care, reflecting a deliberate shift toward facility-based and professionally supported maternal health services. The observed improvements over time suggest that sustained policy commitments particularly the Free MCH Services Policy and the Midwifery Improvement Plan played a critical role in strengthening service availability and utilization. By standardizing midwifery training, expanding the deployment of skilled providers, and reducing financial barriers to care, these reforms contributed to structural changes in the health system that enabled greater uptake of maternal health services nationwide (UNFPA, 2016; Ministry of Health Lao PDR, 2020). However, as discussed below, gains in coverage do not necessarily translate into equitable access or consistent quality of care, particularly for women in rural, remote, and ethnically diverse communities.

Lao PDR's maternal health landscape has made commendable progress over the past two decades, characterized by expanded service coverage, strategic policy reforms, and strengthened workforce capacity. However, significant gaps persist—particularly in equitable access to care, the quality of emergency obstetric services, and the responsiveness of the health system. Maternal deaths in Lao PDR are not inevitable; they are the result of preventable and systemic failures. If these challenges are not urgently addressed, the country remains at risk of falling short of achieving Sustainable Development Goal 3.1, which aims to reduce the maternal mortality ratio to fewer than 70 per 100,000 live births by 2030.

Persistent Inequities and Implementation Challenges

Despite these gains, critical disparities persist. Rural-urban and socioeconomic divides remain pronounced: 80% of urban births are attended by skilled providers compared to just 40% in rural areas (WHO, 2020). Workforce maldistribution is a core issue, with 70% of midwives concentrated in urban settings. Many remote health centers report midwife vacancy rates exceeding 30% (World Bank, 2021). These patterns reflect deeper structural challenges in health financing, rural incentives, and facility readiness—gaps inadequately addressed in the RMNCH Strategy (Ritchie & Spencer, 1994).

Financial protection has improved under the Free MCH Services Policy, contributing to increased ANC and institutional delivery utilization. However, indirect costs—including transportation,

food, and opportunity costs—remain significant barriers for rural and low-income families (UNFPA, 2019). As global evidence suggests, eliminating user fees alone does not ensure equitable access (Kruk et al., 2016).

Ethnic and educational disparities further compound the issue. Women in the richest wealth quintile and those with secondary or higher education have ANC coverage rates of 97.3%, while Hmong and rural women, despite notable improvements, still lag behind (Ahissou et al., 2023; Phommachanh et al., 2019).

Gaps in Continuity and Quality of Care

A major concern is the gap between ANC1 and ANC4, signaling issues in service continuity and quality. This gap reflects not only systemic bottlenecks but also behavioral, cultural, and logistical challenges that affect consistent care-seeking.

Postnatal care (PNC) remains underutilized despite improvements. Between 2006 and 2017, fewer than 4% of women received PNC within 48 hours, with most services accessed by wealthier, urban women (NSC, 2023). By 2023, PNC coverage had increased to 64.2%, but follow-up visits beyond immediate postpartum care remained low at just 3.5%. This represents a major gap in the continuum of care, where missed opportunities for addressing maternal and newborn complications persist. Key barriers include inadequate outreach, cultural norms, and weak health education. Meeting the national target of 80% PNC coverage within two days by 2025 will require culturally sensitive outreach strategies, village health volunteer training, conditional follow-up incentives, and integration of PNC into routine surveillance and EmONC preparedness assessments.

Emergency Obstetric and Newborn Care (EmONC) Readiness

While policy efforts have expanded midwifery training and coverage, facility readiness remains insufficient, especially in rural areas. As of 2008, fewer than 50% of provincial and district hospitals met minimum EmONC standards (Jolivet et al., 2012). Although improvements have been reported, gaps persist in lifesaving services such as cesarean sections, assisted deliveries, and blood transfusion capacity.

Postpartum hemorrhage (PPH) remains the leading direct cause of maternal mortality, often exacerbated by poor recognition, lack of supplies like uterotonics, and limited emergency response. Programs such as Helping Mothers Survive (HMS) and community-based misoprostol distribution have shown promise, but remain inadequately scaled or unsupported by formal policy (Smith et al., 2013; UNFPA Lao PDR, 2019).

Surveillance and Data Systems

Significant strides have been made in health information systems with the implementation of District Health Information Software 2 (DHIS2) and Maternal Death Surveillance and Response (MDSR). While DHIS2 has strengthened facility-level reporting since 2015, it does not capture community-level deaths. MDSR, designed to fill this gap, remains limited by underreporting, capturing only 50% of maternal deaths and reviewing less than a third (UNICEF & WHO, 2023). The lack of integration between DHIS2 and MDSR contributes to inconsistent MMR estimates and weak system responsiveness.

Recent MDSR data show a reduction in maternal deaths from 151 in 2017 to an estimated 73 in 2024 driven by better outreach and referral mechanisms. Yet, hospital-based deaths remain high, indicating persistent gaps in quality of care. The forthcoming MPDSR Guideline rollout in 2025 presents a critical opportunity to standardize reporting, improve accountability, and institutionalize maternal death reviews.

Insights from the Three Delays Model

Applying the Three Delays Model (Thaddeus & Maine, 1994) to maternal death cases in Lao PDR highlights how mortality is shaped by interconnected systemic failures rather than isolated clinical events**.** Across cases, socio-cultural constraints, geographic isolation, and health system limitations interacted to delay timely and effective care. Delays in decision-making were influenced by low health literacy, reliance on traditional practices, and heightened vulnerability among adolescents, particularly in ethnically diverse and rural communities. Even when care was sought, barriers related to distance, transport, and referral pathways impeded timely access to facilities. Upon reaching care, deficiencies in emergency obstetric capacity such as shortages of skilled staff, blood transfusion services, and functional referral systems further compromised outcomes.

Together, these patterns underscore that maternal deaths in Lao PDR reflect structural weaknesses in service readiness, quality, and accountability, consistent with evidence from other low-resource settings where preventable deaths persist despite contact with the health system (Mgawadere et al., 2017; Geleto et al., 2018).

5. Conclusion

This study reveals that despite Lao PDR's strong political commitment and progress under key policies like the RMNCH Strategy and Free MCH Services Policy, significant systemic barriers continue to drive preventable maternal deaths, particularly among rural and ethnic minority populations. The Three Delays Model analysis highlights that the most critical challenge lies in delays to receiving timely and adequate care at health facilities, caused by workforce shortages, limited facility readiness, and weak referral systems. Lao PDR is characterized by relatively high fertility and ongoing reproductive health challenges, with a total fertility rate above replacement level, a high crude birth rate, and persistent unmet need for contraception particularly among adolescents, rural populations, and ethnic minority groups. These demographic patterns contribute to a substantial volume of pregnancies occurring in contexts of social vulnerability, limited autonomy, and constrained access to timely care.

To achieve the Sustainable Development Goal 3.1 target of reducing maternal mortality below 70 per 100,000 live births by 2030, urgent actions are needed to strengthen rural health infrastructure, improve workforce distribution and retention, expand Emergency Obstetric and Newborn Care capacity, and institutionalize maternal death reviews through a fully integrated MPDSR system. Additionally, culturally appropriate and adolescent-friendly maternal health services must be prioritized, alongside better integration of data systems to enhance monitoring and accountability. Maternal deaths in Lao PDR are preventable and reflect systemic shortcomings; addressing these requires sustained political will and targeted reforms to ensure safe, equitable maternal care for all women.

6. Policy Implementation Recommendations for Maternal Health in Lao PDR

To bridge the gap and achieve SDG 3.1, the following actions are recommended:

1. **Strengthen Health Workforce Distribution and Retention**
    - Implement targeted rural deployment incentives and compulsory service for newly trained midwives to address workforce maldistribution.
    - Increase investment in training, supervision, and career development to improve retention, especially in remote and underserved areas.
2. **Upgrade Rural Health Infrastructure and Facility Readiness**
    - Prioritize upgrading provincial, district, and health center facilities to meet Emergency Obstetric and Newborn Care (EmONC) standards.
    - Expand access to essential services including cesarean sections, blood transfusion, and postpartum care.
    - Ensure consistent availability of supplies like uterotonics and emergency equipment.
3. **Enhance Emergency Transport and Referral Systems**
    - Develop and subsidize emergency transport networks in rural areas to reduce delays in reaching care by improving and standardize referral system.
    - Decentralize blood banking and improve referral communication between facilities to accelerate emergency response.
4. **Strengthen Emergency Response**
    - Strengthening Health Service system, provision of Emonc service 24 h / 7 days
    - Establish Emonc team for every facilities
    - Improving PPH and Preclampsia boxes for better signal function performance
5. **Institutionalize Maternal and Perinatal Death Surveillance and Response (MPDSR)**
    - Fully implement the forthcoming MPDSR guideline nationwide, integrating it with DHIS2 for real-time data reporting and feedback.
    - Strengthen community-level death reporting to capture underreported maternal deaths and improve responsiveness.
6. **Promote Culturally Sensitive and Adolescent-Friendly Care**
    - Develop health education and risk communication programs tailored for ethnic minorities and adolescents, addressing socio-cultural barriers to care-seeking.
    - Train health workers in cultural competence and adolescent health to improve service acceptability and uptake.
7. **Improve Continuity and Quality of Maternal Care Across the Continuum**
    - Establish integrated service protocols linking antenatal care, skilled birth attendance, postnatal care, and postpartum follow-up to ensure seamless care.
    - Expand outreach, conditional incentives, and community health volunteer programs to increase postnatal care utilization, especially within 48 hours after birth.
    - Improving Continuing Professional Development for health care providers (ANC and Emonc)
8. **Address Financial and Non-Financial Barriers**
    - Complement the Free MCH Services Policy by subsidizing indirect costs such as transportation, food, and opportunity costs for low-income and rural families.
    - Implement social support mechanisms to reduce economic barriers that impede timely care-seeking.

9. **Enhance Data Quality and Use for Decision-Making**
    - Improve integration and accuracy between DHIS2 and MDSR datasets to produce reliable maternal mortality statistics.
    - Utilize data for targeted, evidence-based planning and monitoring at national and subnational levels.

By adopting these multi-sectoral, equity-focused actions, Lao PDR can close critical gaps in maternal health service delivery, reduce preventable maternal deaths, and accelerate progress toward achieving SDG 3.1 by 2030.

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Annex 1 Case Summary:

Maternal Death Case Report: Case 1

Location: Ban Phonsawanh, Nam Bak District, Luang Prabang Province
Age: 15 years
Gestational Age: 40 weeks
Gravida 2, Para 1
Clinical History and Presentation
According to her family, the patient had been experiencing abdominal pain and cramps for three days, with worsening pain on the final day. On **April 6, 2025, at 15:00**, she presented to **Nam Thuam Health Center** with increasing abdominal cramps. She remained under observation until **April 7, 2025, at 24:00**, when labor began progressing.
Antenatal Care

- Attended five antenatal care (ANC) visits at Nam Thuam Health Center.
- Last visit recorded on **April 6, 2025**.
- No abnormalities reported during ANC.
- Routine tests performed: blood and urine tests.
- Received 30 iron tablets and 60 calcium tablets on **April 2, 2025**.

Physical Examination (Initial Presentation)

- **BP:** 110/70 mmHg
- **Pulse:** 80 bpm
- **Respiration:** 20/min
- **Temperature:** 36.5°C
- **LMP:** Unknown
- **EDD:** April 8, 2025 (by ultrasound)
- **Uterine height:** 31 cm
- **Abdominal circumference:** 93 cm
- **Fetal heart rate:** 145 bpm
- **Estimated fetal weight:** 3100g
- **Cervical dilation:** 2 cm
- **Fetal position:** Cephalic, engaged
- **Membranes:** Intact

Labor and Delivery
On **April 7, 2025 at 17:00**, cervical dilation was 7 cm with moderate uterine contractions.

- **Medication administered:**
    - Buscopan 2g IM
    - 0.9% NSS 1000 ml at 28 drops/min

At **18:40**, she delivered a **male infant** weighing **2900g**, with an **Apgar score of 6/10**. The umbilical cord was clamped and cut immediately.
Post-delivery:

- **18:41:** Uterus assessed; no second twin detected.
- **18:45:** Delivery complete, newborn stable.
- Cervical laceration noted with ongoing bleeding.
- Cervix was thin and friable; uterus appeared atonic and prone to tearing.
- Hemostatic drugs discontinued; compression dressing applied.
- Patient referred to district hospital due to excessive bleeding.

Transfer and Emergency Management
At the district hospital:

- Received **0.9% NSS 1000 ml** + **2 ampoules of oxytocin**.
- Estimated blood loss: **1350 ml**
- Transferred to **Nam Bak District Hospital**
- **Arrival time:** 20:50, April 7, 2025
- Patient condition: drowsy, cold, weak, pale, exhausted
- **Vital signs:**
    - **BP:** 64/54 mmHg → dropped to 68/30 mmHg
    - **Pulse:** 76 → rose to 187 bpm
    - **O_2 saturation:** 94% → dropped to 42%
    - **Respiration:** 24/min
    - **Temperature:** 36.4°C

Medical Interventions

- Administered IV fluids: NSS 1000 ml and Ringer Lactate 1000 ml with oxytocin
- Administered:
    - Tranexamic acid (Transamin) 250 mg/1g
    - Ceftriaxone 1g IV x2
    - Paracetamol 1g IV x3
    - Vitamin K 50 mg IM
- Vaginal exam revealed:
    - 1000 ml of bright red blood
    - Cervical tear, vaginal swelling, ongoing discharge (history of vaginal discharge)
- Urinary retention noted

Consultation and Family Communication
At **21:00**, Dr. Sulaphat and Dr. Saeng Dawon were called for further management.

- Family informed about the critical condition; consent obtained from relatives (Gongchengyang, Biyang, Xue Kangka, Mrs. Yang).
- At **21:08**, cervical tear identified and repaired; bleeding seemed controlled, but patient remained unconscious.

Emergency Measures and Outcome

- Provincial blood center contacted; 5 bags of A+ blood requested, but had not arrived in time.
- Surgical team prepared for emergency surgery.

Laboratory results (CBC):

- **WBC:** 17.74 x10⁹/L
- **LYM:** 1.33 x10⁹/L
- **PLT:** 99 x10⁹/L
- **HGB:** 5.3 g/dL
- **HCT:** 15.78%
- **Blood group:** A++

Final vital signs:

- **BP:** 42/30 mmHg
- **Pulse:** 24 bpm
- Rapid breathing, cold extremities, unconscious
- **Cardiac arrest occurred** → CPR performed for 30 minutes

- **Time of death:** 02:10, April 7, 2025

Conclusion:
Maternal death occurred within 24 hours postpartum.

Maternal Death Case Report: Case 2

Patient Information

- **Name**: Mrs. Sommai
- **Age**: 28 years
- **Occupation**: Housewife
- **Residence**: Muang Ngoi Kao Village, Ngoi District, Luang Prabang Province

Reason for Admission

Admitted with abdominal pain in preparation for delivery of her second child.

Gestational Age: 41 weeks and 2 days (based on ultrasound findings).

Medical History

- Underwent thyroid surgery in 2021.

Thyroid Function Test on 15 January 2024:

- TSH: 2.11 µIU/mL (normal range: 0.27–4.20)
- FT3: 2.03 pg/mL (normal range: 2.00–4.40)
- FT4: 0.75 ng/dL (normal range: 0.93–1.70)

Initial Physical Examination

- Conscious and ambulatory
- **Vital Signs**: BP 110/70 mmHg, Pulse 89 bpm, Temperature 36.5°C, Respiratory Rate 22 bpm
- **Abdominal Circumference**: 100 cm
- **Fundal Height**: 35 cm
- **Fetal Heart Rate**: 144 bpm
- **Per Vaginal Exam**: Cervix 3 cm dilated, station +1, membranes intact, fetus in cephalic position

Initial Diagnosis: Term pregnancy (GA 41+2 weeks), in early labor (first stage), admitted for monitoring of spontaneous labor.

Total ANC Visits: 13 times in Vientiane Capital (as documented in antenatal book), with later follow-ups in Ngoi District.

29 January 2024

Ms. Somkha visited Wongsai Health Center for a routine antenatal check-up. No abnormalities were found. The physician advised her to begin preparing baby supplies and scheduled her next appointment for 5 February 2024.

6 February 2024

She returned to Wongsai Health Center for follow-up, seen by Dr. Kaewmanee. The check-up was unremarkable. The physician advised her to return immediately if she experienced abdominal pain, abnormal vaginal discharge, or bleeding. Due to her history of thyroid surgery, she was advised to deliver at the provincial hospital rather than at the district facility due to potential complications.

17 February 2024

Ms. Somkha attended a check-up at the hospital. Clinical findings included:

- BP: 133/86 mmHg
- Pulse: 90 bpm
- Abdominal circumference: 101 cm
- Uterine height: 33 cm
- Estimated fetal weight: 3,350g
- Fetal heart rate: 141 bpm

- Fetus: cephalic presentation

The doctor again recommended delivery at the provincial hospital due to her thyroid history. Ms. Sommai (relative) responded that they would consult with family first.

23 February 2024

Another hospital visit revealed:

- BP: 135/88 mmHg
- Pulse: 94 bpm
- Gestational age: 40 weeks (ultrasound)
- Fetal heart rate: 145 bpm
- Uterine height: 35 cm
- Fetal position: cephalic with normal movements

Ultrasound findings showed normal amniotic fluid volume, normal fetal heart rate and movements. The doctor advised delivery at the provincial hospital. Next follow-up was scheduled for 29 February 2024.

29 February 2024

Ms. Somkha contacted Muang Ngoi Hospital due to concerns about her pregnancy and requested a recalculation of her estimated due date based on her menstrual cycle. The recalculated EDD was 21 February 2024. She was advised to prepare for referral to the provincial hospital the next day. However, she declined due to fear of surgery (Video clip evidence provided).

1 March 2024, 08:40 AM

Ms. Sommai presented at the postpartum ward with intermittent abdominal pain since 5–6 AM. Vitals were stable. She was assessed in the delivery room:

- Fetal movements: normal
- Presentation: cephalic
- Cervical dilation: 1 cm

Due to her surgical history, referral to the provincial hospital was advised again. However, she declined and opted to return home to consult with family. The doctor agreed, as labor was not imminent.

1 March 2024, 9:00 PM

She returned with persistent abdominal pain and bloody vaginal discharge. Gestational age was now 41 weeks and 1 day (ultrasound). She was admitted for labor monitoring.

2 March 2024, 3:00 AM

Increased pain and contractions observed. Examination findings:

- Fetal heart rate: 144 bpm
- Contractions: 3 per 10 minutes, 25 seconds each
- Cervical dilation: 4 cm
- Amniotic sac: intact
- Fetal position: cephalic

The team counseled the patient and her family, reassuring them of normal labor progress.

6:00–7:00 AM

Labor progressed. Findings:

- Fetal heart rate: 150 bpm
- Contractions: 3 per 10 minutes, 42 seconds duration

- Cervical dilation: 8 cm
- Cephalic position, station: +2

Family was updated. The patient's husband was still in Vientiane.

8:00 AM

Labor intensified. Vitals:

- BP: 120/76 mmHg
- Pulse: 87 bpm
- RR: 26 bpm
- Temp: 36.5°C
- Fetal heart rate: 123 bpm
- Contractions: 5 per 10 minutes, 60 seconds duration
- Cervical dilation: 10 cm

An IV of Ringer's Lactate was started. The amniotic sac was ruptured; fluid was light green and odorless. Delivery was initiated.

8:30 AM

Continuous abdominal pain observed.

- Fetal heart rate dropped to 40 bpm
- Contractions: 5 per 10 minutes, 65 seconds duration

8:40 AM

The baby was delivered with the umbilical cord tightly wrapped around the neck once. The cord was immediately cut. The placenta was delivered along with the infant. The baby was non-responsive and pale. Resuscitation was attempted without success. The medical team initiated postpartum hemorrhage management due to excessive bleeding and uterine atony.

Actions taken:

- Uterine massage
- Oxytocin 10 IU IM
- Perineal repair (3 stitches)
- Fluid resuscitation
- Misoprostol 4 tablets (200 mcg SL)
- Vital signs: BP 110/76 mmHg, HR 96 bpm, RR 29 bpm, Temp 36.6°C

9:00 AM

Persistent bleeding.

- Additional IV fluids: NSS + 2 vials of oxytocin
- Catheterization performed
- Referral arranged to Nam Bak Hospital
- HB: 5.2 g/dL, Hct: 16.9%, Platelets: 88,000

9:30 AM

Uterus contracted. Vaginal bleeding decreased. Patient was transported with full medical team.

In Transit:

- BP dropped to 70/40 mmHg
- Pulse: 125 bpm
- Oxygen administered
- Two IV lines maintained
- Patient was still alert and communicative

9:55 AM, Arrival at Nam Bak District Hospital

The medical team transferred the patient with handover. Patient's condition worsened—

uncontrolled bleeding and unmeasurable vitals. Despite rapid blood and medication administration, the patient went into shock and passed away at **10:10 AM**.
While the medical team was completing the documentation, they asked Ms. Sommai why she had not gone to the central or provincial hospital for delivery. Ms. Sommai explained that her parents and relatives preferred she give birth at a nearby facility, close to her mother-in-law's house, for ease of care and family support.

Before the team departed from Muang Ngoi Hospital, they informed the patient that they were leaving. The patient asked whether her siblings had also returned. The team later informed the patient's mother that her children had already returned. The mother, who was gravely ill, expressed heartfelt gratitude to the medical team.

The patient delivered vaginally, with the fetus in a cephalic (head-down) position. The umbilical cord was tightly wrapped once around the neck and was immediately clamped and cut. The infant, a male, was stillborn. The placenta was delivered concurrently with the baby. Large blood clots, approximately the size of two fists, were observed. An estimated 2.65 liters of blood was collected in a plastic bag.

The uterus failed to contract post-delivery, prompting the medical team to perform continuous uterine massage and manage the hemorrhage according to standard emergency obstetric protocols. Given the extensive blood loss and the lack of blood transfusion capacity at Muang Ngoi Hospital, the team arranged for an urgent transfer to a higher-level facility.
Transfer and Death Timeline:

- **9:30 AM, 2 March 2024:** The patient was transferred from Muang Ngoi District Hospital, with continuous monitoring and resuscitative care en route.
- **9:45 AM:** The patient arrived at Nam Bak District Hospital. Her condition had deteriorated significantly, with ongoing hemorrhage and unmeasurable vital signs. She was unconscious and in hypovolemic shock.
- Immediate medical interventions included administration of IV fluids, blood products, and medications to support cardiovascular function. However, her condition did not respond to resuscitation efforts.
- **10:10 AM:** The patient was pronounced dead.

This was a sudden and severe emergency without early warning signs—an obstetric emergency that might have been survivable had blood transfusion services been available at the community hospital level. Unfortunately, Muang Ngoi District Hospital lacked the necessary blood and blood product supplies for such cases.
Maternal Death Summary

- **Deceased:** 28-year-old pregnant woman
- **Residence:** Muang Ngoi Kao Village, Muang Ngoi District, Luang Prabang Province
- **Cause of Death:**
    1. Hypovolemic shock secondary to postpartum hemorrhage
    2. Contributing factors: vaginal delivery, prolonged rupture of membranes, uterine atony, abnormal coagulation, and delay in referral

Maternal Death Case Report: Case 3

Patient Profile

- **Age:** 14 years old
- **Ethnicity:** Hmong
- **Education:** Primary level
- **Gravida/Parity:** G1P0 (first pregnancy)
- **Obstetric History:** No history of miscarriage or complications
- **Antenatal Care (ANC):** One ANC visit at 24 weeks gestation
- **Medical History:** No known underlying conditions; no abnormalities detected at the initial ANC visit

Clinical Course and Events

Date: 6 February 2024

Gestational Age: 38 weeks (by ultrasound)

At approximately **12:00 PM**, the patient experienced seizures at home, characterized by convulsions followed by brief periods of regained consciousness. According to family reports, her condition progressively worsened—seizures became more frequent, and she eventually lost consciousness. The family attempted traditional stimulation methods, including piercing joints with needles, but her condition did not improve.

At **7:30 PM**, the family brought her to the hospital.

Admission Status

- **Consciousness:** Unconscious with continuous seizures
- **Vital signs:**
    - **BP:** 144/99 mmHg
    - **Pulse:** 100 bpm
    - **Temperature:** 36.5°C
    - **Respiratory rate:** 22 breaths/min
    - **Urine output:** None
    - **Fetal heart rate:** 80–110 bpm
    - **Reflexes:** Positive clonus (hyperreflexia)
- **Interventions initiated:**
    - Oxygen therapy
    - Magnesium sulfate ($MgSO_4$) 2.6 ampoules with 100 mL NSS (administered rapidly)
    - Urinary catheterization

Given the patient's critical condition, the anesthesia team was immediately called. The family was informed of the urgency and gave consent for emergency surgery.

Emergency Cesarean Section Timeline

- **7:38 PM:** Patient taken to the operating room
- **7:45 PM:** Anesthesia and surgical preparation completed
- **7:49 PM:** Vertical incision made
- **7:50 PM:** Live male infant delivered
    - **Birthweight:** 2800 grams
    - **Apgar Scores:** 1' = 1/10, 5' = 3/10, 10' = 5/10
    - **Infant outcome:** Transferred to ICU for neonatal follow-up
- **8:15 PM:** Surgery completed

Postoperative Course

After anesthesia recovery, the patient continued to experience seizures. Intubation was attempted but unsuccessful.

Medications administered:

- **Magnesium sulfate:** 2g IV over 5 minutes
- **Diazepam (Valium):** 10 mg IV slowly
- **Maintenance:** $MgSO_4$ 16 ampoules in Ringer's Lactate 340 mL at 7 drops/min over 24 hours

Vital signs post-surgery:

- **BP:** 126/86 mmHg
- **Pulse:** 132 bpm
- **Oxygen saturation:** 98%

At 30 hours postpartum:

- The patient's condition deteriorated rapidly:
    - **Breathing slowed**
    - **Pupils non-reactive to light**
    - **BP:** 96/31 mmHg
    - **Pulse:** 76 bpm
    - **Temperature:** 36°C
    - **O_2 saturation:** 89%
    - **Urine output:** 400 mL
- **Dopamine** was administered to support blood pressure

At 6:10 AM: The patient experienced cardiac arrest. Resuscitation was attempted but unsuccessful.

Time of death: 6:20 AM, 7 February 2024

Cause of Death (ICD-11 Classification)

Hypertensive disorder in pregnancy: Eclampsia

- Maternal death occurred during labor and within 24 hours postpartum
- Contributing factors included limited antenatal care (only one visit at 24 weeks) and delayed hospital presentation following the onset of seizures

Annex 2

Table 1: Use of at least 1 ANC by sociodemographic and economic factors in the years 2006, 2012, and 2017 and 2023

	Year 2006 (N=1622)			Year 2012 (N=4444)			Year 2017 (N=4460)			Year 2023 (N=3448)			Years 2012 and 2006	Years 2017 and 2012	Years 2023 and 2017
Variables	n	**%**	**95%CI**	**n = 4357**	**%**	**95%CI**	**N**	**%**	**95%CI**	**n**	**%**	**95%CI**			
	n=1597						**N= 4459**			**N=3137**					
Overall	547	35.7	31.3–40.3	2295	55.4	52.6–58.1	3438	78.4	76.1–80.5		89.8	88.7-90.8		23.0	3.3
Mother's age	**n=1597**			**n = 4357**			**N = 4459**			**N=3137**					
15–19	70	38.3	30.3–47.1	285	49.7	45.0–54.4	406	74.4	69.4–78.8	657	88.7	87.6-89.7	11.4	24.7	13.3
20–24	167	38.7	32.9–44.9	756	58.8	55.0–62.5	1,075	79.4	76.5–82.0				20.1	20.6	0.5
25–34	248	35.3	29.8–41.2	1016	57.9	54.3–61.4	1,627	80.8	78.2–83.1	2,507	91.3	90.3-92.2	22.6	22.9	0.3
35–49	62	28.3	21.8–35.9	238	44.8	39.8–49.9	330	70.3	65.0–75.0	282	78.5	77.1-79.9	16.5	25.5	9.0
Educational attainment	**n=1580**			**n = 4357**			**N= 4459**			**N=3137**					
No education	93	14.5	10.7–19.4	307	23.7	20.6–27.2	431	49,5	44.5–54.6	439	62.1	60.4-63.7	9.2	25.8	16.6
Primary	265	38.3	33.2–43.7	991	57.3	54.0–60.5	1256	76.5	73.6–79.2	1,050	88.8	87,7-89.8	19.0	19.2	0.2
Secondary or higher	185	76.5	69.6–82.2	997	83	80.1–85-5	1751	92,2	90.5–93.6	1494	95.9	95.2-96.5	6.5	9.2	2.7
Area of residence	**n=1597**			**n = 4357**			**N= 4459**			**N=3137**					

	Year 2006 (N=1622)			Year 2012 (N=4444)			Year 2017 (N=4460)			Year 2023 (N=3448)			Years 2012 and 2006	Years 2017 and 2012	Years 2023 and 2017
Rural without road	56	14.4	9.8–20.8	84	19.3	13.8–26.2	328	55,4	48.0–62.6	242	71.5	69.9-73.0	4.9	36.1	31.2
Rural with road	321	34.3	29.0–40.1	1477	50.8	47.6–53.9	2012	76.4	73.5–79.1	2,318	89.1	88.0-90.1	16.5	25.6	9.1
Urban	170	77.8	68.8–84.9	734	85.4	80.8–89.0	1098	93.3	91.0–95.1	888	96.5	95.8-97.1	7.6	7.9	0.3
Ethnicity	**n = 1596**			**n = 4351**			**N= 4459**			**N=3137**					0.0
Other	82	21.1	15.5–28.1	597	41.0	36.6–45.5	139	60.4	50.0–69.9	161	87,2	86.0-88.3	19.9	19.4	-0.5
Hmong	24	11.2	7.1–17.2	130	24.2	19.4–29.7	537	61.3	55.3–66.9	551	84.4	83.1-85.6	13,0	37.1	24.1
Khmu	72	31.3	21.4–43.2	249	43.6	37.6–49.9	888	66.8	62.2–71.2	82.8	82.8	81.5-84.0	12.3	23.2	10.9
Lao	369	51.7	45.3–58.0	1314	74.5	70.4–78.2	1874	89,4	87.0–91.4	1,74	95.7	95.0-96.4	22.8	14.9	-7.9
Wealth quintiles	**n = 1597**			**N= 4357**			**N= 4459**			**N=3137**					
Poorest	86	16.6	12.2–22.2	297	23.4	20.3–26.8	659	51.8	47.3–56.2	930	73.9	72.4-75.4	6.8	28.4	21.6
Poor	106	24.9	19.6–30.9	434	42.9	38.7–47.1	791	74	70.4–77.4	783	90.6	89.6-91.6	18.0	31.1	13,1
Middle	100	31.7	25.4–38.7	536	63.4	59.0–67.5	734	88.3	85.3–90.7	665	96.4	89.4-91.4	31.7	24.9	-6.8
Rich	115	55.3	47.4–62.8	516	78.6	74.3–82.3	645	93.7	91.3–95.5	584	98.6	98.1-99.0	23,3	15.1	-8.2

	Year 2006 (N=1622)			Year 2012 (N=4444)			Year 2017 (N=4460)			Year 2023 (N=3448)			Years 2012 and 2006	Years 2017 and 2012	Years 2023 and 2017
Richest	140	88.9	82.1–93.3	512	93.7	90.4–95.9	609	97.3	94.9–98.6	485	99.2	98.8-99.5	4.8	3.6	-1.2

Source: Ahissou, *et al.* (2023). Data from MICs, 2000, 2006 and LSIS, 2012, 2017 and 2023

Annex 3

Table 2: Institutional deliveries by sociodemographic and economic factors in years 2006, 2012 and 2017 and 2023

Variables	Year 2006 (N=1622)			Year 2012 (N=4444)			Year 2017			Year 2023			% Change between Years 2012 and 2006	% Change between Years 2017 and 2012	% Change between Years 2023 and 2012
	n	%	95%CI	n	%	95%CI	n	%	95%CI	n	%	95%CI			
	N = 1597			N = 4381			N = 4460			N=3488					
Overall	337	23.1	19.3–27.3	1645	40.7	38.1–43.4	2843	65.5	63.1–67.9	2,696	78.2	76.8-79.6	17,6	24,8	7,2
Mother's age	n = 1597			n = 4381			n = 4460			N=3488					0,0
15–19	46	25.1	18.0–33.9	232	41.6	36.9–46.4	321	57.8	52.1–63.2	657	75.0	73.5-76.4	16,5	16,2	-0,3
20–24	98	23.7	18.7–29.4	522	41.9	38.5–45.5	892	66.8	63.6–69.8			78.6-81.3	18,2	24,9	6,7
25–34	152	23.3	18.5–28.9	715	41.8	38.4–45.3	1346	67.6	56.4–66.8	2,507	80.0		18,5	25,8	7,3
35–49	41	19.1	13.7–25.9	176	33.8	29.2–38.8	284	61.8	63.1–67.9	282	70.1	68.5-71.6	14,7	28,0	13,3
Educational attainment	n = 1580			n = 4381			n = 4460			N=3488					

Variables	Year 2006 (N=1622)			Year 2012 (N=4444)			Year 2017			Year 2023			% Change between Years 2012 and 2006	% Change between Years 2017 and 2012	% Change between Years 2023 and 2012
No education	80	11.9	0.7–18.7	265	20.8	17.5–24.7	333	38.2	33.4–43.2	439	53.1	51.4-54.8	8,9	17,4	8.5
Primary	117	177	14.3–21.7	554	32.7	29.7–35.8	957	58.5	55.1–61.8	1,050	67.9	66.3-69.4	15.0	25.8	10,8
Secondary or higher	135	60.4	51.9–68.4	826	70.7	67.3–73.8	1553	83.2	80.7–85.4	1999	94.6	93.8-95.3	10.3	12.5	2.2
Area of residence	**n = 1597**			**n = 4381**			**n = 4460**			**N=3488**					
Rural without road	40	10.1	4.6–20.8	94	17.6	12.1–24.2	235	40.1	33.3–47.3	242	48.4	46.7-50.1	7.5	22.5	15.0
Rural with road	170	17.9	14.3–22.1	911	32.4	29.5–35.4	1579	60.2	56.9–63.4	2,318	75.3	73.8-76.7	14.5	27.8	13.3
Urban	127	63.6	53.0–73.0	640	76.5	71.8–80.7	1029	89.0	86.4–91.1	888	93.9	93.1-94.7	12.9	12.5	-0.4
Ethnicity	**n = 1596**			**n = 4375**			**n = 4460**			**N=3488**					
Other	90	22.1	13.4–34.3	488	34.3	30.2–38.6	110	46.5	37.1–56.3	161	72.8	71.3-74.3	12.2	12.2	0.0
Hmong	20	9.7	6.1–15.0	90	16.8	13.2–21.2	420	47.0	40.8–53.3	551	68.9	67.3-70.4	7.1	30.2	23.1
Khmu	26	10.9	6.8–17.0	134	23.6	19.2–28.1	662	50.5	46.1–54.8	997	67.9	66.3-69.4	12.7	26.9	14.2
Lao	201	31.5	25.8–37.7	930	54.7	50.5–58.9	1651	78.6	75.8–81.1	1,74	88.8	87.7-89.8	23.2	23.9	0.7
Wealth quintiles	**n = 1597**			**n = 4381**			**n = 4460**			**N=3488**					
Poorest	75	12.8	7.5–21.1	205	15.6	12.6–19.1	452	35.5	31.4–39.8	930	53.1	51.4-54.8	2.8	19.9	17.1
Poor	53	13.6	9.9–18.5	236	24.4	20.8–28.3	575	53.7	49.7–57.7	783	75.9	74.4-77.3	10.8	29.3	18.5
Middle	39	12.3	8.6–17.2	343	40.3	36.2–44.6	623	73.1	69.0–76.7	665	87.5	84.5-86.9	28.0	32.8	4.8

Variables	Year 2006 (N=1622)			Year 2012 (N=4444)			Year 2017			Year 2023			% Change between Years 2012 and 2006	% Change between Years 2017 and 2012	% Change between Years 2023 and 2012
Rich	55	29.0	22.3–36.7	378	57.6	52.8–62.3	592	86.0	82.6–88.9	584	93.9	93.1-94.7	28.6	28.4	-0.2
Richest	115	75.9	66.4–83.3	483	89.0	85.4–91.8	601	96.3	94.2–97.6	485	98.7	98.3-99.0	13.1	7.3	-5.8

Source: Ahissou, *et al.* (2023). Data from MICs, 2000, 2006 and LSIS, 2012, 2017 and 2023

Annex 4

Table 3: Mother's facility-based postnatal visit within 2 days of delivery by sociodemographic and economic factors in the years 20112, and 2017 and 2023

Variables	Year 2012 (N=4318)			Year 2017 (N=4451)			Year 2023 (N=)			% Change betweenYears 2017 and 2012	% Change between Years 2023 and 2017
	n	%	95%CI	n	%	95%CI	n	%	95%CI		
	n = 4357			n = 4459			n=2,697				
Overall	4357	47.0	45.5-48.5	4459	52,7	51.2-54.2	2697	66.5	64.7-68.3	5.7	13.8
Mother's age	n = 4357			n = 4451			N=2,697				0.0
15–19	278	39.8	37.5-40.5	400	55.9	54.4-57.4	493	67.7	65.9-69.5	16.9	11.8
20–29	1,199	45.5	44.0-47.0	2116	52.6	51.1-54.1	2,006	66.6	64.8-68.4	7,1	14.0
35–49	138	39.7	38.2-41.2	215	47.9	46.4-49.4	198	62.6	60.7-64.4	8,2	14.7
Educational attainment	n = 4324			n = 4451			n=2,697				0,0
None	187	36.3	34.9-37.8	493	66,3	64.9-67.7	233	66.3	64.5-68.1	30.0	0.0
Primary	537	44.8	43.3-46.3	685	68,7	67.3-70.1	685	68.7	66.9-70.5	23.9	0.0
Secondary or higher	890	46.4	44.9-47.9	445	64,0	62.6-65.5	1780	64.0	62.1-65.8	17.6	0.0

Variables	Year 2012 (N=4318)			Year 2017 (N=4451)			Year 2023 (N=)			% Change betweenYears 2017 and 2012	% Change between Years 2023 and 2017
	n	%	95%CI	n	%	95%CI	n	%	95%CI		
Area of residence	**n = 4381**			**n = 4451**			**n=2,697**				
Urban	710	46.3	44.8-47.8	1,009	54,4	52.9-55.9	835	63.5	61.7-65.3	8.1	9.1
Rural with road	856	41.7	40.2-43.2	1,522	52.1	50.6-53.6	1,746	68.5	66.7-70.2	10.4	16.4
Rural without road	49	46.5	45.0-48.0	198	49.2	47.7-50.7	117	58.3	56.4-60.2	2.7	9.1
Ethnicity	**n = 4313**			**4407**			**n=2,697**				
Lao	1,243	44.3	42.8-45.8	1,837	52.7	51.2-54.2	1,545	87.7	86.4-88.9	8.4	35.0
Khmu	243	42.7	41.2-44.2	532	51.1	49.6-52.6	676	79.5	77.9-81.0	8.4	28.4
Hmong	88	49.0	47.5-50.5	284	56.6	55.1-58.1	380	88.8	87.5-90.0	7.6	32.2
Other	40	22.1	20.9-23.4	77	50.8	49.3-52.3	78	72.4	70.7-74.1	28.7	21.6
Wealth quintiles	**n = 4318**			**n = 4451**			**n=2,697**				
Poorest	124	41.3	39.8-42.8	366	53.5	52.0-55.0	494	75,2	73.5-76.8	12.2	21.7
Poor	200	42.1	40.6-43.6	481	47.8	46.3-49.3	594	82	80.5-83.4	5.7	34.2
Middle	303	40.8	39.3-42.3	571	50	43.5-46.5	582	84,5	83.1-85.8	9.2	34.5
Rich	390	42.6	41.1-44.0	623	55.3	52.8-56.8	548	91,2	90.0-92.2	12.7	35.9
Richest	598	47.5	46.0-49.0	689	55.6	54.1-57.1	479	94,7	93.8-95.5	8.1	39.1
Source: LSIS 2012, 2017, 2023											

Source: Data from MICs, 2000, 2006 and LSIS, 2012, 2017 and 2023

Published by:

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Internal Reviewers: Visanou Hansana, Touy Chanthalangsy
External Reviewers: ARROW
Copy Editor: Vanphanom Sychareun
Layout Design: Johnly Phanthady and ARROW
Year Publication: August, 2025