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Determinants of Maternal Death in Nakuru County, Kenya: A Cross-Sectional Study

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Abstract

Purpose: Maternal mortality remains a significant public health concern in Kenya, with Nakuru County among the regions experiencing high rates. Understanding the determinants of maternal deaths is crucial for targeted interventions and improved maternal health outcomes. This study aimed to identify the factors contributing to maternal deaths in Nakuru County using the Three Delays Model as an analytical framework.

Methods: A cross-sectional design was employed, analyzing 200 maternal death cases reported between 2018 and 2022 from five major health facilities in Nakuru County. Data were obtained through maternal death review forms, facility records, and verbal autopsies. Quantitative data were analyzed using SPSS version 27, with descriptive statistics, chi-square tests, and logistic regression applied to determine significant associations.

Results: Hemorrhage (30%), hypertensive disorders (25%), and sepsis (15%) emerged as the leading direct causes of maternal death. Indirect causes included anemia and HIV-related complications. The study found that 65% of maternal deaths were associated with the third delay (receiving adequate care at a health facility), while 20% and 15% were linked to the second (reaching the facility) and first delays (seeking care), respectively. Multivariate logistic regression analysis indicated that lack of skilled birth attendance (OR = 2.8; 95% CI: 1.6–4.7;

$p < 0.01$) and absence of emergency obstetric care at facilities (OR = 3.2; 95% CI: 1.9–5.3; $p < 0.001$) were significant predictors of maternal mortality.

Conclusion: Maternal deaths in Nakuru County are primarily driven by preventable factors, especially delays in receiving adequate care and lack of skilled birth attendance. Strengthening emergency obstetric services, ensuring the availability of skilled personnel, and enhancing community awareness are critical to reducing maternal mortality.

Keywords: *Maternal mortality, Three Delays Model, hemorrhage, skilled birth attendance, emergency obstetric care, Kenya*

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1. Introduction

Maternal mortality continues to pose a major challenge globally, particularly in low- and middle-income countries. In Kenya, despite efforts to improve maternal health, the maternal mortality ratio remains high at 355 per 100,000 live births (Kenya Demographic and Health Survey, 2022). Nakuru County has recorded significant numbers of maternal deaths in recent years, estimated at 200 deaths between 2018 and 2022, necessitating a closer examination of their causes (Ministry of Health, 2021). This study investigates the determinants of maternal death in the region to inform policy and practice.

1.1 Problem Statement

Despite numerous interventions to improve maternal health in Kenya, the maternal mortality ratio remains unacceptably high at 355 deaths per 100,000 live births (KDHS, 2022). Nakuru County, in particular, has experienced a notable number of maternal deaths, estimated at 200 between 2018 and 2022 (MOH, 2021). These deaths are often preventable and result from multifactorial causes, including delayed healthcare seeking, limited access to quality obstetric care, and systemic failures in emergency response. However, there is a paucity of localized research analyzing these factors in an integrated manner using the Three Delays Model. Without a comprehensive understanding of these determinants, targeted and effective policy responses remain elusive. This study, therefore, sought to fill this gap by investigating the health system, socio-demographic, and clinical contributors to maternal deaths in Nakuru County.

1.2 Objectives of the Study

i. To identify the socio-demographic characteristics of women who died due to maternal causes in Nakuru County, Kenya.
ii. To assess the health system-related factors contributing to maternal deaths in Nakuru County, Kenya.
iii. To determine the clinical causes (direct and indirect) of maternal deaths in Nakuru County, Kenya.
iv. To explore the extent and impact of the “Three Delays” in the context of maternal mortality in Nakuru County, Kenya.

1.3 Hypotheses of the Study

Null Hypothesis (H_0): There is no significant relationship between socio-demographic, clinical, and health system factors and maternal mortality in Nakuru County.

Alternative Hypothesis (H_1): There is a significant relationship between socio-demographic, clinical, and health system factors and maternal mortality in Nakuru County.

2. Literature Review

2.1 Theoretical review

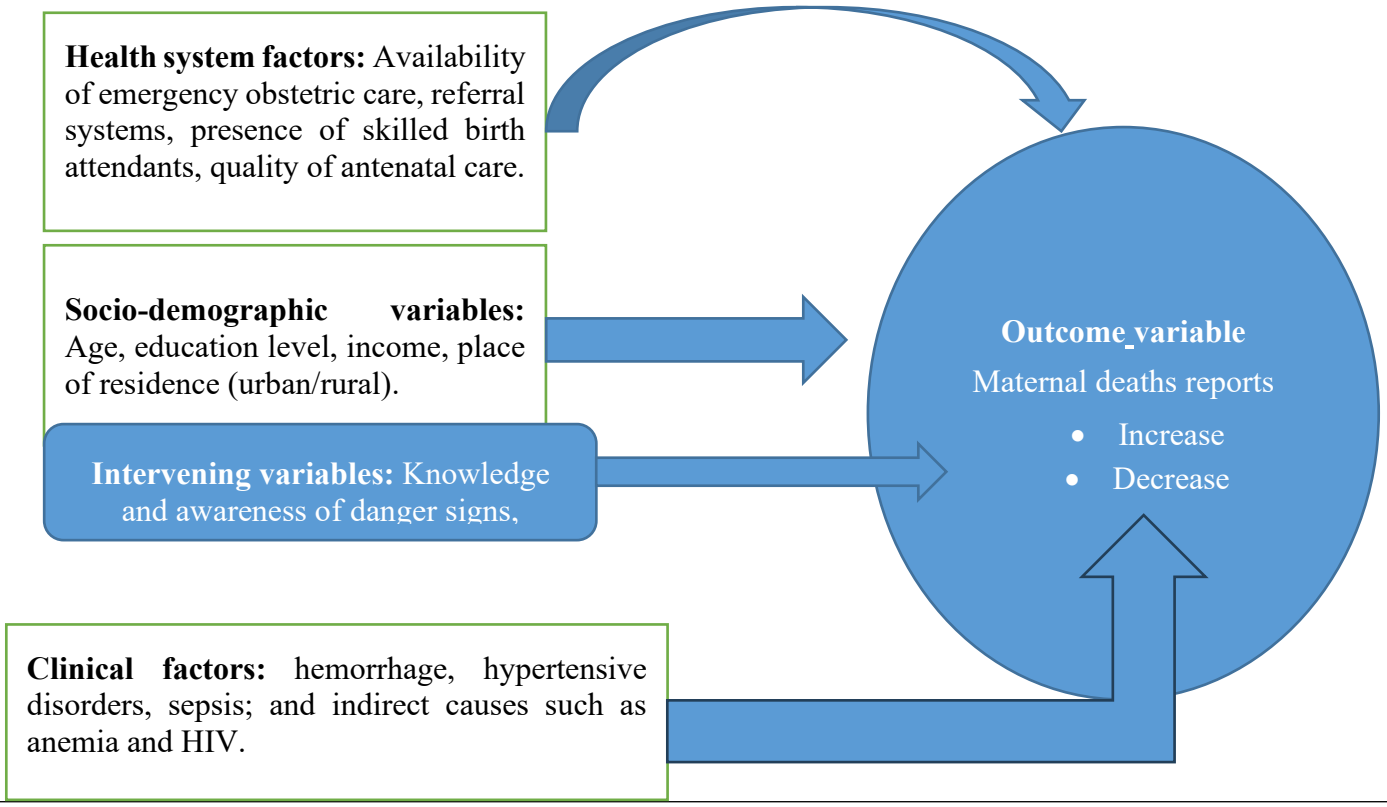
This study is guided by the Three Delays Model by Thaddeus and Maine (1994), which identifies critical delays contributing to maternal mortality: (1) delay in the decision to seek care, (2) delay in reaching care, and (3) delay in receiving adequate care. This model provides a useful lens to analyze health systems and individual-level barriers that increase the risk of maternal death. It emphasizes the importance of timely access to skilled healthcare and highlights systemic gaps that must be addressed to improve maternal outcomes.

2.2 Conceptual Framework

The conceptual framework is based on the integration of health system factors, socio-demographic variables, clinical causes of death, and intervening variables that influence the relationship between these factors and maternal outcomes:

- Health system factors: Availability of emergency obstetric care, referral systems, presence of skilled birth attendants, quality of antenatal care.
- Socio-demographic variables: Age, education level, income, place of residence (urban/rural).
- Clinical factors: Direct causes such as hemorrhage, hypertensive disorders, sepsis, and indirect causes such as anemia and HIV.
- Intervening variables: Knowledge and awareness of danger signs, cultural beliefs and practices, health-seeking behavior, decision-making autonomy, availability and cost of transportation, communication systems between community and facilities, and perceived or experienced quality of care.

These components interact to influence maternal health outcomes. A failure at any point delayed decision-making, inaccessible facilities, or poor quality of care, can result in preventable maternal death. The intervening variables mediate how socio-demographic, clinical, and health system determinants ultimately contribute to maternal outcomes.



3. Materials and Methods

A descriptive cross-sectional study design was adopted. The study was conducted across five major health facilities in Nakuru County. Data were collected from 200 maternal death review reports, facility registers, and verbal autopsies (WHO, 2018). The inclusion criteria encompassed all maternal deaths reported between 2018 and 2022. Data were analyzed using descriptive and inferential statistics in SPSS (IBM Corp, 2021). Data Collection and Analysis by Objectives

To achieve the study objectives, data were collected through a combination of maternal death review reports, facility-based records, and verbal autopsy interviews with relatives and healthcare providers. The data collection tools were standardized according to the WHO Maternal Death Surveillance and Response (MDSR) guidelines (WHO, 2018). Trained data collectors reviewed a total of 200 maternal death cases reported between 2018 and 2022 in five major health facilities across Nakuru County.

Objective 1 (Socio-demographic characteristics): Socio-demographic data such as age, education level, occupation, marital status, and residence were extracted from hospital records and verbal autopsies. Descriptive statistics, including frequencies, percentages, and cross-tabulations, were used to summarize these variables using SPSS v27.

Objective 2 (Health system-related factors): Facility records and death review summaries provided data on access to skilled birth attendants, referral systems, and emergency obstetric services. Data were analyzed using chi-square tests to identify associations between facility-level characteristics and maternal death outcomes.

Objective 3 (Clinical causes): Clinical diagnoses were drawn from facility death reports and categorized into direct and indirect causes following WHO classifications (e.g., hemorrhage, hypertensive disorders, sepsis, anemia, HIV). Frequencies and proportions were used to establish the most common causes of maternal death.

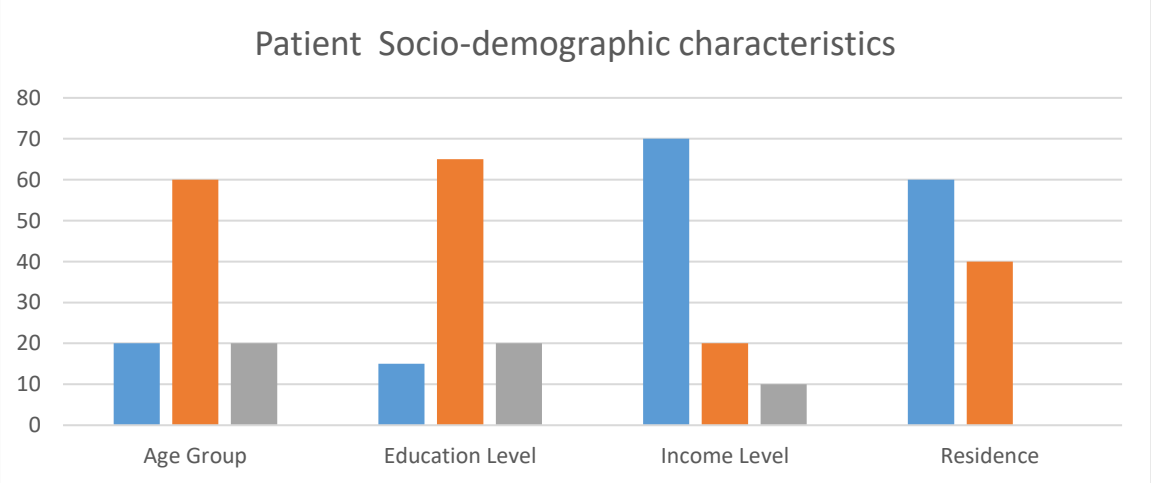
Objective 4 (Three Delays): Each maternal death was assessed using the Three Delays Model framework through verbal autopsy narratives and review reports. A structured matrix was developed to identify whether a delay occurred in deciding to seek care, reaching care, or receiving adequate care. These variables were coded and analyzed as categorical variables, with descriptive summaries and cross-tabulations used to demonstrate the extent and overlaps between delay types.

Quantitative data were cleaned, coded, and analyzed using SPSS v27. Results were presented in tables and charts, and findings were compared with similar studies from regional and international contexts for validation.

4. Results

4.1 Objective 1: Socio-demographic characteristics

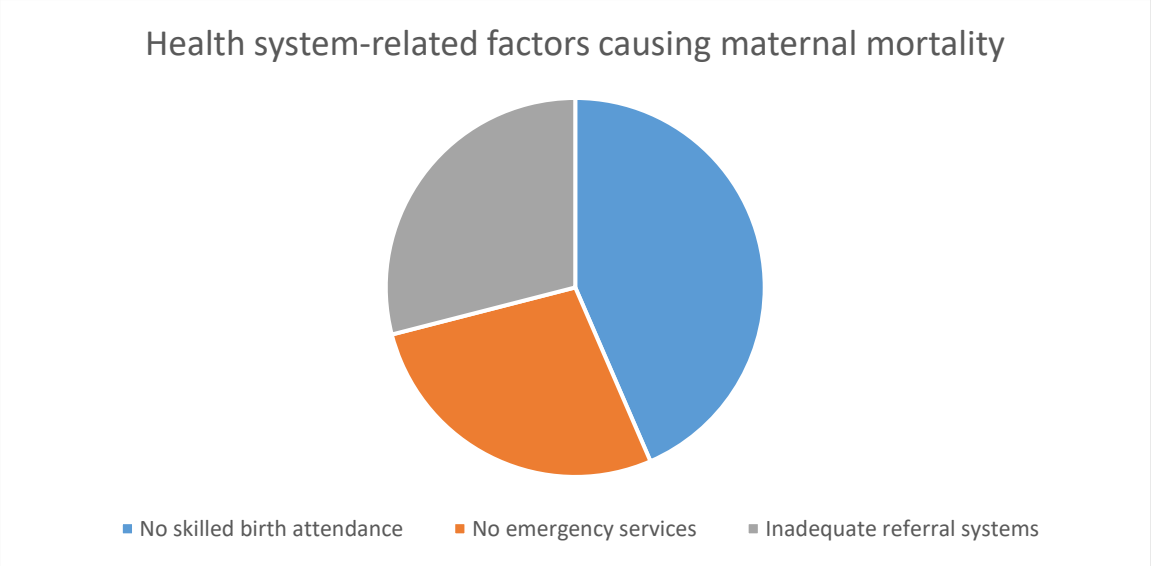
- Majority of the women were aged between 20–34 years (60%).
- 65% had only primary-level education.
- 70% were from low-income households.
- 60% resided in rural areas.



4.2 Objective 2: Health system-related factors

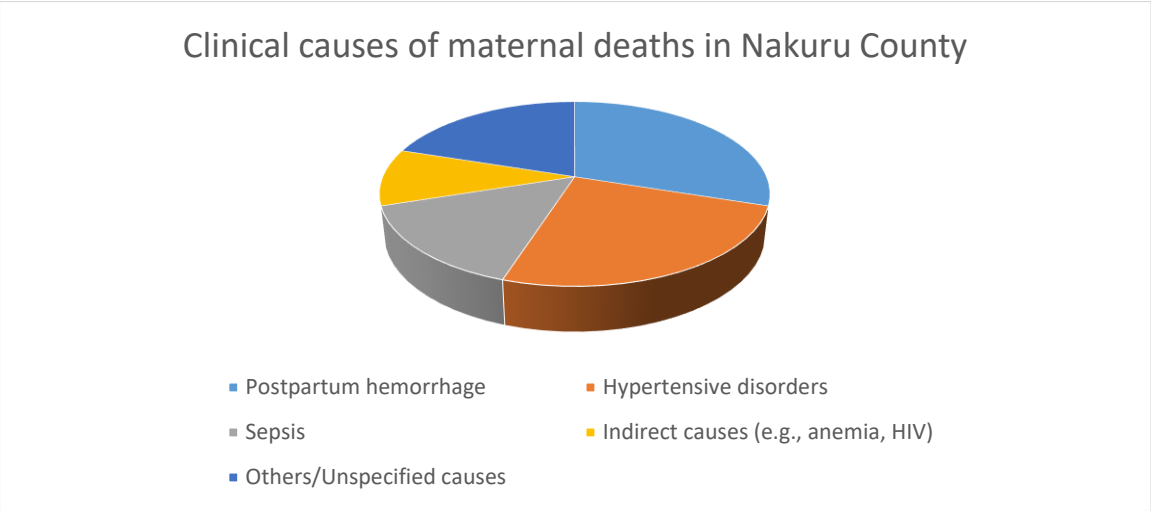
- 60% of the deceased did not receive skilled birth attendance.
- 38% of the deaths occurred in facilities without emergency obstetric services.

- Inadequate referral systems were reported in 40% of the cases.



4.3 Objective 3: Clinical causes of death

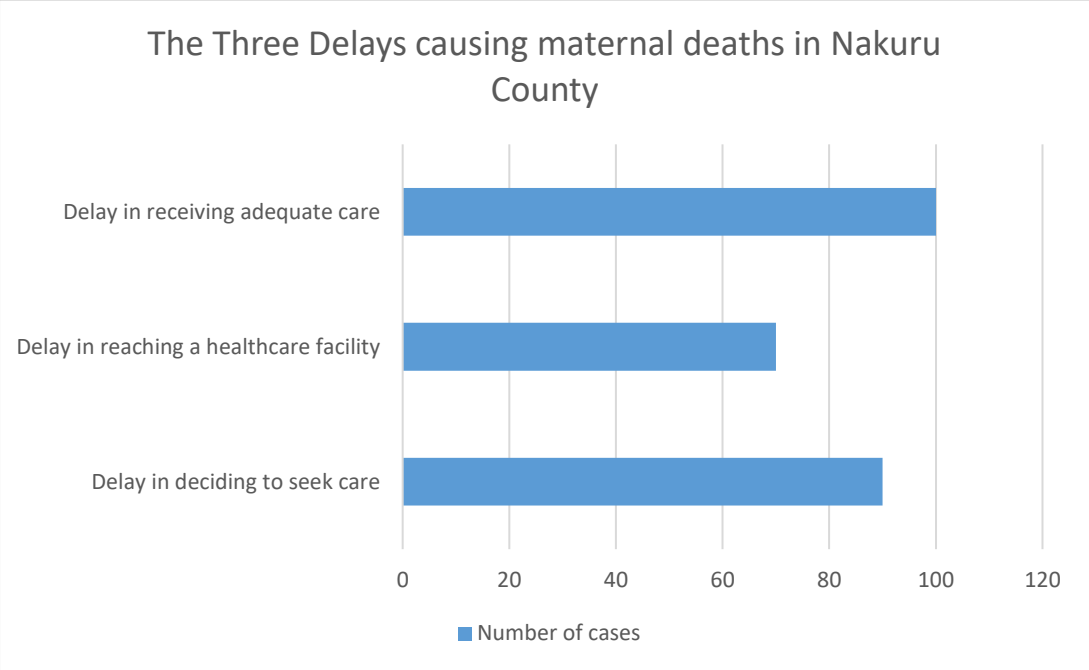
- Postpartum hemorrhage accounted for 30% (n=60) of the deaths.
- Hypertensive disorders (e.g., preeclampsia/eclampsia) were found in 25% (n=50).
- Sepsis contributed to 15% (n=30), while indirect causes like anemia and HIV accounted for 10% (n=20).
- A vertical bar chart below shows: Postpartum Hemorrhage – 30%, Hypertensive Disorders – 25%, Sepsis – 15%, Anemia & HIV – 10%, and Others/Unspecified – 20%



4.4 Objective 4: The Three Delays

- Delay in deciding to seek care was present in 45% (n=90) of cases.

- Delay in reaching a healthcare facility accounted for 35% (n=70).
- Delay in receiving adequate care after arrival at a facility affected 50% (n=100). These delays were often interrelated and contributed significantly to preventable maternal deaths.



4.5 Discussion

The results of this study underscore the multifactorial nature of maternal mortality in Nakuru County, aligning with global and regional evidence that situates maternal death within both individual-level and systemic determinants. The application of the Three Delays Model was instrumental in contextualizing the sequence of events that contributed to maternal deaths. Among the three delays, the delay in receiving adequate care at health facilities emerged as the most prevalent (50%), highlighting systemic deficiencies in facility readiness, human resources, and timely intervention. This pattern mirrors findings from Malawi and Nigeria, where poor facility preparedness and healthcare worker shortages were linked to preventable maternal deaths (Mgawadere et al., 2017; Okonofua et al., 2019).

Conversely, urban-based studies in Kenya, such as Mohammed et al. (2020), demonstrated lower rates of the third delay due to improved infrastructure and referral systems, indicating significant rural-urban disparities in access and quality of care. This suggests that localized context, especially health system capacity and geographic location, plays a pivotal role in maternal outcomes.

Clinical causes in this study were consistent with regional patterns. Hemorrhage (30%) and hypertensive disorders (25%) were the leading direct causes of death, aligning with findings from Ethiopia and the broader Sub-Saharan Africa region (Berhan & Berhan, 2014; Say et al., 2014). However, the relatively higher incidence of sepsis (15%) compared to reports from Rwanda (Binagwaho et al., 2015) signals persistent gaps in infection prevention and control

protocols in Nakuru's healthcare facilities. This gap may reflect limited adherence to clinical guidelines or inadequate postnatal follow-up.

Socio-demographic disparities were also evident. The predominance of maternal deaths among women with only primary education (65%), low-income status (70%), and rural residence (60%) echoes findings by Fotso et al. (2009), who identified socio-economic vulnerability as a significant predictor of poor maternal outcomes. These findings emphasize the intersectionality of education, income, and geographic location in shaping health-seeking behavior and access to timely care.

This study advances the discourse by integrating the Three Delays Model with localized empirical evidence, thereby offering a nuanced understanding of maternal mortality determinants in Nakuru County. Importantly, the findings call for interventions that not only strengthen facility-based care but also address upstream socio-economic and informational barriers. These insights contribute to the evidence base for Kenya's maternal health strategy, reinforcing the urgency for targeted, context-specific policies.

5. Conclusion

Maternal mortality in Nakuru County is driven by an interplay of socio-demographic vulnerabilities, clinical complications, and systemic failures within the healthcare delivery process. The high prevalence of delays, particularly the third delay related to receiving adequate care, highlights persistent gaps in facility preparedness, timely response, and emergency obstetric capacity. Clinical factors such as hemorrhage, hypertensive disorders, and sepsis remain predominant causes of death, while low education levels, poverty, and rural residence compound access barriers and delay decision-making. The study affirms the applicability of the Three Delays Model in diagnosing the multifaceted nature of maternal mortality and underscores the need for a comprehensive, equity-driven response that addresses both demand- and supply-side determinants.

6. Recommendations

Based on the findings, the following recommendations are proposed to reduce maternal mortality in Nakuru County:

Strengthen Facility Readiness and Emergency Response- Upgrade health facilities to provide continuous access to emergency obstetric care (EmOC), including blood transfusion services, surgical capacity, and trained personnel. Ensure consistent availability of essential supplies, drugs, and equipment to manage obstetric emergencies effectively.

Enhance the Capacity and Distribution of Skilled Birth Attendants- Recruit, train, and equitably deploy skilled birth attendants, especially in rural and underserved areas. Promote continuous professional development focused on emergency obstetric care, infection prevention, and respectful maternity care.

Improve Referral and Transport Systems- Establish and maintain functional referral networks with clear protocols and reliable transport options to reduce delays in reaching care. Implement community-based emergency transport schemes supported by local governments and partners. Promote Community Awareness and Health Literacy- Conduct targeted community sensitization campaigns on the danger signs of pregnancy, the

importance of antenatal care, and early health-seeking behavior. Engage community health volunteers and leaders to bridge the knowledge gap and build trust in formal healthcare services. Address Socio-Economic Barriers- Implement social protection mechanisms (e.g., transport vouchers, maternity waivers) for low-income women to encourage timely access to care. Integrate maternal health interventions with education and poverty reduction strategies to address the root causes of vulnerability.

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