

Maternal Mortality in Adamawa North, Nigeria: Prevalence, Determinants and Community-Based Evidence

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ABSTRACT

Introduction: Maternal mortality has been a significant public health challenge in Nigeria, especially in the northern region, due to limited access to good reproductive health services. This research sought to investigate the prevalence and determinants of maternal mortality in selected areas of Adamawa State, Northern Nigeria.

Methods: A descriptive cross-sectional research design was used for the study, which was carried out in Mubi North and Mubi South Local Government Areas, among others, in the Northern Senatorial Zone of Adamawa State. Structured questionnaires were distributed to 364 respondents selected through a multistage sampling design. The data were described, and chi-square tests were used to identify relationships between variables.

Results: The prevalence rate of maternal mortality found in the study was consistent with the high rate described in the North of Nigeria. It is stated that the number one cause of maternal mortality has been the case of hemorrhage (32.4%), followed by hypertensive disorders (21.7%), sepsis (16.5%), and delay in accessing the emergency obstetric care (15.3%). Significant determinants included a distance to health care facilities ($\chi^2 = 11.62$, $p < 0.05$), a shortage of skilled birth attendants ($\chi^2 = 14.31$, $p < 0.05$), poor utilisation of the services of the Antenatal (ANCS) ($\chi^2 = 18.42$, $p < 0.05$) and socioeconomic status (SES) ($\chi^2 = 9.27$, $p < 0.05$).

Conclusion: Systemic challenges include inadequate referrals, poor reporting of maternal health information, and poor coordination of emergency responses. Evidence from the international literature shows that AI can facilitate maternal health by enabling predictive data analysis for high-risk pregnancies, automating support for frontline health care providers, and enabling digital surveillance of maternal complications in resource-poor zones. Integrate AI-powered maternal risk prediction tools into existing reproductive health programs in Adamawa State to support efforts to prevent preventable maternal deaths, the study recommends.

Keywords: Maternal mortality, reproductive health, Artificial Intelligence, Adamawa State.

Introduction

Maternal mortality remains one of the most critical indicators of a functioning health system and societal progress worldwide. According to recent estimates, approximately 287,000 women die each year from complications related to pregnancy and childbirth, with over 94% of these deaths occurring in low and middle-income countries ¹. Sub-Saharan Africa alone accounts for nearly a third of the global burden, with a maternal mortality ratio (MMR) of 545 deaths per 100,000 live births.¹ Despite global commitments

under Sustainable Development Goal (SDG) 3 to reduce the MMR to below 70 by 2030, progress in many developing regions has stagnated.² Nigeria carries one of the highest maternal mortality burdens globally. Recent data from the Nigeria Demographic and Health Survey indicate an MMR ranging from 512 to 917 deaths per 100,000 live births.³ This crisis is particularly acute in Northern Nigeria, including Adamawa State, where socioeconomic inequalities, cultural practices, limited access to skilled birth attendance, and inadequate emergency obstetric

care create a perfect storm of risk.⁴ The rural communities within the Adamawa North Senatorial Zone face additional challenges such as insecurity, a scarcity of health facilities, poor road networks, and long referral distances to hospitals. These factors directly contribute to the ‘three delays’ model of maternal death: the delay in deciding to seek care, delay in reaching a facility, and delay in receiving adequate care.^{5,6} While the direct medical causes of maternal death—haemorrhage, hypertensive disorders, sepsis, obstructed labour, and unsafe abortion, are well-documented,^{7,8} the underlying contextual determinants like pervasive poverty, poor health financing, and dysfunctional referral systems are under-researched, especially among Nigeria's most impoverished populations. This study therefore aims to examine the prevalence and determinants of maternal mortality in the Adamawa Northern Senatorial Zone, with the goal of informing targeted maternal health policies for North-Central Nigeria.

Methodology

Research Design

A descriptive cross-sectional survey design was employed to estimate the prevalence and determinants of maternal mortality. This design

was appropriate for collecting quantitative data at a single point in time to describe existing maternal health conditions and associated risk factors in the region.⁹

Study Location

The study was conducted in the Adamawa Northern Senatorial Zone of Adamawa State, Nigeria. The zone comprises five Local Government Areas (LGAs), but the research focused on three, Maiha, Mubi North, and Mubi South, selected due to their severe maternal health challenges and poor accessibility. The area is predominantly rural, with agriculture as the main occupation, and is characterised by inadequate health infrastructure, frequent insecurity, and long distances to health facilities.¹⁰

Population and Sampling

The study population included women of reproductive age (15–49 years), traditional birth attendants (TBAs), and maternal healthcare providers (nurses, midwives, and Community Health Extension Workers [CHEWs]) residing in the selected LGAs. A sample size of 364 respondents was determined using the Yamane formula¹¹ with a 95% confidence level. A multistage sampling technique was used: first, three LGAs were purposively selected; then, two

wards were randomly selected from each LGA;

finally, households and respondents were chosen

via systematic and simple random sampling,

respectively.

Data Collection and Analysis

Data were collected using a structured questionnaire adapted from established maternal health assessment tools. The instrument covered socio-demographics, obstetric history, exposure to maternal mortality, and key determinants. It was validated by public health and reproductive health experts, and a pilot test in Hong LGA yielded a Cronbach's alpha of 0.82. Trained research assistants conducted face-to-face interviews to accommodate low literacy levels. Data were analysed using IBM SPSS Statistics version 25. Descriptive statistics (frequencies, percentages) summarised the data, and Chi-square (χ^2) tests identified associations between determinants and maternal mortality, with a significance level set at $p < 0.05$.

Ethical Considerations

Ethical approval was granted by the Adamawa State Ministry of Health Research Ethics Committee. Permissions were also obtained from LGA health authorities and community leaders. Participation was voluntary, anonymity was

assured, and informed consent was secured from all respondents.

Results

Socio-demographic Characteristics

All 364 questionnaires were completed and analysed, yielding a 100% response rate. As shown in Table 1, most respondents were aged 26–35 years (41.5%) and married (82.4%). Farming (38.7%) and petty trading (27.2%) were the primary occupations. A significant proportion had no formal education (46.2%), and over half (55.5%) lived more than 5 km from the nearest health facility. The majority (62.1%) reported a monthly income of less than ₦30,000, indicating widespread low socioeconomic status.

Prevalence and Reported Causes of Maternal Mortality

Over a quarter of respondents (27.5%) reported knowing of at least one maternal death in their community or family in the preceding five years. The leading cause reported was postpartum haemorrhage (32.4%), followed by eclampsia/preeclampsia (21.7%) and sepsis (16.5%) (Table 2).

Determinants of Maternal Mortality

Chi-square analysis revealed statistically significant associations between maternal

Table 1: Socio-demographic profile of respondents (n=364)

(ANC) ($\chi^2 = 18.42$, $p < 0.05$), and low

socioeconomic status ($\chi^2 = 9.27$, $p < 0.05$).

Variable	Category	Frequency	Percentage (%)
Age (years)	15–25	98	26.9
	26–35	151	41.5
	36–45	106	29.1
	46–49	9	2.5
Marital Status	Married	300	82.4
	Single	32	8.8
	Widowed	25	6.9
	Divorced	7	1.9
Education Level	No formal education	168	46.2
	Primary	97	26.6
	Secondary	44	12.1
	Tertiary	54	14.8
Occupation	Farming	141	38.7
	Petty trading	99	27.2
	Civil servant	54	14.8
	Others	70	19.2
Distance to health facility	< 2 km	61	16.8
	2–5 km	101	27.7
	> 5 km	202	55.5

Qualitative feedback from respondents also highlighted health system weaknesses, such as late referrals and a lack of emergency transport, as critical contributing factors.

Discussion

This study confirms that maternal mortality remains alarmingly high in the Adamawa Northern Senatorial Zone, consistent with national and regional estimates.^{3,10} The finding that 27.5% of respondents were aware of a recent maternal death underscores the profound impact of this crisis and highlights stark inequities in access to quality maternal healthcare.

The profile of causes aligns with established literature from Nigeria and sub-Saharan Africa,

Table 2: Reported causes of maternal deaths

where haemorrhage and hypertensive disorders

Cause of Maternal Death	Frequency	Percentage (%)
Postpartum haemorrhage	118	32.4
Eclampsia/preeclampsia	79	21.7
Sepsis/infection	60	16.5
Prolonged/obstructed labour	45	12.3
Unsafe abortion	38	10.4
Anaemia	24	6.7

are consistently leading direct causes of obstetric death.^{7,12,13} The high prevalence of these preventable conditions in Adamawa points to critical failures in the availability of emergency

obstetric care and skilled birth attendance. It reinforces the World Health Organization's stance that most maternal deaths are preventable with timely and effective clinical intervention.¹

mortality and several key determinants. These included distance to a health facility ($\chi^2 = 11.62$, $p < 0.05$), shortage of skilled birth attendants ($\chi^2 = 14.31$, $p < 0.05$), low utilisation of antenatal care

The identified determinants—long distances to health facilities, a shortage of skilled staff, and low ANC uptake—resonate strongly with the ‘three delays’ framework.⁵ Our findings are supported by other studies in rural Nigeria, which similarly identify delays in seeking care (due to cost and cultural factors), reaching care (due to transport issues), and receiving care (due to poorly resourced facilities) as the primary pathways to maternal death.¹⁴ The statistically significant link between distance and mortality ($\chi^2 = 11.62$, $p < 0.05$) corroborates a meta-analysis which found that women living more than 5 km from a facility were twice as likely to die from pregnancy-related complications.¹⁵

Conclusion and Recommendations

This study concludes that maternal mortality is a severe public health emergency in the Adamawa Northern Senatorial Zone, driven by both direct medical causes and entrenched socioeconomic and health system barriers. The findings demonstrate that maternal survival is intrinsically linked to poverty, weak health infrastructure, and geographical inaccessibility.

Consequently, a multi-pronged approach is urgently needed. We recommend that government and health agencies:

1. Equip primary healthcare centres in rural areas with essential life-saving commodities, including drugs for managing haemorrhage and eclampsia, and establish functional blood transfusion services.
2. Deploy and incentivise more skilled midwives and community health workers to underserved rural areas, supported by regular in-service training on emergency obstetric care.

Limitations

This study is subject to limitations. The reliance on self-reported data may introduce recall bias, particularly concerning past maternal deaths. The cross-sectional design does not permit causal inferences to be drawn. Furthermore, as the study was confined to three LGAs, the findings may not be generalisable to the entire state. Nonetheless, it provides crucial community-level evidence from a conflict-affected region, highlighting the need for future longitudinal research to better establish causal relationships between social determinants and maternal outcomes.

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