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Original Research Article

Prevalence and Determinants of Maternal Mortality in Mazabuka District, Southern Province, Zambia (2018-2022)

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Abstract: ***Background*:** Maternal mortality remains a major public health challenge globally, particularly in Sub-Saharan Africa and Zambia, despite the availability of interventions aimed at reducing preventable deaths. In Mazabuka District, maternal deaths continue to occur, reflecting gaps in access to timely and quality maternal healthcare services. Achieving the Sustainable Development Goal target of reducing maternal mortality to fewer than 70 deaths per 100,000 live births by 2030 remains a significant challenge. ***Objective*:** This study aimed to determine the prevalence and identify the determinants of maternal mortality in Mazabuka District, Zambia. ***Materials and Methods*:** A retrospective analytical cross-sectional study design using a quantitative approach was employed. Data were extracted from 13,519 maternal records at Mazabuka General Hospital covering the period January 2018 to December 2022. Purposive sampling was used to select maternal death cases, while systematic random sampling was used for non-mortality cases. Data were analysed using descriptive statistics, Chi-square tests, and Pearson's correlation analysis at a 95% confidence level. ***Results*:** The prevalence of maternal mortality during the study period was 0.274% (37/13,519). Maternal mortality was significantly associated with maternal age ($p<0.01$), referral status ($p<0.001$), duration of referral ($p<0.001$), and mode of delivery ($p<0.001$). Patient-related factors including cause of death, pregnancy interval ($p=0.002$), parity ($p=0.001$), period of death ($p<0.001$), and complications during pregnancy ($p=0.003$) were also significantly associated with maternal mortality. Postpartum haemorrhage was identified as the leading cause of death. Socio-demographic factors such as education, marital status, occupation, and residence were not significantly associated with maternal mortality. ***Conclusion*:** Maternal mortality in Mazabuka District is primarily driven by delays in referral, obstetric complications, and high-risk clinical conditions rather than socio-demographic factors. Strengthening referral systems, improving early detection and management of complications, and enhancing emergency obstetric care particularly for postpartum haemorrhage are critical to reducing maternal deaths in the district.

Keywords: Maternal Mortality, Prevalence, Determinants, Referral Delay, Postpartum Haemorrhage, Zambia.

1. INTRODUCTION

Maternal mortality remains a critical global public health challenge, disproportionately affecting low- and middle-income countries. Despite sustained international efforts, many women continue to die from preventable causes related to pregnancy and childbirth. In 2015, the global maternal mortality ratio (MMR) was estimated at 216 deaths per 100,000 live births, with the majority of these deaths occurring in developing regions [1]. The World Health Organization defines maternal death as the death of a woman during pregnancy or within 42 days of termination of pregnancy, from causes related to or aggravated by the pregnancy or its management, excluding accidental or incidental causes [2].

Efforts to reduce maternal mortality have been prioritized under Sustainable Development Goal (SDG)

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3.1, which aims to lower the global MMR to fewer than 70 deaths per 100,000 live births by 2030 [3]. However, progress remains uneven. Approximately 800 women die each day from largely preventable maternal causes, with nearly 99% of these deaths occurring in low-income countries, particularly in Sub-Saharan Africa [4]. Evidence shows that most maternal deaths are avoidable and are often linked to delays in seeking care, reaching health facilities, and receiving appropriate treatment [5].

Sub-Saharan Africa accounts for more than half of global maternal deaths, reflecting persistent challenges in access to quality maternal healthcare, shortages of skilled health personnel, and weak referral systems [6]. Zambia is among the countries with a high maternal mortality burden, with an estimated MMR of 252 deaths per 100,000 live births [7]. Although efforts such as the deployment of skilled birth attendants, strengthened referral systems, and the introduction of electronic health platforms like SMARTCARE have been implemented, maternal mortality remains a major concern. In 2021, Zambia recorded 696 maternal deaths [8].

At the district level, disparities are often more pronounced. In Mazabuka District, 11 maternal deaths were recorded in 2022 [9]. Given the relatively small number of live births, this represents a disproportionately high burden compared to national and global targets. These deaths are frequently associated with preventable factors, including delays in accessing care, limited availability of skilled services, and inefficiencies within referral systems.

Although several interventions have been introduced such as training midwives, expanding maternity services, mobile antenatal care, and improving emergency referral mechanisms maternal deaths persist. This suggests that underlying determinants, including socio-demographic factors, health system constraints, and care-seeking behaviors, may not be fully addressed. This study therefore assessed the prevalence and determinants of maternal mortality in Mazabuka District, Zambia.

2. MATERIALS AND METHODS

2.1 Study Design, Setting, and Participants

A retrospective analytical cross-sectional study design was used to assess the prevalence and determinants of maternal mortality. The study was conducted at Mazabuka General Hospital in Mazabuka District, approximately 175 km south of Lusaka. The hospital is the main referral facility for 26 health centres and 21 health posts and provides comprehensive maternal health services, including routine and emergency obstetric care. On average, it attends to about 70 maternity cases weekly and records approximately seven maternal deaths annually.

The study population comprised records of all pregnant women who delivered between 1st January 2018 and 31st December 2022 (13,519 files). The study included maternal death and survival cases. Files with missing, erased, or unclear information were excluded.

2.2 Data Collection Procedure

Data were collected through retrospective review of maternal case files from the hospital's medical records department, supported by admission registers, delivery records, and maternal death review reports. A pre-tested data extraction checklist ensured consistency and completeness. Ethical clearance was obtained from UNZABREC (5565-2024) and NHRA (1777/10/12/2024). Permission was granted by the District Health Office. Patient consent was waived, and all data were anonymized and securely stored to maintain confidentiality.

2.3 Instruments

A structured data extraction tool (checklist) was used to collect relevant information from maternal case files through retrospective review. The tool was pre-tested to ensure consistency, completeness, and suitability for the study. The checklist was divided into sections covering key study variables, including maternal characteristics, obstetric factors, and clinical information related to maternal mortality. Questions on maternal factors were adapted from Ntoimo *et al*., [14], while items on maternal mortality and selected demographic characteristics were adapted from Ghasemi *et al*., [15]. These tools were selected because they had been previously validated and reviewed by obstetric experts.

Validity was ensured by adapting standardized instruments from previous studies and through expert review of the checklist. Internal validity was strengthened by using a uniform data extraction tool across all files and including only records with confirmed causes of death. External validity was supported by the use of real clinical data from hospital records. Reliability was achieved through pilot testing and by standardizing the data extraction process. Regular cross checking and verification of extracted data were conducted to minimize errors and ensure consistency.

2.4 Data Analysis

Data were extracted, verified for completeness, coded, and entered into Microsoft Excel before being exported to SPSS version 27.0 for analysis. Descriptive statistics were used to summarize variables, with frequencies and proportions for categorical data and measures such as minimum and maximum values for continuous variables. The Chi-square test was used to assess associations between independent variables and maternal mortality, while Fisher's exact test was applied where appropriate. Pearson's correlation analysis was conducted to determine the strength of relationships between variables. A 95% confidence interval and a

significance level of 0.05 were applied. Prevalence was calculated as the proportion of maternal deaths in the sample.

3. RESULTS

Table 1: Socio-demographic characteristics of participants (n = 113)

Variable	Category	Frequency (n)	Percent (%)
Age (years)	12–19	22	19.5
	20–24	24	21.2
	25–29	24	21.2
	30–34	14	12.4
	35–39	19	16.8
	40–45	10	8.8
Marital status	Single	29	25.7
	Married	84	74.3
Education level	None	4	3.5
	Primary	51	45.1
	Secondary	49	43.4
	Tertiary	9	8
Occupation	Employed	19	16.8
	Unemployed	94	83.2
Residence	Rural	53	46.9
	Urban	60	53.1
Distance to health facility	<5 km	57	50.4
	5–10 km	18	15.9
	>10 km	38	33.6

Table 1 shows that the most represented age groups were 20–24 and 25–29 years (21.2% each), while the least represented group was 40–45 years (8.8%). The majority of participants were married (74.3%) and unemployed (83.2%). Most had primary (45.1%) or secondary (43.4%) education, with only 3.5% having no formal education. Slightly more participants resided in urban areas (53.1%) compared to rural areas (46.9%). Half of the participants (50.4%) lived within 5 km of a health facility.

3.2 Prevalence of Maternal Mortality

The prevalence of maternal mortality during the study period was 0.274%.

$$MMR = \frac{maternal\ deaths}{total\ live\ births\ in\ the\ period} \times 100$$
$$= \frac{37}{13519} \times 100$$
$$= .002749$$
$$= 0.274\%$$

While the prevalence of maternal mortality may seem low in percentage, its impact on maternal case management can still be significant. Even a small number of maternal deaths can highlight serious challenges in the healthcare system.

3.3 Association between Maternal Mortality and Independent Variables

A Pearson's Chi-square test was performed to examine the association between maternal mortality and selected independent variables, including socio-demographic, service-related, and patient-related factors. Statistical significance was assessed at a 95% confidence interval, with a p-value of less than 0.05 considered significant.

3.3.1 Socio-Demographic Factors

Table 2: Association of maternal mortality and socio-demographic data (n=113)

Variable name	Variable	Outcome		P- Value
		No Mortality	Mortality	
Marital status	Single	22	7	0.181
	Married	54	30	
Education level	None	2	2	0.782
	Primary	33	18	
	Secondary	35	14	
Spouses' level of education	None	1	1	0.227
	Primary	6	5	
	Secondary	24	8	
	Tertiary	13	2	
	N/A	32	21	

Variable name	Variable	Outcome		P- Value
		No Mortality	Mortality	
Occupation (of the client)	Employed	11	8	0.34
	unemployed	65	29	
Residence	Rural	34	19	0.508
	Urban	42	18	
Age	19-Dec	19	3	0.007
	20-24	21	3	
	25-29	15	9	
	30-34	8	6	
	35-39	8	11	
	40-45	5	5	

Table 2 shows that only age was significantly associated with maternal mortality ($p < 0.01$), with higher mortality observed among women aged 35–39 and 40–45 years. No significant associations were found for other demographic variables.

3.3.2 Service-Related Factors

Table 3: Association of maternal mortality and service-related factors (n=113)

Variable name		Outcome		P -Value
		No mortality	Mortality	
Referral status	Not referred	47	11	<0.001
	Referred	29	26	
Duration of referral	>12hours	5	8	<0.001
	5-12hours	4	9	
	<5hours	0	4	
	N/A	67	16	
Distance to a health facility	<5km	38	19	0.884
	5-10km	13	5	
	>10km	25	13	
Mode of delivery	SVD	62	14	<0.001
	CS	10	8	
	Others	2	2	
	Not delivered	2	13	

Table 3 shows that referral status, duration of referral, and mode of delivery were significantly associated with maternal mortality ($p < 0.001$). Higher mortality was observed among referred cases and those experiencing delays in referral. A large proportion of deaths occurred before delivery, while among delivered cases, mortality was higher in caesarean section and other assisted deliveries compared to spontaneous vaginal delivery.

3.3.3 Patient-Related Factors

Table 6: Association of maternal mortality and patient-related factors (n=113)

Variable		No Mortality	Mortality	P-Value
Diagnosis of the cause of death	PPH	0	12	<0.001
	Anaemia	0	7	
	Rheumatic Heart Disease	0	1	
	Hypertension	0	3	
	High parity & Hypertension	0	1	
	Ruptured Uterus	0	5	
	Sepsis	0	3	
	Septic Abortion	0	1	
	Concealed Placenta	0	1	
	Internal Haemorrhage	0	1	
	Hypotension	0	1	
	Severe malaria	0	1	
	N/A	76	0	

Variable		No Mortality	Mortality	P-Value
Gestational age (week)	<14	0	2	0.103
	14-28	6	4	
	>28	70	31	
Pregnancy interval (month)	<12 months	34	15	0.002
	>=12 months	15	18	
	N/A	27	4	
Period of death	Antepartum	0	20	<0.001
	Intra-partum	0	2	
	Postpartum	0	15	
	N/A	76	0	
Place of delivery)	Hospital	71	23	<0.001
	Maternity facility centre	0	2	
	Home	0	1	
	N/A	5	11	
Place of death)	Hospital	5	36	<0.001
	On the way to the hospital	0	1	
	N/A	71	0	
ANC booking status for antenatal	Not booked	8	4	1
	Booked	68	33	
Parity	0	28	4	0.001
	1	20	6	
	4-Jan	21	16	
	>=5	7	11	
Early pregnancy loss	0	42	15	0.301
	3-Jan	26	18	
	>=4	8	4	
Complications in Index Pregnancy	No	49	13	0.003
	Yes	27	24	
Chronic illness during pregnancy	No	29	15	0.483
	Yes	47	22	

Table 4 shows that several patient-related factors were significantly associated with maternal mortality ($p < 0.01$), including diagnosis of cause of death, pregnancy interval, period of death, parity, and complications in the index pregnancy. Postpartum haemorrhage (PPH) was the leading cause of death. Higher mortality was observed among women with pregnancy intervals greater than 12 months, those with higher parity (≥5), and those with complications during pregnancy. Maternal deaths were more likely to occur during the antepartum period, with fewer deaths occurring during labour.

3.4 Correlation between Maternal Mortality and Independent Variables

Pearson's correlation analysis was performed to assess the strength and direction of the relationship between maternal mortality and selected independent variables, including socio-demographic, service-related, and patient-related factors. Statistical significance was evaluated at a 95% confidence interval.

3.4.1 Socio-Demographic Factors

Table 5: Correlation of socio-demographic factors with maternal mortality (n = 113)

Variables	Pearson Correlation	P -Value
Referral status	.301**	0.001
Duration of referral process	-.476**	0
Distance to a health facility	0.005	0.961
Mode of delivery	.453**	0

*** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).*

Table 5 shows that there were no statistically significant correlations between maternal mortality and socio-demographic variables ($p > 0.05$).

3.4.2 Service-Related Factors

Table 6: Correlation of service-related factors with maternal mortality (n = 113)

Variables	Pearson Correlation	P-Value
Referral status	.301**	0.001
Duration of referral process	-.476**	0.000
Distance to a health facility	0.005	0.961
Mode of delivery	.453**	0.000

** Correlation is significant at the 0.01 level (2-tailed).

Table 6 shows that referral status ($r = 0.301$, $p < 0.01$), duration of referral ($r = -0.476$, $p < 0.01$), and mode of delivery ($r = 0.453$, $p < 0.01$) were significantly correlated with maternal mortality. Referral status and mode of delivery showed weak positive correlations, while duration of referral showed a weak negative correlation.

3.4.3 Patient-Related Factors

Table 7: Correlation of patient-related factors with maternal mortality (n = 113)

Variables	Pearson Correlation	P-Value
Diagnosis of the cause of death	-.999**	0.000
Gestational age (week)	-0.17	0.072
Pregnancy interval (month)	-.258**	0.006
Place of delivery)	.313**	0.001
Place of death)	-.907**	0.000
ANC booking status for antenatal	-0.004	0.964
Parity	.367**	0.000
Early pregnancy loss	0.105	0.27
Complications in Index Pregnancy	.277**	0.003
Chronic illness or illness during pregnancy	-0.023	0.809

Table 7 shows significant positive correlations between maternal mortality and place of delivery ($r = 0.313$, $p < 0.01$), parity ($r = 0.367$, $p < 0.01$), and complications in the index pregnancy ($r = 0.277$, $p < 0.01$). Significant negative correlations were observed for pregnancy interval ($r = -0.258$, $p < 0.01$), place of death ($r = -0.907$, $p < 0.01$), and diagnosis of cause of death ($r = -0.999$, $p < 0.01$).

4. DISCUSSION OF FINDINGS

This study assessed the prevalence and determinants of maternal mortality in Mazabuka District, Zambia, using retrospective facility-based data from 2018 to 2022. The findings demonstrate that maternal mortality, although relatively low at 0.274%, remains a significant public health concern. Maternal deaths are largely preventable and often reflect systemic gaps in access to timely and quality maternal healthcare services [16]. Globally, maternal mortality remains disproportionately high in low- and middle-income countries, particularly in sub-Saharan Africa, where health system challenges continue to affect maternal outcomes [16]. In Zambia, despite improvements in maternal health services, maternal mortality remains high, reflecting persistent gaps in service delivery [7].

The study found that most women were married, had primary or secondary education, and were unemployed, which is consistent with national demographic patterns reported in Zambia [7]. While socio-demographic factors are often associated with health-seeking behaviour, this study found that marital status, education level, occupation, and residence were not significantly associated with maternal mortality. This suggests that in this context, maternal mortality is less influenced by background characteristics and more strongly driven by clinical and health system factors. Similar findings have been reported in other low-resource settings, where the quality and timeliness of care are stronger determinants of maternal outcomes than socio-demographic characteristics alone [17].

Age was the only socio-demographic factor significantly associated with maternal mortality, with higher mortality observed among women aged 35–39 and 40–45 years. This finding is consistent with evidence showing that advanced maternal age is associated with increased risk of obstetric complications, including hemorrhage, hypertensive disorders, and poor pregnancy outcomes [18]. In Zambia, older maternal age has also been linked to increased risk due to cumulative reproductive exposure and underlying health conditions [19].

Service-related factors were found to be major determinants of maternal mortality. Significant associations were observed between maternal mortality and referral status, duration of referral, and mode of delivery. These findings reflect systemic challenges in maternal healthcare delivery, particularly in referral

systems. The association between referral delays and maternal mortality is consistent with global evidence indicating that delays in accessing emergency obstetric care remain a leading cause of maternal death [16]**.** In Zambia, referral systems are often constrained by transportation challenges, limited emergency response capacity, and delayed decision-making at primary healthcare facilities [19].

The findings strongly support the concept of delays in accessing care, where late referrals contribute to poor outcomes. The observation that some women died shortly after referral suggests that they were referred at an advanced stage of complications, indicating weaknesses in early diagnosis and timely referral decision making. This underscores the need to strengthen referral systems, including improving transportation, communication, and clinical decision-making at lower level health facilities.

Mode of delivery was also significantly associated with maternal mortality. A large proportion of deaths occurred before delivery (antepartum), indicating that complications often arise before labour and are not detected early. Among those who delivered, higher mortality was observed in women undergoing caesarean section and assisted deliveries compared to spontaneous vaginal delivery. This finding reflects the severity of complications requiring surgical intervention rather than the procedure itself. Similar findings have been reported in global studies, where emergency obstetric interventions are often associated with severe maternal conditions [20].

Patient-related factors showed the strongest associations with maternal mortality. Postpartum haemorrhage (PPH) was identified as the leading cause of maternal death in this study. This is consistent with global evidence showing that hemorrhage remains the leading cause of maternal mortality, particularly in low-resource settings [16]**.** In Zambia, PPH continues to be a major contributor to maternal mortality, reflecting gaps in emergency obstetric care, including delays in management and limited access to blood transfusion services [19].

Pregnancy interval was significantly associated with maternal mortality, with higher mortality observed among women with intervals of 12 months or more. While optimal birth spacing is important for maternal health, this finding may reflect contextual factors such as delayed healthcare utilization or underlying health conditions. Evidence suggests that both short and long birth intervals can pose risks depending on access to care and maternal health status [21].

The study also found that maternal mortality was more likely to occur during the antepartum period. This indicates that complications are developing before labour and are not being detected or managed during antenatal care. Similar findings have been reported in sub-Saharan Africa, where gaps in antenatal care quality contribute to delayed identification of high risk pregnancies [17].

Parity was significantly associated with maternal mortality, with higher mortality observed among women with parity of five or more. High parity is associated with increased risk of complications such as uterine rupture, anemia, and hemorrhage [16]**.** In Zambia, high fertility rates and limited uptake of family planning services contribute to increased maternal risk [7].

Complications during pregnancy were also significantly associated with maternal mortality. Women who experienced complications were more likely to die compared to those without complications. This finding reinforces the importance of early detection and management of complications through quality antenatal care. Evidence shows that timely management of complications significantly reduces maternal mortality [17]**.**

Correlation analysis further confirmed that maternal mortality in this study is primarily influenced by service-related and patient-related factors rather than socio-demographic variables. Significant correlations were observed for referral status, duration of referral, mode of delivery, parity, complications, and pregnancy interval. These findings highlight the interconnected nature of health system and clinical factors in determining maternal outcomes.

The absence of significant correlations between maternal mortality and socio-demographic variables further emphasizes that improving health system performance is critical. Similar conclusions have been drawn in global studies, which highlight that access to quality care and timely interventions are the most important determinants of maternal survival [16]**.**

Overall, the findings of this study indicate that maternal mortality in Mazabuka District is primarily driven by delays in care, complications during pregnancy, high parity, and leading causes such as postpartum haemorrhage. These findings are consistent with both global and national evidence and highlight the need for targeted interventions.

5. CONCLUSION

The study identified several factors as being significant in influencing maternal mortality in Mazabuka District, particularly service-related and patient-related factors. These included referral delays, complications during pregnancy, high parity, pregnancy interval, and postpartum haemorrhage as the leading cause of death. Age was the only socio-demographic factor significantly associated with maternal mortality, with higher mortality observed among older women.

This implies that reducing maternal mortality requires strengthening the health system, particularly in improving referral systems, early detection of complications, and effective management of obstetric emergencies. The high proportion of deaths occurring before delivery further indicates gaps in antenatal care and risk identification.

The observed associations emphasize the need for a comprehensive approach to maternal health that addresses both clinical and health system challenges. By improving timely access to care and strengthening management of complications, maternal mortality can be significantly reduced.

6. Recommendations

Strengthening referral systems is essential to reduce delays associated with maternal mortality, particularly through improved transportation, communication, and timely decision making. Health facilities should also enhance antenatal care services to ensure early identification and management of pregnancy related complications, especially given the high proportion of deaths occurring during the antepartum period.

There is a need to improve emergency obstetric care, particularly in the management of postpartum haemorrhage, by ensuring the availability of skilled personnel, essential supplies, and access to blood transfusion services. Targeted interventions should focus on high-risk groups, particularly older women and those with high parity, through closer monitoring and specialized care.

In addition, strengthening family planning services and community awareness programs is important to promote optimal birth spacing and encourage early healthcare seeking behaviour. Further research is recommended to expand on these findings and improve generalizability across different settings.

7. Limitations of the Study

This study was based on retrospective data obtained from maternal case records, which may have contained incomplete or missing information, potentially affecting the quality and accuracy of the data. In addition, the use of secondary data limited the ability to capture important contextual factors such as socio-cultural influences and patient experiences that may affect maternal health outcomes. The relatively small sample size and restriction of the study to Mazabuka District further limit the generalizability of the findings to other settings, particularly urban areas where healthcare resources and service delivery may differ. Furthermore, reliance on routinely recorded data may have introduced information bias due to inconsistencies or inaccuracies in documentation.

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