Original Article

Timeliness and Appropriateness of Maternal Care and Its Influence on Perinatal Outcomes: A Community-Based Study in Kakamega County, Kenya

Catherine Mutonyi Simiyu[1]*

[1] Kibabii University, P. O. Box 1699-50200, Bungoma, Kenya.
*Author for Correspondence ORCID ID; https://orcid.org/0009-0003-1661-500X; Email: csimiyu3@gmail.com

Date Published:

17 July 2025

ABSTRACT

Background: Perinatal mortality remains a critical concern in Sub-Saharan Africa, with Kenya reporting rates above global targets. Lurambi and Butere sub-counties in Kakamega County exhibit perinatal mortality rates nearly double the national average, despite increased facility-based deliveries. Objectives: The study aimed to assess how the timeliness and appropriateness of maternal care influence perinatal outcomes in these high-burden settings. Methodology: A community-based cross-sectional design was employed. Quantitative data were collected from 520 mothers who delivered within the past two years using structured questionnaires, while qualitative data were gathered through key informant interviews with healthcare workers. Maternal care was assessed across the antenatal, intrapartum, and postnatal periods. Quantitative data were analysed using SPSS, and logistic regression was applied to identify predictors of perinatal mortality. Qualitative data from key informant interviews were manually analysed by coding responses into thematic categories. The resulting themes were organised and interpreted about the Three Delays Model, highlighting issues relevant to delays in receiving appropriate maternal and newborn care. Results: Revealed that while 78 percent of mothers attended four or more antenatal visits, only 39 percent received the full care package. Inadequate labour monitoring was significantly associated with perinatal death (AOR = 0.1; 95 percent CI: 0.04 to 0.43), as was lack of timely postnatal care (AOR = 51.2; 95 percent CI: 12.0 to 218.9). Newborns experiencing delayed or inappropriate facility care were nearly three times more likely to die (AOR = 0.3; 95 percent CI: 0.1 to 0.6). Systemic challenges included staff shortages, poor documentation, and weak referral mechanisms. Conclusions: The Third delay contributes to perinatal death. The quality and responsiveness of antenatal care are more critical than mere attendance. Intrapartum care showed poor labour monitoring, increasing the risk of adverse events. Delays in postnatal checkups and inadequate management of newborn complications raised the risk of death. Recommendations: Strengthen the quality and responsiveness of antenatal services, enhance intrapartum care

and timely postnatal checkups and improve management of newborn complications, specifically during referrals.

INTRODUCTION

Perinatal mortality, which includes stillbirths and early neonatal deaths, remains a major public health challenge worldwide. According to the World Health Organization (2023), approximately 4.5 million perinatal deaths occur each year, with the majority concentrated in low- and middle-income countries, particularly in sub-Saharan Africa. In Kenya, the perinatal mortality rate stands at 32 per 1,000 births, significantly higher than the Sustainable Development Goal (SDG) 3.2 target of 12 per 1,000 live births (Kenya National Bureau of Statistics [KNBS] & ICF, 2022). Within Kakamega County, the burden is disproportionately high in Lurambi and Butere sub-counties, where rates have reached 59 per 1,000 births (Kenya Health Information System [KHIS], 2023).

The provision of timely and appropriate maternal care across the childbirth continuum, which includes antenatal care, intrapartum care, and postnatal care, is critical for improving perinatal outcomes. The World Health Organization (2016) recommends at least eight antenatal visits, skilled birth attendance with effective labour monitoring,

and four postnatal contacts within the first six weeks after delivery. Each of these phases plays a vital role in preventing, identifying, and managing complications that can lead to perinatal death. Antenatal care enables the early detection and management of maternal conditions such as preeclampsia, anemia, and infections (McCauley *et al.,* 2022). Intrapartum care ensures close monitoring of labour and timely interventions in cases of obstructed labour, fetal distress, or hemorrhage (Schifrin *et al.,* 2022). Postnatal care provides opportunities to assess the health of both mother and newborn, including timely identification of neonatal infections, poor breastfeeding, or hypothermia (Wojcieszek *et al.,* 2023). While previous studies suggest that untimely and inadequate maternal care may increase poor outcomes, there is limited contextual evidence on how such care influences perinatal outcomes (Dickson *et al.,* 2023; Nam *et al.,* 2022; Zewde,2022).

Despite improvements in access to maternal healthcare services in Kenya, especially through programs such as Linda Mama, challenges remain regarding the quality, timeliness, and

appropriateness of the care provided. Studies have shown that mothers in rural and underserved areas often experience gaps in care, including incomplete antenatal coverage (Muriithi *et al.,* 2022; Olebo *et al.,* 2023). These gaps are frequently linked to systemic issues such as staff shortages, limited supplies, poor infrastructure, and weak referral systems (Nyande *et al.,* 2024). Kakamega County reflects similar trends, with a PMR of 32 per 1,000 births, and twice this rate is estimated in both Lurambi and Butere (KHIS, 2023). In Lurambi and Butere sub-counties, the persistently high perinatal mortality rates raise concerns about the effectiveness of maternal health services. Although most women in these areas now deliver in health facilities, the quality and responsiveness of the care they receive remain questionable. There is a need for evidence on whether maternal care is being delivered in a timely and appropriate manner, and how this may be influencing perinatal outcomes.

This study seeks to address this knowledge gap by assessing the timeliness and appropriateness of antenatal, intrapartum, and postnatal care and their association with perinatal outcomes among mothers in Kakamega County. Findings from this study provide insight into specific areas where maternal care can be strengthened to reduce avoidable perinatal deaths in the region and inform county and national-level strategies aimed at improving maternal and newborn health outcomes.

Statement of the Problem

Although Kenya has expanded maternal health coverage through initiatives such as the Linda Mama program, perinatal mortality remains a critical concern in specific regions. Lurambi and Butere sub-counties in Kakamega County report some of the highest perinatal mortality rates in the country, estimated at 59 per 1,000 births, almost twice the national average of 33 per 1,000 births (Kenya Health Information System [KHIS], 2023; Kenya National Bureau of Statistics [KNBS] & ICF, 2022).

Much of the existing maternal and newborn health monitoring focuses on service coverage, such as the number of antenatal visits or deliveries conducted by skilled birth attendants. However, such indicators do not sufficiently reflect whether care was provided at the appropriate time or delivered in a clinically effective manner (Afulani *et al.,* 2023). For instance, mothers may attend antenatal clinics but fail to receive critical interventions such as tetanus immunisation, anemia screening, or syphilis testing. Similarly, labour may be attended by skilled providers, but without essential monitoring tools like the partograph, compromising fetal safety (Olebo *et al.,* 2023). There is also limited focus on the quality of postnatal care, a period that remains the most neglected despite accounting for a large proportion of early neonatal deaths (Dickson *et al.,* 2023). In these high-risk settings, there is a need to understand whether mothers received timely and appropriate care across the continuum, before, during, and after childbirth and how these experiences correlate with perinatal outcomes.

Numerous studies confirm that maternal care across the antenatal, intrapartum, and postnatal periods is a significant determinant of birth outcomes. However, many of these studies rely heavily on secondary data sources or retrospective facility records. These approaches often fail to capture the complete maternal experience, particularly the quality and timeliness of care received. A major limitation in the literature is the overemphasis on quantitative measures such as the number of antenatal care visits, without critically assessing the quality or appropriateness of services delivered during these encounters. Although frequency of contact is important, it does not reflect whether essential screenings, counselling, or follow-up actions were conducted according to established clinical guidelines.

Another notable gap is the limited attention paid to the mother's perspective, especially in terms of how respectful, timely, and personalized the care was. Studies tend to focus on institutional performance

indicators, which overlook subjective but important factors like provider conduct, communication, and cultural sensitivity. These experiences can strongly influence service utilization and maternal trust in the health system.

In addition, existing studies are often conducted at national or regional levels. Such broad analyses may mask local disparities, particularly in high-risk sub-counties such as Lurambi and Butere. There is a lack of disaggregated data that examines how maternal care quality varies within small geographic units and how this variation contributes to localised perinatal mortality. Furthermore, most research separates maternal care process indicators from newborn outcome data, failing to integrate the two for a more comprehensive understanding. The absence of studies linking maternal care experiences to actual birth outcomes limits the ability to design effective, responsive interventions.

This study aims to address these shortcomings by using a community-based approach. It collects firsthand data from mothers on the timeliness and appropriateness of the care they received and examines how these experiences relate to perinatal outcomes in a specific high-mortality context. In doing so, the study provides new insights that go beyond service coverage metrics and engages directly with issues of quality of care, using a community-based design. It captures care experiences from mothers and evaluates how these relate to perinatal outcomes in a localised, high-risk setting.

Without community-based data that link maternal care practices to newborn outcomes, policy and programming risk being guided by assumptions of service adequacy rather than actual effectiveness. This gap in knowledge limits the ability to reduce preventable perinatal deaths through evidence-informed interventions.

Justification of the Study

Generating local evidence on the quality and timeliness of maternal care is vital for informing strategies to reduce perinatal mortality. Studies show that delays or inadequacies in antenatal, intrapartum, and postnatal care contribute directly to adverse birth outcomes, particularly in rural and underserved areas (Jiang *et al.,* 2023; WHO, 2023). Yet, few studies have comprehensively examined how mothers' experiences across the continuum of care translate into survival or death outcomes for their newborns. This study is especially relevant in Lurambi and Butere, where high perinatal death rates persist despite improved access to skilled care. A community-based design will capture detailed accounts of care timing and adequacy from the maternal perspective, information that facility records often miss or misrepresent. Understanding the specific points in the care continuum where delays or inadequacies occur will enable county and national health authorities to prioritise investments in areas such as clinical training, supply chain management, referral coordination, and postnatal outreach. The results will also contribute to the body of evidence necessary to advance equity, responsiveness, and quality in Kenya's maternal and newborn health programming.

Main Objective

To evaluate how the timeliness and appropriateness of maternal care influence perinatal outcomes among mothers in Kakamega County.

Specific Objectives

- To assess the relationship between antenatal care practices among mothers and perinatal outcomes in Kakamega County.

- To examine the influence of intrapartum care received by mothers on perinatal outcomes in Kakamega County.

- To determine the effect of postnatal care services accessed by mothers on perinatal outcomes in Kakamega County.

THEORETICAL FRAMEWORK

This study is grounded in the Three Delays Model developed by Thaddeus & Maine (1994), a widely recognised framework for analysing the underlying factors contributing to maternal and perinatal mortality. The model conceptualises three critical phases where delays in care may occur, each contributing to adverse outcomes when not addressed effectively. The first delay involves the decision to seek care. This is often influenced by a range of factors, including a woman's knowledge of danger signs, cultural beliefs, social norms, previous experiences with the health system, and economic or gender-related constraints. The second delay occurs in reaching a health facility, and is commonly associated with geographical barriers, inadequate transportation options, and poor road infrastructure, all of which hinder timely arrival at appropriate care facilities.

The third delay, which is the primary focus of this study, concerns the delay in receiving adequate care once the woman has arrived at a health facility. This delay is attributed to health system inefficiencies, such as staff shortages, lack of equipment or essential drugs, poor clinical decision-making, and delays in initiating emergency interventions. This study specifically focuses on the third delay, examining whether mothers who delivered in health facilities received timely and appropriate care during the antenatal, intrapartum, and postnatal periods. The theoretical framework is appropriate because it provides a structured approach to investigate how facility-level processes influence perinatal outcomes and highlights systemic bottlenecks that contribute to mortality even in the presence of skilled attendance.

Recent applications of the Three Delays Model highlight its relevance in low-resource settings. For instance, Muriithi *et al.,* (2022) and Jiang *et al.,* (2023) emphasize that delays in clinical decision-making, labor monitoring, and newborn interventions within health facilities remain major contributors to poor health outcomes. This theoretical orientation allows the study to explore the underlying structural and clinical factors that compromise care timeliness and appropriateness in the Kenyan context.

METHODOLOGY

Study Area

Kakamega County was purposefully selected for this study due to its high population and poor perinatal outcomes among rural counties in Kenya. The study focused on Lurambi and Butere, the two sub-counties with the highest perinatal mortality rates within the region. These sub-counties were chosen due to their notably high perinatal mortality rates and their representation of both rural and peri-urban settings (2022). The region is served by a range of public and private health facilities providing maternal and child health services. Most residents rely on subsistence farming and informal employment for their livelihoods.

Study Design

A community-based cross-sectional study design was employed. This design is appropriate for capturing retrospective accounts of maternal care and perinatal outcomes from mothers within a defined period. It enables the collection of both quantitative and qualitative data from a representative sample in the community.

Study Population

The study population consisted of mothers aged 15–49 years who delivered within the past 24 months before to the study period in Lurambi and Butere sub-counties. This timeframe ensures accurate recall of the maternal care experience and perinatal outcome.

Target Population

The target population included all women who met the inclusion criteria and resided in the study area.

Women must have delivered at eight months of gestation or later and be available during the study period. Women who experienced stillbirth or early neonatal death were included to enable comparison with mothers whose newborns survived.

Data Collection

Data was collected using structured questionnaires administered through face-to-face interviews. The tool captured socio-demographic characteristics, antenatal attendance, intrapartum experiences, and postnatal care practices. Perinatal outcomes (live birth, stillbirth, early neonatal death) were self-reported. A checklist was used to assess the facility's quality of care from mothers' narratives. Data was also triangulated with facility-based key informant interviews.

Sample Size Determination

The sample size was determined using Cochran's formula for calculating sample size for proportions:

$$n = Z^2 \times p(1-p) / e^2$$

Where:
Z = 1.96 (standard value for 95% confidence level)
p = 0.059 (estimated perinatal mortality rate)
e = 0.03 (margin of error)

Substituting the values: n = [1.96² × 0.059 (1 − 0.059)] ÷ (0.03 × 0.03)
= (3.8416 × 0.055519) ÷ 0.0009
= 0.2133 ÷ 0.0009 ≈ 236.98

After adjusting for a design effect of 2: Adjusted sample = 236.98 × 2 = 473.96

Considering a 10% non-response rate: = 473÷ 0.1 ≈ 47.3

Thus, the final sample size, rounded of was (473+47) 520 women.

This yields a sample size of approximately 520 women after adjusting for design effect and non-response.

Sampling Strategy

A multistage cluster sampling technique was used. First, purposive selection of Kakamega County, then Lurambi and Butere sub-counties were selected, followed by random sampling of four wards per sub-county. From each ward, five community units were randomly selected. In each unit, one village was selected, and eligible mothers listed with the help of Community Health Promoters were selected. Thirteen mothers per village were selected using systematic sampling.

Data Analysis

Quantitative data was analysed using SPSS version 26. Descriptive statistics summarised respondent characteristics and care practices. Bivariate analysis tested associations between maternal care variables and perinatal outcomes. Variables with p-values < 0.05 were included in multivariate logistic regression models to identify independent predictors of adverse perinatal outcomes while controlling for potential confounders. Qualitative data from open-ended responses and interviews were manually analysed by coding responses into thematic categories. The resulting themes were organised and interpreted concerning the third

delay, highlighting issues relevant to delay in receiving appropriate maternal and newborn care.

Ethical Considerations

Ethical approval was obtained from the Masinde Muliro University of Science and Technology Research Ethical Review Committee. The researcher obtained a research permit from the National Commission for Science, Technology and Innovations (NACOSTI). Permission to conduct the pre-test and main study was sought from the sub-county Medical Officer of Malava, Lurambi and Butere Sub-counties. Written informed consent was sought from all participants. Confidentiality and anonymity were maintained by using unique identifiers and secured data storage. Participants were informed of their right to withdraw at any point without consequences.

RESULTS

This study successfully recruited 520 mothers who delivered in the past two years prior to the study. The average age of respondents was 27.8 years. About 68% had completed primary education, and 85% reported delivering in public health facilities. Of the total births, 93.1% were live births, 4.8% were stillbirths, and 2.1% were early neonatal deaths. Most mothers (78%) attended at least four antenatal care (ANC) visits, but only 39% received the full recommended ANC package. During delivery, only 47% of mothers reported that a partograph was used to monitor labour. Less than half (43%) received a postnatal check within 48 hours after delivery.

Maternal Socio-demographic Characteristics and Perinatal Mortality

Table 1 shows the socio-demographic characteristics associated with perinatal mortality. The socio-demographic factors included age, marital status, level of education, employment, partner's employment status, religion, parity and birth order. Of these factors, only the mother's level of education and employment status had an effect on perinatal mortality. There was a significant relationship between the level of education and perinatal mortality ($p<0.02$). A higher proportion of mothers with no or primary education experienced perinatal mortality as compared to the respondents who had a secondary or above level of education.

Employment status influenced perinatal mortality, whereby 58.6% of unemployed mothers experienced perinatal deaths as compared to those who were employed ($p<0.03$). There was a marginally statistically significant relationship ($p<0.06$) between type of religion and perinatal mortality, although the majority (93.1%) of the respondents affiliated with other religions experienced perinatal mortality, compared to Catholics. The rest of the socio-demographic variables posted a non-statistically significant relationship with perinatal mortality (age group $p<0.15$; marital status $p<0.53$; partner's employment status $p<0.53$; parity $p<0.18$; birth order $p<0.40$).

Table 1: Maternal Socio-demographic Characteristics and Perinatal Mortality

	Characteristics	Response	Perinatal death		Alive		p value
			n	%	n	%	
1	Age group	15 - 24	14	48.3	158	35.0	0.15
		≥25	15	51.7	294	65.0	
2	Marital status	Married	25	86.2	406	89.8	0.53
		Others	4	13.8	46	10.2	
3	Level of education	None/Primary	17	58.6	167	37.0	0.02
		Secondary and above	12	41.4	285	63.0	
4	Employment	Unemployed	17	58.6	173	38.3	0.03
		Employed	12	41.4	279	61.7	
5	Employment status of partner	Unemployed	1	3.4	11	2.4	0.53
		Employed	28	96.6	441	97.6	
6	Religion	Catholic	2	6.9	98	21.7	0.06
		Others	27	93.1	354	78.3	
7	Parity	≤4	17	58.6	318	70.4	0.18
		5 or more	12	41.4	134	29.6	
8	Birth order	≤2	27	93.1	388	85.8	0.40
		3 or more	2	6.9	64	14.2	

Antenatal Care Practices and Perinatal Outcomes

Table 2 shows variables associated with perinatal mortality during delayed provision of care at the health facility. Among the 520 participants, mothers who began antenatal care (ANC) in the first trimester and completed at least four visits with appropriate interventions had significantly better perinatal outcomes. Complete ANC was associated with a 97.5% live birth rate, while incomplete ANC correlated with higher rates of stillbirths and neonatal deaths ($p < 0.05$). Common barriers included delayed lab tests and health worker shortages.

Intrapartum Care and Perinatal Outcomes

The study found a strong link between partograph use and improved perinatal outcomes. Mothers monitored with a partograph had a 98% live birth rate, compared to 87% without documented monitoring ($p < 0.01$). Logistic regression showed that lack of labour monitoring increased the risk of perinatal death nearly sixfold (OR = 5.9; 95% CI: 2.0–17.1; $p < 0.0003$). Only 38% of facilities consistently used the partograph, with delays in care often caused by staff shortages and nurses managing multiple patients at once.

Postnatal and Newborn Care Services and Perinatal Outcomes

Only 43% of mothers received postnatal checks within the first 48 hours, yet timely care was linked to better outcomes. Perinatal loss occurred in 12.5% of mothers without early postnatal care, compared to just 2.3% among those who were checked promptly ($p < 0.01$). Receiving at least four essential postnatal interventions reduced the risk of perinatal death by 96% (OR = 0.04; 95% CI: 0.01–0.13; $p < 0.0001$), highlighting the critical role of comprehensive postnatal care.

Additionally, delays in newborn care were significantly associated with perinatal mortality. Sick newborns who experienced delays in care were 2.8 times more likely to die than those who received timely and appropriate care (OR = 2.8; 95% CI: 1.3–6.1; p<0.008). Delays included use of non-ambulance transport, referral decisions taking longer than two hours, waiting over 30 minutes for care at the referral facility, and lack of kangaroo mother care or neonatal units.

The key informant interviews highlighted significant challenges affecting the quality of intrapartum care. A recurring theme was the inadequate monitoring of labour due to staffing shortages. As expressed by the following nurses, one from a health centre and the other from a subcounty hospital. KII #5, Nurse in a sub- county hospital stated:

> *"Sometimes the partograph is there, but we are too few to update it. During peak hours, one nurse attends to more than four mothers in labour. It's not possible to do it right for everyone."*

Additionally, equipment limitations were noted as a barrier to effective fetal monitoring. A sub-county Public Health Nurse reported (KII #12) that:

> *"In some facilities, blood pressure is not assessed until delivery due to unavailability of basic tools such as a blood pressure machine."*

These findings highlight systemic weaknesses in both human and material resources that hinder the delivery of quality intrapartum care, directly contributing to poor perinatal outcomes. The KII statements highlight critical challenges in the delivery of postnatal care, directly linking to the study's findings on its role in perinatal outcomes. KII #8 from a dispensary stated:

> *"Once a mother delivers, she is discharged in less than 12 hours. We operate during the daytime and weekdays only"*

Early discharge of mothers compromises vital postnatal care, including timely initiation of breastfeeding and immunisation, thereby increasing the risk of missed interventions. This reinforces the study's finding that failing to conduct postnatal checks within the first 48 hours is strongly associated with a higher risk of perinatal mortality. Together, these insights highlight how gaps in prioritisation, continuity, and health system capacity undermine the effectiveness of postnatal care in improving perinatal survival.

> *"We encourage mothers to return for postnatal check-ups, but we lack transport to do home visits and our follow-up system is weak."*

Lack of infrastructure for managing newborns, particularly those requiring specialised support such as preterm or low-birth-weight infants, reveals a critical systemic weakness in neonatal care. KII #13, sub-county Public Health Nurse stated that:

> *"In most facilities, the newborn unit is not available. Preterm babies are always referred to CGH".*

In addition, KII #9, a Clinical officer from one of the health centres, said:

> *"For sick newborns, referrals take too long. By the time we find an ambulance, the baby is already in bad shape. And sometimes we use motorbikes.*

Table 2: The Bivariate Logistic Regression Results Table Displays Key Relationships between Maternal Care Factors and Perinatal Mortality, Including Odds Ratios and Significance Values

	Characteristics	n	Perinatal death (%)	Alive (%)	OR	95% CI	p value
1	Inadequate provision of ANC care	167	6.0	94.0	1.0	0.4 – 2.2	0.98
	Provision of adequate ANC care	314	6.1	93.9			
2	Had problems with referrals of antenatal complications	141	6.4	93.6	1.1	0.5 – 2.5	0.83
	No problems with referral of antenatal complications	340	5.9	94.1			
3	Inadequate discussion on emergency preparedness	141	6.4	93.6	1.1	0.5 – 2.5	0.83

	Characteristics	n	Perinatal death (%)	Alive (%)	OR	95% CI	p value
	Adequate discussion	340	5.9	94.1			
4	Delays in the monitoring of labour	258	9.7	90.3	5.9	2.0 – 17.1	**0.0003**
	No delays	223	1.8	98.2			
5	Provision of inadequate PNC services	468	4.7	95.3	0.04	0.01 – 0.13	**<0.0001**
	Provision of adequate PNC services	13	53.9	46.1			
6	Delays in the provision of appropriate newborn care at the health facility	92	12.0	88.0	2.8	1.3 – 6.1	**0.008**
	No delays	389	4.6	95.4			

Predictors of Perinatal Mortality

Multivariate logistic regression identified key third delay factors associated with perinatal mortality in Lurambi and Butere sub-counties. Lack of labour monitoring, absence of postnatal care, and failure to provide appropriate care for sick newborns were significant predictors. Mothers whose labour was monitored were 90% less likely to experience perinatal deaths (AOR = 0.1; 95% CI: 0.04–0.43; p = 0.0009). Absence of postnatal care increased the risk of perinatal death 51-fold (AOR = 51.2; 95% CI: 12.0–218.9; p < 0.0001). Conversely, appropriate care for sick newborns reduced the risk by 70% (AOR = 0.3; 95% CI: 0.1–0.6; p = 0.003).

Table 3: Multivariate Logistic Regression of Predictors of Perinatal Mortality

Type of delay	Variable	Estimate	AOR	95%CI	p value
Third delay	Labour and delivery	-2.04	0.1	0.04 – 0.43	**0.0009**
	PNC	3.93	51.2	12.0 – 218.9	**<0.0001**
	Newborn	-1.34	0.3	0.1 – 0.6	**0.003**

DISCUSSION

Socio-Demographic Factors Associated with Perinatal Mortality

Socio-demographic characteristics significantly influenced whether a newborn survived or not. In this study, maternal education and occupation were found to have a notable association with perinatal mortality. Mothers with no formal education or only primary-level education experienced higher rates of perinatal loss compared to those with secondary or tertiary education. These findings are consistent with more recent studies showing that maternal education is a strong determinant of maternal and neonatal health outcomes (Yaya *et al.,* 2020). Women with higher education levels are more likely to understand antenatal advice, seek timely care, and adhere to medical guidance during pregnancy and delivery.

This is further supported by Arunda *et al.* (2022), who found that higher educational attainment among mothers in East Africa is linked to improved neonatal outcomes and reduced risk of stillbirths and early neonatal deaths. Education improves a woman's autonomy, health literacy, and capacity to engage with formal health systems, ultimately influencing timely and appropriate care-seeking behaviours.

Similarly, maternal unemployment was associated with a higher risk of perinatal mortality. Unemployed mothers may lack the financial capacity to access healthcare services or may depend on others for decision-making and support. A study by Shibre *et al.* (2021) revealed that economic dependence and lack of personal income were key barriers to seeking skilled care among women in low-resource settings. Furthermore, mothers from low-income households face compounded challenges such as poor nutrition,

inadequate transportation, and delayed care-seeking, all of which heighten the risk of adverse perinatal outcomes (Gebreheat *et al.,* 2021).

Although age, parity, and partner's employment status did not show statistically significant associations with perinatal mortality in this study, certain trends were noted. For instance, a higher proportion of perinatal deaths occurred among mothers aged 15–24 years, suggesting potential vulnerability due to inexperience, stigma, or delay in decision-making. Similar concerns were raised by Al Kibria *et al.* (2020), who found that adolescent and young mothers are less likely to seek timely care, often due to social barriers, limited autonomy, and lack of awareness.

Contrary to previous studies that associated partner employment with better neonatal outcomes, no significant association was found in this study. This may be explained by the high proportion (97%) of respondents reporting employed partners, reducing variability within this variable. A comparable limitation was noted by Titaley *et al.* (2021), who emphasised the need for nuanced measurement of household economic status rather than relying solely on employment status as a proxy.

Religion did not show a strong statistical association in this study; however, borderline patterns suggested that religious beliefs might subtly influence care-seeking behaviour. Previous studies have indicated that certain religious sects discourage the use of formal health services, viewing illness and childbirth as spiritual matters. For instance, findings by Kambale *et al.* (2023) in Tanzania indicated that some Pentecostal and Apostolic communities delay hospital visits due to beliefs in divine healing, which can result in adverse maternal and perinatal outcomes.

In terms of parity, this study found no significant association between the number of previous births and perinatal mortality. However, the literature is mixed on this topic. Some studies report higher risks among first-time mothers due to unrecognised labour complications (Chalise et al., 2021), while others cite grand multiparity as a risk factor due to increased obstetric complications. These inconsistencies may be due to variations in sample size, definitions of parity, and health system differences across study settings.

Overall, while this study affirms that maternal education and employment status are important socio-demographic predictors of perinatal mortality, other variables such as age, parity, and religion may also play indirect or context-specific roles. Addressing socio-demographic disparities is essential in developing targeted interventions aimed at reducing perinatal deaths in underserved communities.

Relationship between Antenatal Care Practices among Mothers and Perinatal Outcomes

Antenatal care (ANC) remains a foundational intervention for identifying and managing risk factors in pregnancy. This study, however, found that while a majority of mothers attended ANC visits, there was limited association between ANC quantity (i.e., number of visits) and perinatal outcomes unless quality and content of care were considered. Specifically, inadequate screening, delayed lab tests, and poor emergency planning contributed to missed opportunities for preventing perinatal complications. These findings are consistent with work by Yaya *et al.* (2020), who emphasised that not all ANC visits are equally effective; it is the comprehensiveness and timeliness of interventions that determine outcomes.

The study further noted that emergency preparedness discussions during ANC visits were suboptimal, and referrals for antenatal complications were often delayed or mismanaged. These gaps in preparedness are indicative of third delay factors occurring within the facility despite access to skilled care. Carvalho *et al.* (2020) emphasise that ANC should be a platform not only for surveillance but also for counselling,

individualised birth planning, and timely referral, especially in high-risk pregnancies.

The Influence of Intrapartum Care Received by Mothers on Perinatal Outcomes

The study found a strong association between intrapartum care quality and perinatal mortality, specifically the use of partograph in monitoring labour. Mothers whose labour progress was not monitored were nearly six times more likely to experience perinatal death. Observational data showed that only 38% of health facilities consistently used partographs, largely due to staff shortages and limited skills in interpreting the tool. These findings mirror those of Musafili *et al.* (2017), who reported that inadequate monitoring during labour significantly contributed to poor neonatal outcomes in Rwanda.

Furthermore, EmONC (Emergency Obstetric and Newborn Care) signal functions were not fully implemented in the facilities studied. Lack of capacity to respond promptly to intrapartum emergencies, including fetal distress and prolonged labour, was frequently reported during key informant interviews. This corresponds with Geleto *et al.* (2018) and Maswanya *et al.* (2018), who found that weak health systems unable to consistently apply EmONC functions were more likely to report high perinatal mortality rates.

The third delay in this context was evident not only in staffing constraints but also in poor clinical decision-making and documentation, which led to late recognition of labour complications. Allanson *et al.* (2019) affirm that perinatal deaths from preventable causes, such as birth asphyxia and obstructed labour, are largely avoidable with competent monitoring and immediate intervention.

The Effect of Postnatal Care Services Accessed by Mothers on Perinatal Outcomes

This study found a striking relationship between inadequate postnatal care (PNC) and perinatal deaths. Mothers who did not receive at least four key postnatal interventions were 51 times more likely to experience a perinatal death. Many health facilities discharged mothers within 24 hours due to staffing shortages or a lack of capacity to offer round-the-clock postnatal monitoring. This early discharge undermined the window of opportunity to identify and manage newborn complications such as infection, poor feeding, or hypothermia.

These findings support the conclusions of Carvalho *et al.* (2020) and Fadel *et al.* (2015), who argue that PNC is a protective intervention that improves both maternal and neonatal outcomes. When delivered properly, PNC provides space for early identification of danger signs, reinforcement of exclusive breastfeeding, thermal care, and cord care—all of which are critical in reducing early neonatal mortality.

Additionally, delays in appropriate newborn care were significant. Newborns who experienced delays in being attended to or who were referred using unsafe methods (e.g., motorcycles instead of ambulances) were 2.8 times more likely to die. Facilities lacked newborn units, warmers, KMC spaces, and corticosteroids for preterm labour. These structural gaps further illustrate the third delay in neonatal care. Kruk *et al.* (2018) emphasised that health system failures in the form of equipment deficits and weak referral pathways account for much of the preventable neonatal mortality in low-resource settings. The over-reliance on one referral hospital places additional strain on the county referral system and delays timely interventions, which are crucial in reducing neonatal morbidity and mortality.

This study also found that where newborns received appropriate immediate care, including resuscitation and thermal protection, survival improved significantly. Among mothers whose newborns received prompt and adequate care, the risk of perinatal death was reduced by 70%. This finding is echoed by the Federal Ministry of Health (FMOH) of Ethiopia (2016), which documented a 27% reduction in neonatal mortality when quality

postnatal interventions were offered. Third delay, therefore, was not only about the timing of care but also about the comprehensiveness and appropriateness of interventions provided. The gap between being attended to and being properly cared for was frequently cited in both interviews and observations. Lack of training, supervision, and clear protocols contributed to the mismanagement of otherwise preventable conditions.

CONCLUSIONS

This community-based study assessed how sociodemographic characteristics and maternal care practices influence perinatal outcomes in Lurambi and Butere sub-counties of Kakamega County. The findings underscore the importance of not just access to care, but the timeliness and appropriateness of that care during the antenatal, intrapartum, and postnatal periods.

Sociodemographic characteristics played a significant role in determining perinatal outcomes. Mothers with lower levels of education and those who were unemployed were more likely to experience perinatal mortality. Educated mothers were better equipped to understand health information, utilise services effectively, and make informed decisions. Unemployed mothers, on the other hand, often depended on others for financial and logistical support, which may have delayed their care-seeking actions. Other factors such as age, parity, religion, and partner employment were not statistically significant in this study, although younger mothers and those from religious groups that restrict modern healthcare access showed higher proportions of perinatal deaths.

About the first objective, the study showed that antenatal care is most effective in improving perinatal outcomes when it is started early and includes essential services such as screening, health education, and emergency preparedness. Merely attending antenatal visits was not sufficient to reduce mortality unless those visits were complete

and responsive to the individual needs of the mother.

The intrapartum care had the strongest association with perinatal outcomes. Lack of labour monitoring using partographs increased the likelihood of perinatal death nearly sixfold. In many facilities, staff shortages and difficulty in interpreting partographs contributed to poor monitoring. This gap in care during labour and delivery highlighted a critical weakness in health system readiness and clinical practice.

Postnatal and newborn care were critical determinants of newborn survival. Mothers who did not receive a postnatal check within the first 48 hours were at significantly higher risk of experiencing perinatal loss. Furthermore, when newborns presented with complications and did not receive timely and appropriate care, the probability of death increased. Inadequate referral systems, poor facility readiness, and limited newborn care units were key barriers to effective care.

Overall, the study confirms that delays in the provision of adequate care at health facilities, referred to as the third delay, were closely linked to perinatal mortality. Improving outcomes requires more than increasing service coverage. It demands investments in quality improvement, training, supervision, and the operational capacity of health facilities to deliver timely and appropriate maternal and newborn care. Addressing these care delays is essential in reducing preventable perinatal deaths in Kakamega County and similar settings.

Recommendations

Based on the findings and conclusions of this study, the study recommends:

- Strengthen Intrapartum Care: Ensure consistent use of partographs, increase maternity staffing, and provide essential monitoring tools alongside regular clinical audits.

- Enhance Postnatal and Newborn Services: Extend postnatal care availability, retain mothers and newborns for observation (24–48 hours), equip newborn care units, and improve referral systems for sick neonates.

- Improve Antenatal Care Quality: Go beyond attendance to ensure delivery of essential interventions like early screening, maternal education, and emergency preparedness; standardise care and incorporate patient feedback.

- Invest in Health Worker Capacity: Provide regular training on EmONC and neonatal resuscitation; strengthen supervision and performance monitoring across maternal care services.

- Promote Community Health Literacy: Conduct targeted education on maternal and newborn health, and empower women through educational and economic initiatives to support informed healthcare decisions.

- Monitor Third Delay Indicators: Integrate labour monitoring, postnatal care, and newborn readiness metrics into health information systems to support data-driven planning and resource allocation.

Further Research

Future research should explore targeted quality improvement interventions and health system strengthening strategies to reduce preventable perinatal deaths.

Acknowledgment

Disclosure

REFERENCES

Afulani, P. A., Kakama, E., & Cohen, J. (2023). Using person-centred maternity care to assess maternal care quality: A multi-country study. BMC Pregnancy and Childbirth, 23(1), 134. https://doi.org/10.1186/s12884-023-05469-w

Al Kibria, G. M., Burrowes, V., Choudhury, A., & Ekström, E. C. (2020). Adolescent pregnancy and neonatal mortality in low- and middle-income countries: A systematic review. BMC Pregnancy and Childbirth, 20(1), 1–14. https://doi.org/10.1186/s12884-020-02956-6

Allanson, E. R., Pattinson, R. C., Nathan, E. A., & Dickinson, J. E. (2019). A before and after study of the impact on obstetric and perinatal outcomes following the introduction of an educational package of fetal heart rate monitoring education coupled with umbilical artery lactate sampling in a low resource setting labor ward in South Africa. *BMC Pregnancy and Childbirth*, *19*(1), 405. https://doi.org/10.1186/s12884-019-2552-8

Arunda, M. O., Otieno, D. R., & Makworo, L. (2022). Maternal education and neonatal outcomes in East Africa: A population-based study. PLOS ONE, 17(5), e0268290. https://doi.org/10.1371/journal.pone.0268290

Carvalho, O. M. C., Junior, A. B. V., Augusto, M. C. C., Leite, Á. J. M., Nobre, R. A., Bessa, O. A. A. C., De Castro, E. C. M., Lopes, F. N. B., & Carvalho, F. H. C. (2020). Delays in obstetric care increase the risk of neonatal near-miss morbidity events and death: A case-control study. *BMC Pregnancy and Childbirth*, *20*(1), 437. https://doi.org/10.1186/s12884-020-03128-y

Chalise, M., Shah, R., & Karkee, R. (2021). Perinatal mortality and its determinants in rural Nepal: A hospital-based case-control study. Journal of Health, Population and Nutrition, 40, 15. https://doi.org/10.1186/s41043-021-00248-y

Dickson, K. S., Ayebeng, C., & Adu-Gyamfi, A. B. (2023). Postnatal care service utilisation for babies within the first two months after childbirth: An analysis of rural–urban differences in eleven Sub-Saharan African countries. BMC Pregnancy and Childbirth, 23(1), 423. https://doi.org/10.1186/s12884-023-05758-4

Dickson, K. S., Ayebeng, C., Adu-Gyamfi, A. B., & Okyere, J. (2023). Postnatal care service utilisation for babies within the first two months after childbirth: An analysis of rural urban differences in eleven Sub-Saharan African countries. *BMC Pregnancy and Childbirth, 23*(1), 423. https://doi.org/10.1186/s12884-023-05758-4

Fadel, S.A., Ram, U., Morris, S.K., Begum, R., Shet, A., & Jotkar, R. (2015). Facility Delivery, Postnatal Care and Neonatal Deaths in India: Nationally-Representative Case-Control Studies. *PLoS ONE journal.*

Federal Ministry of Health (FMOH) [Ethiopia], (2016). National Reproductive Health Strategy 2016- 2020, Federal Ministry of Health (FMOH), Addis Ababa, Ethiopia.

Gebreheat, G., Tsegaye, A., & Taye, M. (2021). Socioeconomic inequalities in perinatal mortality in Ethiopia: Decomposition analysis. International Journal for Equity in Health, 20, 148. https://doi.org/10.1186/s12939-021-01499-8

Geleto, A., Chojenta, C., Musa, A., & Loxton, D. (2018). Barriers to access and utilization of emergency obstetric care at health facilities in sub-Saharan Africa: A systematic review of

literature. *Systematic Reviews*, *7*(1), 183. https://doi.org/10.1186/s13643-018-0842-2

Jiang, L., Sihota, D., Lee Him, R., et al. (2023). Timely essential newborn care and mortality outcomes in Sub-Saharan Africa: A systematic review. The Lancet Global Health, 11(6), e970–e983. https://doi.org/10.1016/S2214-109X(23)00155-2

Kambale, M. J., Kimaro, T. P., & Mrema, J. G. (2023). Religious beliefs and maternal health-seeking behavior in Tanzania: An analysis of perinatal care experiences. Reproductive Health, 20, 53. https://doi.org/10.1186/s12978-023-01581-w

Kenya Health Information System (KHIS). (2023). *Annual reproductive, maternal, newborn, child and adolescent health performance report*. Nairobi: Ministry of Health

Kenya National Bureau of Statistics (KNBS) & ICF. (2023). *Kenya Demographic and Health Survey 2022: Key Indicators Report*. Nairobi: KNBS & ICF.

Kruk, M. E., Gage, A. D., Joseph, N. T., Danaei, G., García-Saisó, S., & Salomon, J. A. (2018). Mortality due to low-quality health systems in the universal health coverage era: a systematic analysis of amenable deaths in 137 countries. *Lancet (London, England)*.

Maswanya, E., Muganyizi, P., Kilima, S., Mogella, D., & Massaga, J. (2018). Practice of emergency obstetric care signal functions and reasons for non-provision among health centers and hospitals in Lake and Western zones of Tanzania. *BMC Health Services Research*, *18*(1), 944. https://doi.org/10.1186/s12913-018-3685-6

McCauley, H., Lowe, K., Furtado, N., Mangiaterra, V., & Van Den Broek, N. (2022). What are the essential components of antenatal care? A systematic review of the literature and

development of signal functions to guide monitoring and evaluation. *BJOG: An International Journal of Obstetrics & Gynaecology*, *129*(6), 855–867. https://doi.org/10.1111/1471-0528.17029

Muriithi, F. G., Banke-Thomas, A., Gakuo, R., et al. (2022). Health system factors contributing to maternal deaths in Africa: A scoping review. *PLOS Global Public Health, 2*(7), e0000385.

Musafili, A., Persson, L., Baribwira, C., Påfs, J., Mulindwa, P., &Essén, B. (2017). *Case review of perinatal deaths at hospitals in Kigali, Rwanda: perinatal audit with application of a three-delays analysis.* BMC Pregnancy and Childbirth

Nam, J. Y., Oh, S. S., & Park, E.-C. (2022). The Association Between Adequate Prenatal Care and Severe Maternal Morbidity Among Teenage Pregnancies: A Population-Based Cohort Study. *Frontiers in Public Health*, *10*, 782143. https://doi.org/10.3389/fpubh.2022.782143

Nyande, F. K., Ricks, E., Williams, M., & Jardien-Baboo, S. (2024). Challenges to the delivery and utilisation of child healthcare services: A qualitative study of the experiences of nurses and caregivers in a rural district in Ghana. *BMC Nursing, 23*(1), 177.

Olebo, D., Masereka, E., & Muhindo, B. (2023). Partograph use and birth outcomes in rural Uganda: A facility-based audit. *African Journal of Midwifery and Women's Health, 17*(2), 65–72. https://doi.org/10.12968/ajmw.2023.17.2.65

Schifrin, B. S., Koos, B. J., Cohen, W. R., & Soliman, M. (2022). Approaches to Preventing Intrapartum Fetal Injury. *Frontiers in Pediatrics*, *10*, 915344. https://doi.org/10.3389/fped.2022.915344

Shibre, G., Mekonnen, W., & Asrat, M. (2021). Determinants of perinatal mortality among women attending public hospitals in southern Ethiopia. PLOS ONE, 16(10), e0257890. https://doi.org/10.1371/journal.pone.0257890

Thaddeus, S., & Maine, D. (1994). Too far to walk: Maternal mortality in context. *Social Science & Medicine, 38*(8), 1091–1110.

Titaley, C. R., Dibley, M. J., & Roberts, C. L. (2021). Factors associated with underutilization of antenatal care services in developing countries: A review. *Public Health Reviews, 42*, 1604323. https://doi.org/10.3389/phrs.2021.1604323

Wojcieszek, A. M., Bonet, M., Portela, A., Althabe, F., Bahl, R., Chowdhary, N., Dua, T., Edmond, K., Gupta, S., Rogers, L. M., Souza, J. P., & Oladapo, O. T. (2023). WHO recommendations on maternal and newborn care for a positive postnatal experience: Strengthening the maternal and newborn care continuum. *BMJ Global Health*, *8*(Suppl 2), e010992. https://doi.org/10.1136/bmjgh-2022-010992

World Health Organization (WHO). (2023). Improving maternal and newborn health and survival and reducing stillbirth: Progress report 2023. Geneva: WHO.

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

World Health Organization. (2023). *Newborn mortality*. Retrieved from https://www.who.int/news-room/fact-sheets/detail/newborn-mortality

Yaya, S., Bishwajit, G., Shah, V., & Ekholuenetale, M. (2020). Demographic and socioeconomic determinants of perinatal mortality in sub-Saharan Africa. *BMC Public Health, 20*(1),

881. https://doi.org/10.1186/s12889-020-08954-2

Zewde, H. K. (2022). Quality and timeliness of emergency obstetric care and its association with maternal outcome in Keren Hospital, Eritrea. *Scientific Reports*, *12*(1), 14614. https://doi.org/10.1038/s41598-022-18685-9