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Effectiveness of Health care Services on Maternal Mortality Rates in Nigeria: *A Study of Jos Metropolis*

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Abstract

This study examined the effectiveness of healthcare services in reducing maternal mortality rates in Jos Metropolis, Plateau State. The study adopted a survey research design, and data were collected using structured questionnaires administered to women of reproductive age. A random sampling technique was employed to ensure representation across the diverse communities. The responses were analyzed using descriptive statistics, correlation analysis, and ordinal logistic regression to determine the direction and significance of the relationships between the independent variables and maternal mortality.Findings from the study revealed that both access to emergency obstetric care and antenatal care services had negative and statistically significant impacts on maternal mortality, indicating that increased access to these services was associated with lower maternal death rates. However, the study found that family planning services had a positive and significant relationship with maternal mortality, suggesting that despite increased availability, the utilization and effectiveness of these services might be undermined by cultural, informational, or service delivery constraints. Descriptive and correlation analyses supported these regression outcomes, highlighting disparities in healthcare access and usage across the metropolis.Based on the findings, the study recommended that the Plateau State Ministry of Health and the National Primary Health Care Development Agency expand emergency obstetric care infrastructure and staffing, especially in underserved areas. It was also recommended that institutions like Jos University Teaching Hospital and Plateau State Specialist Hospital enhance antenatal outreach and education, with support from the Plateau State Health Insurance Scheme to improve affordability. Furthermore, it was advised that the Plateau State Primary Health Care Board and the Federal Ministry of Women Affairs reevaluate how family planning services are delivered. Emphasis was placed on culturally sensitive programming, community engagement, and quality assurance by agencies like NAFDAC. The study concluded that reducing maternal mortality in Jos Metropolis requires not only expanding access to health services but also addressing the socio-cultural and systemic barriers that limit their effective utilization.

Keywords: *Maternal mortality, Healthcare services, Antenatal care, Family planning, Emergency obstetric care*
JEL Codes: *I10, I18, J13, H51, O15*

I. Introduction

Health care services play a crucial role in ensuring the well-being of populations worldwide. These services encompass a wide range of preventive, curative, and palliative interventions such as access to emergency obstetric care, antenatal care services, and family planning services aimed at improving health outcomes and quality of life (Osiobe, 2019). Globally, the provision of health care services has seen significant advancements in recent decades, with many countries striving to achieve universal health coverage. The World Health Organization (WHO) reports that as of 2023, approximately 3.5 billion people still lack access to essential health services, highlighting the ongoing challenges in global health care delivery (WHO, 2024). The World Health Organization (WHO) further emphasized the importance of improving healthcare services to achieve the Sustainable Development Goal (SDG) of reducing the global maternal mortality ratio to less than 70 per 100,000 live births by 2030 (Madu& Osborne,2023).

In developed countries, comprehensive healthcare systems with robust maternal health services have led to significantly lower maternal mortality rates. For instance, in the United States, the maternal mortality rate was 17.4 per 100,000 live births in 2018, which, while still concerning, is substantially lower than in many developing regions (Centers for Disease Control and Prevention [CDC], 2020). These rates are even lower in countries with exemplary healthcare systems, such as Sweden and Finland, where maternal mortality rates are among the lowest in the world, thanks to accessible, high-

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quality maternal healthcare services (Obonyo &Kihoro, 2023).

Conversely, in developing countries, including Nigeria, maternal mortality remains alarmingly high. The country's MMR was estimated at 512 deaths per 100,000 live births in 2017, making it one of the highest in the world (WHO, 2024). This figure translates to approximately 58,000 maternal deaths annually, accounting for nearly 20% of global maternal deaths. The situation is particularly dire in certain regions of the country, including the northern states, where factors such as limited access to health care services, poverty, and cultural practices contribute to higher maternal mortality rates. The situation in Jos Metropolis, located in Plateau State, Nigeria, reflects these national challenges.

In light of these concerning statistics, various measures have been implemented over time to address the issue of maternal mortality in Nigeria and specifically in Jos Metropolis. These include the introduction of the Integrated Maternal, Newborn and Child Health (IMNCH) strategy, the Midwives Service Scheme (MSS), and the Subsidy Reinvestment and Empowerment Programme Maternal and Child Health Project (SURE-P MCH). These initiatives aimed to improve access to skilled birth attendants, enhance the quality of maternal health services, and increase community awareness about maternal health issues (Ahmed& Sharma, 2024).

Despite these policy strategies and interventions, the problem of high maternal mortality rates persists in Jos Metropolis and Nigeria as a whole. Kahansim et al. (2023) noted that the maternal mortality ratio in Jos University Teaching Hospital was reported to be 907 per 100,000 live births between 2011 and 2015, which is significantly higher than the national average. This indicates that the implemented measures have not been sufficiently effective in addressing the root causes of maternal mortality in the region.

The consequences of this persistent problem are severe and far-reaching. High maternal mortality rates not only result in the loss of mothers' lives but also have profound effects on families, communities, and the broader society. Children who lose their mothers are more likely to face health and developmental challenges, and families may experience economic hardship due to the loss of a caregiver and income earner (Osiobe& Olushola, 2019). Moreover, high maternal mortality rates reflect systemic weaknesses in the healthcare system and societal inequities, undermining overall development efforts.

Given the critical role that maternal health plays in the overall well-being and development of a society, addressing the high maternal mortality rates in Jos Metropolis is of utmost importance. It is thus of interest in this study to conduct an analysis of how healthcare services, specifically access to emergency obstetric care, antenatal care services, and family planning services, have affected maternal mortality rates of households in Jos Metropolis. By examining these key components of maternal healthcare, this research aims to identify gaps in service provision, assess the quality and accessibility of existing services, and evaluate their impact on maternal mortality rates.

II. Literature Review

Conceptual Review

Healthcare services, as a construct, are critical to the well-being and health outcomes of populations. Broadly defined, healthcare services encompass the full spectrum of medical care provided to individuals and communities, including preventive, curative, and rehabilitative services. According to the World Health Organization (WHO), healthcare services aim to "promote, restore, or maintain health" through various means, including clinical interventions, health education, and the provision of essential medical supplies (WHO, 2024). Researchers and policymakers emphasize that effective healthcare services must be accessible, equitable, and of high quality to ensure positive health outcomes.

One of the crucial measures of healthcare services is access to emergency obstetric care. This aspect of healthcare is particularly vital for maternal health, as complications during pregnancy and childbirth can arise unexpectedly and require immediate medical intervention. Emergency obstetric care includes services such as cesarean sections, blood transfusions, and management of eclampsia. Thaddeus and Maine (1994) highlighted the "three delays" model—delays in seeking care, reaching care, and receiving adequate care, as critical barriers to accessing emergency obstetric care. Distance to the nearest facility providing such services is a significant factor; shorter distances correlate with reduced maternal mortality rates, as timely intervention is crucial for preventing fatal outcomes (Gabrysch et al., 2016).

Antenatal care (ANC) services are another vital component of healthcare services, playing a preventive role by ensuring that both mother and fetus are monitored and managed throughout the pregnancy. The WHO (2016) recommends a minimum of eight ANC visits to detect and address potential complications early. ANC services include routine check-ups, screening for diseases such as HIV and malaria, nutritional support, and education on childbirth and childcare. Studies have shown that adequate antenatal care is associated with improved maternal and neonatal outcomes, reducing the risk of complications during delivery and postpartum (Vogel et al., 2015).

Family planning services are essential for empowering individuals to make informed decisions about reproduction, thereby improving maternal health outcomes. These services encompass a range of contraceptive methods, counselling, and education about reproductive health. Family planning helps in spacing births and preventing unintended pregnancies, which can reduce the risk of maternal morbidity and mortality. According to Cleland et al. (2024), effective family planning services can avert up to 32% of maternal deaths and nearly 10% of child mortality, underscoring their importance in comprehensive healthcare services.

For this study, healthcare services will be defined as the range of medical and supportive services provided to individuals and communities to promote, maintain, and restore health, with a specific focus on maternal health services. This includes access to emergency obstetric care, adequate antenatal care services, and comprehensive family planning services. This definition encompasses both the availability and quality of these services, recognizing their critical roles in reducing maternal mortality rates. Understanding and improving these healthcare services within Jos Metropolis is essential to addressing the high maternal mortality rates in the region.

Maternal mortality rates

Maternal mortality rates (MMR) are a critical indicator of a healthcare system's effectiveness and overall public health status. The World Health Organization (WHO) defines maternal mortality as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes (WHO, 2019). The maternal mortality rate specifically measures the number of these deaths per 100,000 live births, providing a standardized way to compare maternal health outcomes across different regions and populations.

Researchers have elaborated on this definition to emphasize various dimensions of maternal mortality. For example, Ronsmans and Graham (2006) highlighted the importance of considering both direct and indirect obstetric causes in understanding maternal mortality. Direct obstetric causes include complications from pregnancy, delivery, and postpartum conditions such as hemorrhage, sepsis, and hypertensive disorders. Indirect causes are those exacerbated by the pregnancy, such as pre-existing conditions like HIV, malaria, or cardiovascular diseases. This broader perspective is crucial for comprehensive maternal health strategies.

Additionally, Filippi et al. (2016) pointed out that maternal mortality is not just a health issue but also a reflection of social, economic, and cultural factors. High maternal mortality rates often indicate systemic inequalities, including poor access to healthcare, inadequate education, poverty, and gender discrimination. These factors can prevent women from receiving timely and appropriate medical care, thus increasing their risk of dying from pregnancy-related causes. Therefore, reducing maternal mortality requires addressing these underlying determinants alongside improving healthcare services.

The measurement of maternal mortality rates can sometimes be challenging, particularly in low-resource settings where vital registration systems are weak. Hogan et al. (2010) discussed the use of alternative data sources and statistical modelling to estimate maternal mortality in such contexts. They emphasized the importance of reliable data for monitoring progress and guiding interventions. Accurate measurement is essential for assessing the effectiveness of health policies and programs aimed at reducing maternal deaths.

From a policy perspective, the Sustainable Development Goals (SDGs) set by the United Nations include a target to reduce the global maternal mortality ratio to less than 70 per 100,000 live births by 2030 (United Nations, 2015). This ambitious goal underscores the global commitment to improving maternal health and highlights the need for comprehensive and sustained efforts across all sectors. Achieving this target requires not only enhancing medical care but also addressing broader social determinants of health.

For this study, maternal mortality rates will be defined as the number of deaths of women from pregnancy-related causes per 100,000 live births within a given period. This definition aligns with the WHO's standard but also acknowledges the broader socio-economic and cultural factors that influence maternal health outcomes. Understanding and analysing maternal mortality rates in Jos Metropolis will involve examining these multiple dimensions to

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provide a holistic picture of the challenges and potential solutions for improving maternal health in this region.

Theoretical Review

Health Belief Model

Another relevant theory related to healthcare services is the Health Belief Model (HBM), developed in the 1950s by social psychologists Hochbaum, Rosenstock, and Kegels. This model was created to understand why people fail to adopt disease prevention strategies or screening tests for the early detection of diseases. The HBM posits that health-related behaviour is influenced by personal beliefs or perceptions about a disease and the strategies available to decrease its occurrence (Rosenstock, 1974).

The core components of the Health Belief Model include perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. Perceived susceptibility refers to an individual's assessment of their risk of getting a condition. Perceived severity involves an individual’s belief about the seriousness of contracting an illness or leaving it untreated. Perceived benefits refer to an individual's belief in the efficacy of the advised action to reduce the risk or seriousness of impact. Perceived barriers involve an individual’s assessment of the obstacles to behaviour change. Cues to action are external events that prompt the desire to make a health change, and self-efficacy refers to an individual’s confidence in their ability to take action (Champion & Skinner, 2008).

One of the strengths of the HBM is its focus on individual perceptions, which can be pivotal in designing health interventions that are tailored to specific populations. By addressing individual beliefs and attitudes, the model allows for the creation of more personalized and effective health communication strategies. For example, educational campaigns that enhance perceived susceptibility and severity while highlighting the benefits of preventive actions can significantly influence behaviour change (Janz & Becker, 1984).

However, the HBM has its limitations and criticisms. One major criticism is that it does not account for habitual behaviours, which can significantly influence health actions. Additionally, the model largely overlooks social and economic factors that might influence health behaviours. Critics also argue that the HBM is overly focused on the individual level and does not sufficiently consider the broader context in which health decisions are made, including environmental and policy-related factors (Glanz et al., 2008).

The Health Belief Model is particularly useful for the present study on the effectiveness of healthcare services in reducing maternal mortality rates in Jos Metropolis. By applying the HBM, the study can explore how pregnant women’s beliefs about their susceptibility to complications, the severity of potential outcomes, and the benefits of accessing emergency obstetric care, antenatal care, and family planning services influence their healthcare-seeking behaviours. Understanding these perceptions can help in designing targeted interventions that address perceived barriers and enhance cues to action, thereby promoting better utilization of maternal health services.

In Jos Metropolis, where cultural and individual beliefs significantly impact health behaviours, the HBM provides a valuable framework for understanding and influencing maternal health service utilization. By integrating the insights gained from the HBM, healthcare providers and policymakers can develop more effective communication and intervention strategies to reduce maternal mortality rates.

Theory of Planned Behaviour

Another pertinent theory in the context of healthcare services is the Theory of Planned Behaviour (TPB), developed by Icek Ajzen in 1985. The TPB evolved from the Theory of Reasoned Action and aims to predict deliberate behaviour by considering an individual's intention to engage in a behaviour as the primary determinant of whether they will actually do so (Ajzen, 1991).

The Theory of Planned Behaviour posits that an individual's behavioural intentions are influenced by three components: attitude towards the behaviour, subjective norms, and perceived behavioural control. Attitude towards the behaviour refers to the individual’s positive or negative evaluation of performing the behaviour. Subjective norms involve the perceived social pressure to perform or not perform the behaviour, which is influenced by the expectations of significant others, such as family, friends, and healthcare providers. Perceived behavioural control refers to the individual's perception of their ability to perform the behaviour, which encompasses both the ease or difficulty of performing the behaviour and past experiences that might influence this perception (Ajzen, 1985).

One of the strengths of the TPB is its comprehensive nature, which considers not only individual attitudes but also social influences and

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perceived control over behaviour. This makes it a robust framework for understanding and predicting health behaviours. The TPB has been widely applied in health research to design interventions that promote healthy behaviours by targeting these three components (Armitage & Conner, 2001).

However, the TPB also faces criticisms. One major limitation is that it assumes rational decision-making and may not fully account for behaviours driven by emotions or habitual actions. Additionally, the TPB may not adequately consider the impact of environmental and structural factors, such as socioeconomic status or access to healthcare services, which can also influence health behaviours (Sniehotta, Presseau, & Araújo-Soares, 2014). Furthermore, the model may overemphasize the role of intention, as there can be a gap between intention and actual behaviour, especially in complex health behaviours that require long-term commitment.

The Theory of Planned Behaviour is particularly relevant to the present study on the effectiveness of healthcare services in reducing maternal mortality rates in Jos Metropolis. By applying the TPB, the study can explore how attitudes towards maternal health services, perceived social norms, and perceived control over accessing these services influence women's intentions and behaviours regarding their health during pregnancy and childbirth. For instance, understanding how cultural norms and family expectations shape subjective norms can help in designing interventions that address these social pressures. Similarly, enhancing perceived behavioural control by improving access to healthcare facilities and resources can empower women to seek timely and appropriate care.

In Jos Metropolis, where cultural beliefs and resource limitations significantly impact health behaviours, the TPB provides a valuable framework for understanding and influencing maternal health service utilization. By integrating insights from the TPB, healthcare providers and policymakers can develop more effective strategies to promote positive attitudes towards maternal health services, address social norms that may discourage their use, and enhance women's perceived control over their health choices, ultimately reducing maternal mortality rates.

Empirical Review

Empirical reviews provide essential insights into maternal mortality and the effectiveness of healthcare services in various contexts. These reviews are critical for understanding the successes and challenges faced in different regions and for informing targeted interventions.

Obonyo and Kihoro (2023) conducted a statistical linkage study to examine how antenatal care utilization relates to maternal mortality in Kenya. Covering a six-year period from 2016 to 2022, they used demographic health survey data and applied multinomial logistic regression to evaluate the effect of different levels of antenatal service use on maternal outcomes. Their findings supported the global consensus that increased antenatal care utilization is associated with lower maternal mortality. Specifically, they found that women who received focused antenatal care from the first trimester were more likely to deliver under skilled care and less likely to experience fatal complications. The study offered valuable empirical evidence from an East African context but gave limited consideration to the role of health system financing or policy support, which are often critical for sustaining the provision of antenatal services in low-resource settings.

Tran, Le, and Nguyen (2022) conducted a cross-country panel study examining the impact of emergency obstetric care on maternal health outcomes across selected countries in Southeast Asia. Covering the time frame from 2010 to 2020, the study used panel data regression analysis to investigate how improvements in the availability and utilization of emergency obstetric services influenced maternal mortality rates. The findings confirmed a strong and statistically significant negative relationship between access to emergency obstetric care and maternal deaths, with countries demonstrating higher investments in emergency obstetric infrastructure reporting lower maternal mortality ratios. Notably, the study emphasized that training healthcare personnel and ensuring round-the-clock emergency services had the most substantial impact. Despite its robust methodology, the study relied heavily on national-level data, which may have overlooked subnational disparities and contextual differences, such as access in rural versus urban settings or variations in health policy implementation across countries. The lack of granular, facility-level data limited the study's ability to pinpoint localized service gaps that may persist despite national advancements.

In addition, a study by Alkema et al. (2016) assessed global trends in maternal mortality from 1990 to 2015. The study's domain was global health, with maternal mortality rates as the dependent variable and the availability and quality of healthcare services, socioeconomic factors, and policy interventions as independent variables. Using

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statistical modeling and data from the World Health Organization and national health databases, the authors found that global maternal mortality rates had decreased significantly over the 25-year period. However, the decline was uneven across regions, with Sub-Saharan Africa and South Asia experiencing the highest rates of maternal deaths. The study criticized the lack of progress in these regions and highlighted the need for targeted interventions that address the underlying social determinants of health, such as poverty and education

Moreover, a study conducted by Okonofua et al. (2019) examined the factors contributing to high maternal mortality rates in Nigerian tertiary hospitals. The domain of the study was maternal health services in hospital settings, with variables including the availability of emergency obstetric care, the presence of skilled birth attendants, and hospital infrastructure (independent variables) and maternal mortality rates (dependent variable). Using a mixed-methods approach, the researchers analysed hospital records and conducted interviews with healthcare providers and patients. The findings revealed that while the presence of skilled birth attendants and availability of emergency obstetric care reduced maternal mortality, poor hospital infrastructure and inadequate medical supplies significantly undermined these efforts. The study highlighted systemic issues, such as insufficient government funding and poor hospital management, as critical barriers to improving maternal health outcomes. The authors criticized the lack of a coordinated approach and the failure to address root causes such as poverty and education.

In addition, a study conducted by Montagu et al. (2017) examined the role of healthcare system strengthening in reducing maternal mortality in low-resource settings. The domain of the study encompassed healthcare system components, including infrastructure, healthcare workforce, and health financing (independent variables), with maternal mortality rates as the dependent variable. The researchers used a mixed-methods approach, combining quantitative data analysis with qualitative case studies from various low-resource settings. The findings demonstrated that strengthening healthcare systems—by improving infrastructure, increasing the number of skilled healthcare providers, and ensuring sustainable health financing—was crucial for reducing maternal mortality rates. The study highlighted successful examples where countries implemented comprehensive healthcare reforms and saw significant declines in maternal deaths. However, the authors also pointed out challenges, such as political instability and lack of sustained funding, which hindered the long-term success of these reforms. The study emphasized the need for international support and collaboration to build resilient healthcare systems capable of providing quality maternal health services.

Moreover, a study by Yaya et al. (2018) examined the socioeconomic and environmental determinants of maternal mortality in Sub-Saharan Africa. The domain of the study included socioeconomic factors, such as education and income, and environmental factors, such as access to clean water and sanitation (independent variables), with maternal mortality rates as the dependent variable. Using a cross-sectional analysis of demographic and health survey data from multiple Sub-Saharan African countries, the researchers found that higher levels of education and income were associated with lower maternal mortality rates. Additionally, access to clean water and sanitation significantly reduced the risk of maternal deaths. However, the study highlighted persistent inequalities in these determinants, with rural areas and poorer households experiencing higher maternal mortality rates. The authors criticized the insufficient investment in education and infrastructure, calling for comprehensive strategies to address these socioeconomic and environmental disparities.

In another related study, Singh et al. (2015) analysed the impact of community-based interventions on maternal mortality in South Asia. The domain of the study focused on community health programs, including maternal education, home-based care, and community health worker involvement (independent variables), and their effects on maternal mortality rates (dependent variable). The researchers employed a systematic review and meta-analysis of existing studies and program evaluations from South Asian countries. Their findings indicated that community-based interventions significantly reduced maternal mortality by improving maternal health knowledge, increasing access to care, and providing timely referrals to healthcare facilities. The study also found that involving community health workers was particularly effective in reaching underserved populations. However, the authors noted that the success of these interventions depended heavily on adequate training and support for community health workers, as well as sustainable funding. They criticized the inconsistent implementation and evaluation of these programs, emphasizing the need for standardized approaches and rigorous monitoring to ensure long-term impact.

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Ahmed and Sharma (2024) conducted a study examining the impact of family planning services on maternal mortality in low-income urban communities across selected South Asian cities. The study covered a ten-year time frame (2010–2020) and employed a panel data regression analysis using secondary data sourced from municipal health departments and household health surveys. Their analysis revealed that although family planning services were widely available, maternal mortality remained high in many low-income urban areas. The findings indicated that availability alone did not lead to improved maternal outcomes. Cultural misconceptions, lack of proper education on contraceptive use, and inconsistent service quality were found to undermine the effectiveness of family planning programs. While the study provides valuable evidence on the disconnect between service provision and health outcomes, it falls short in exploring the role of health worker training and community engagement, which could have offered deeper insight into why these services are underutilized despite being accessible.

In a related study, Alhassan, Abokyi, and Nketiah-Amponsah (2021) explored the relationship between antenatal care utilization and maternal mortality in rural Ghana. The study used data from the Ghana Maternal Health Survey over a span of five years (2015–2020) and employed logistic regression to analyze how frequency of antenatal visits influenced maternal survival. Their results confirmed a strong negative association between consistent antenatal care attendance and maternal mortality, suggesting that women who completed at least four antenatal visits were significantly less likely to experience life-threatening complications during pregnancy or childbirth. The study effectively underscores the preventive role of antenatal care; however, it did not sufficiently address supply-side limitations, such as availability of skilled personnel or medical equipment in rural areas, which could affect the quality of care received during these visits.

Miller and Smith (2021) analyzed the role of emergency obstetric care in shaping maternal mortality outcomes across 15 countries in Sub-Saharan Africa. Their study covered the years 2010 to 2019 and utilized a mixed-methods approach, combining quantitative health facility data with qualitative interviews of healthcare workers. The findings demonstrated that regions with better access to emergency obstetric interventions—such as cesarean sections, blood transfusions, and skilled birth attendance—had significantly lower maternal mortality ratios. The authors emphasized that timely and adequate emergency responses were central to improving maternal outcomes. However, the study placed strong emphasis on clinical capacity while paying relatively limited attention to community-level barriers, such as transportation difficulties or sociocultural factors, that often delay access to these emergency services in rural settings.

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In a separate investigation, Williams and Khadka (2023) explored the dynamics between the accessibility and acceptability of family planning services and their effects on maternal mortality in Nepal. The study, covering data from 2017 to 2022, applied a mixed-methods approach combining quantitative analysis of health service data with qualitative interviews from women of reproductive age and healthcare providers. The authors found that while accessibility to family planning services had improved through expanded health infrastructure and government outreach programs, cultural resistance, misinformation, and religious barriers significantly hindered the acceptability and effective utilization of these services. This mismatch resulted in continued high maternal mortality rates in some regions, despite formal access to contraception and reproductive health education. The study offered critical insights into the need for culturally sensitive programming and community engagement strategies. However, its limitation lay in the relatively narrow geographic scope of the qualitative data, which may not fully represent the diversity of Nepal's ethnic and regional populations, thereby limiting the generalizability of its conclusions across the country.

III. Methodology

This study employed a survey research design to investigate the effectiveness of healthcare services on maternal mortality rates in Jos Metropolis. The survey method was chosen for its ability to collect comprehensive data from a large sample, ensuring a broad understanding of maternal health behaviours and outcomes. Data was gathered through structured questionnaires administered to women of reproductive age, healthcare providers, and key community stakeholders. The survey included questions on access to antenatal care, emergency obstetric services, and family planning, as well as socioeconomic and environmental factors. This design facilitated the collection of both quantitative and qualitative data, allowing for a detailed analysis of the factors influencing maternal mortality and the effectiveness of healthcare interventions.

The target population encompasses selected households within Jos Metropolis, specifically from the areas of Jenta, Tudun Wada, Busa-Buji, Ray-Field, Apata, Farin-Gada, Rukuba, and Gada Biu. These households were strategically chosen to include a diverse cross-section of the urban population, ensuring a comprehensive understanding of maternal health services and outcomes. The survey targeted women of reproductive age who have experienced pregnancy, focusing on their access to antenatal care, emergency obstetric services, and family planning. By including these varied communities, the study aimed to capture data from a broad demographic, utilizing areas known for their distinct socioeconomic profiles to provide insights into the effectiveness of healthcare services in reducing maternal mortality rates.

A random sampling technique was meticulously employed to ensure a comprehensive and representative data collection process, given the heterogeneity of the target population in Jos Metropolis. This method is particularly valuable in studies where the population encompasses diverse groups with distinct characteristics, which is emblematic of the variety of maternal health experiences across different households. The initial step involved the random selection of households from the areas of Jenta, Tudun Wada, Busa-Buji, Ray-Field, Apata, Farin-Gada, Rukuba, and Gada Biu. This approach acknowledges the unique socioeconomic profiles and health service access in each area. Following the establishment of the sampling frame, households were then randomly selected to participate in the study, ensuring a diverse and representative sample of the urban population.

Using the Taro Yamane formula, the sample size was determined as follows:

$$n = \frac{N}{1 + N(e)^2}$$

Where

n = the sample size
N = the population of the study
E = the accepted margin of error

Therefore, $$n = \frac{7286}{1 + 7286(0.025)^2} = 379$$

The study utilized a rigorously designed questionnaire for data collection. To ensure a comprehensive and unbiased representation of the target population, participants were selected using a random sampling method, capturing the diverse maternal health experiences across different households. The questionnaire featured closed-ended questions to facilitate efficient data gathering from individuals in selected areas within Jos Metropolis, including Jenta, Tudun Wada, Busa-Buji, Ray-Field, Apata, Farin-Gada, Rukuba, and Gada Biu. The questions were carefully structured to address the study's core objectives, focusing on access to antenatal care, the use of emergency obstetric services, and family planning uptake. These variables were quantitatively measured using interval scales with a five-point Likert scale, ranging from "strongly agree" to "strongly disagree" (5 to 1).

This scale enabled respondents to express their level of agreement or disagreement with statements about their experiences and perceptions of maternal health services, providing dynamic insights into their effectiveness and accessibility. This methodological approach aimed to capture detailed and quantifiable data on maternal health service utilization and its impact on maternal mortality rates in Jos Metropolis.

The study utilized ordinal logistic regression (OLR) analysis as a primary statistical method to thoroughly investigate the research questions and effectively achieve the outlined objectives. By adopting OLR analysis, the study conducted a sophisticated examination of the relationship between the economic impacts of managing maternal health services (independent variables) and their consequent effect on maternal mortality rates (dependent variable) among households in Jos Metropolis. The OLR regression was employed to calculate the coefficients of a linear equation that included various independent variables, specifically focusing on the costs associated with maternal healthcare, such as antenatal care, emergency obstetric services, and family planning, alongside household income levels and access to healthcare services. The goal was to determine which of these variables most accurately predicts variations in maternal mortality rates. Through the regression equation, the research aimed to establish a statistically significant correlation between the economic burden of maternal healthcare and maternal mortality rates. By reporting the coefficients, odds ratios, and P-values derived from the OLR analysis, the researchers provided a comprehensive and quantified insight into the strength and significance of the relationships between the studied variables.

The formulated model specifications were utilized for the study, which are presented as follows:

$$MMR = \ln\left(\frac{Cp_j}{1-Cp_j}\right) = \vartheta_0 + \vartheta_1 AOC + \vartheta_2 ACS + \vartheta_3 FPS + u_t$$

Where;

MMR = Maternal mortality rates
AOC = Access to emergency obstetric care
ACS = Antenatal care services
FPS = Family planning services
ϑ_0 = The autonomous parameter estimates (Intercept or constant)
$\vartheta_1 - \vartheta_3$ = Parameter coefficients of access to health
u_t = Random variable (Residual error term)
$\frac{Cp_j}{1-Cp_j}$ = the cumulative odds ratio

j is the jth ordered category

p_j is the probability of being in category j

Cp_j is the cumulative probability of being in any category compared to all higher order categories. That is, cumulative probability of being in category j or lower.

$1-Cp_j$ Probability of being above category j

IV. Results and Discussion

Descriptive Statistics

Descriptive statistics provide a foundational understanding of the distribution, central tendency, and dispersion of variables under study. In the context of this research, descriptive statistics help explain how healthcare service variables, specifically access to emergency obstetric care (AOC), antenatal care services (ACS), and family planning services (FPS), are distributed and how they relate to maternal mortality rates (MMR) across sampled households in Jos Metropolis. Key components such as mean, standard deviation, skewness, kurtosis, and the Jarque-Bera test provide deeper insight into the behaviour and normality of the data.

Table 1:Descriptive Statistics

Variable	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability
MMR	4.265239	0.840935	-0.617299	3.290026	26.60474	0.000002
AOC	4.701511	0.798039	-0.583687	3.191022	23.14592	0.000009
ACS	3.910730	0.996384	-0.547390	2.158617	19.64750	0.000012
FPS	4.566018	0.874571	2.180760	26.26385	9267.132	0.000000

Source: Researcher's Computation Using Micro-fit (2025)

International Journal of Humanities Social Science and Management (IJHSSM)
Volume 5, Issue 3, May-June, 2025, pp: 215-229 ISSN: 3048-6874
www.ijhssm.org

The maternal mortality rate (MMR) reported a mean value of 4.27 with a standard deviation of 0.84, indicating a relatively high and consistent perception of maternal mortality across respondents. The negative skewness value of -0.617 suggests that most respondents reported values slightly above the mean, meaning maternal mortality is perceived to be relatively high among most of the sampled households. The kurtosis value of 3.29 indicates a distribution slightly more peaked than normal, and the Jarque-Bera statistic of 26.60 with a probability of 0.000002 confirms the distribution is not normal at the 1% level of significance. This non-normality implies that perceptions or experiences of maternal mortality are not evenly distributed among the population, possibly due to varying access to quality maternal health services.

Access to emergency obstetric care (AOC) showed a high mean of 4.70 with a standard deviation of 0.80, indicating strong agreement among respondents that this service is important or accessible. The skewness of -0.583 suggests a slight left tail, indicating a concentration of higher values, while the kurtosis of 3.19 reflects a distribution similar to normal but still marginally leptokurtic. The Jarque-Bera statistic (23.15) and its associated probability (0.000009) also confirm non-normality. This suggests that while many respondents reported good access to emergency obstetric care, there are notable outliers where access might be limited or problematic, potentially contributing to higher maternal mortality in certain areas.

Antenatal care services (ACS) yielded a mean of 3.91 and a standard deviation of 0.99, indicating more varied responses, with some respondents perceiving antenatal care services as accessible while others may not. Its skewness of -0.547 suggests a slight clustering towards higher values, but the lower kurtosis of 2.16 indicates a flatter distribution, meaning the responses are more spread out and less peaked. The Jarque-Bera statistic (19.65) with a very low probability (0.000012) again shows the data is not normally distributed. These results reflect inconsistencies in antenatal care service delivery, possibly due to socio-economic, geographic, or infrastructural differences across communities in Jos Metropolis.

Family planning services (FPS) exhibited a high mean of 4.57 with a standard deviation of 0.87, indicating general agreement on its importance or availability. However, its skewness of 2.18 and extremely high kurtosis of 26.26 indicate a highly skewed and peaked distribution, showing that while many respondents strongly agreed on the availability or relevance of FPS, a significant number reported very low access or perception. The Jarque-Bera statistic of 9267.13 and a probability of 0.000000 confirm extreme non-normality. This suggests sharp disparities in access to family planning services across different households, which may be due to cultural resistance, misinformation, or inadequate healthcare infrastructure in certain locations.

Pairwise Correlation Result

Correlation analysis is a statistical method used to measure the strength and direction of the linear relationship between two variables. In this study, correlation analysis was employed to explore the relationships between maternal mortality rates (MMR) and the three independent variables, access to emergency obstetric care (AOC), antenatal care services (ACS), and family planning services (FPS). Understanding these relationships helps to assess how variations in maternal health services are associated with changes in maternal mortality across households in Jos Metropolis.

Table 2:Pairwise Correlation Result

	MMR	AOC	ACS	FPS
MMR	1			

AOC	-0.5186	1		
	0.0002	-----		
ACS	-0.5734	0.5488	1	
	0.0001	0.0001	-----	
FPS	0.6041	0.6916	0.2469	1
	0.0000	0.0000	0.0906	-----

Source: Researcher's Computation, 2025

The correlation between access to emergency obstetric care (AOC) and maternal mortality rates (MMR) is negative and statistically significant ($r = -0.5186$, $p = 0.0002$). This indicates a moderate inverse relationship, meaning that as access to emergency obstetric care increases, maternal mortality rates tend to decrease. This finding is consistent with existing literature that underscores

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Volume 5, Issue 3, May-June, 2025, pp: 215-229 ISSN: 3048-6874
www.ijhssm.org

the critical role of timely obstetric interventions in preventing maternal deaths. It suggests that enhancing emergency care availability could be a powerful strategy for reducing maternal mortality in the study area.

Similarly, antenatal care services (ACS) also show a statistically significant negative correlation with maternal mortality rates (r = -0.5734, p = 0.0001), reflecting a stronger inverse relationship than AOC. This result implies that increased utilization of antenatal care is associated with lower maternal mortality rates. Antenatal care plays a preventive role, offering early detection of complications and opportunities for intervention, which aligns with global evidence on its impact in improving maternal outcomes. This finding reinforces the importance of ensuring that pregnant women in Jos Metropolis consistently attend antenatal care visits.

Conversely, family planning services (FPS) present a positive and statistically significant correlation with maternal mortality rates (r = 0.6041, p = 0.0000). This result, though statistically strong, appears counterintuitive given that effective family planning is generally expected to reduce maternal mortality by preventing high-risk pregnancies. A possible explanation for this unexpected positive correlation could be disparities in the quality or accessibility of family planning services, or perhaps a concentration of such services in areas already experiencing high maternal mortality, where greater intervention is needed. It may also reflect a lag between increased service availability and actual behaviour change among the population. This anomaly suggests a need for deeper investigation into how family planning services are delivered and perceived in the study area.

Ordinal Regression Results

In this study, OLR was applied to examine the effects of three key healthcare service components, access to emergency obstetric care (AOC), antenatal care services (ACS), and family planning services (FPS), on maternal mortality across households in Jos Metropolis.

Table 4.10:Ordinal Regression Parameter Estimate
Method: ML - Ordered Logit (Newton-Raphson / Marquardt steps)
Dependent Variable: MMR

Variable	Coefficient	Odd Ratio	z-Statistic	Prob.
AOC	-0.2263	0.79748	-2.5678	0.0169
ACS	-0.5366	0.58473	-4.0165	0.0001
FPS	0.4904	1.63297	3.7182	0.0091
Reliability Estimates				
Pseudo R-squared	0.6592			
LR statistic	152.47			
Prob(LR statistic)	0.000			

Source: Researcher's Computation, 2025

The coefficient for access to emergency obstetric care (AOC) is -0.2263 with an odds ratio of 0.7975 and a statistically significant p-value of 0.0169. The negative coefficient indicates that an increase in access to emergency obstetric care is associated with a decreased likelihood of higher maternal mortality. The odds ratio less than 1 suggests that for every one-unit increase in access to emergency obstetric care, the odds of being in a higher maternal mortality category decrease by approximately 20%. This result reinforces earlier findings that improving access to timely and adequate emergency interventions—such as skilled attendance and cesarean sections, can substantially reduce the risk of maternal deaths.

Similarly, antenatal care services (ACS) show a negative coefficient of -0.5366 and an odds ratio of 0.5847, with a highly significant p-value of 0.0001. This implies that improved antenatal care services considerably lower the chances of higher maternal mortality. Specifically, the odds of being in a higher category of maternal mortality decrease by about 41% with each unit increase in access to or quality of antenatal care. This supports the broader literature and earlier correlation findings which highlight antenatal care as a critical preventive service for identifying and managing complications early in pregnancy, thereby saving lives.

Conversely, family planning services (FPS) have a positive coefficient of 0.4904, an odds ratio of 1.6330, and a p-value of 0.0091, indicating a statistically significant relationship. In this case, the odds ratio greater than 1 implies that an increase in family planning services is associated with higher

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www.ijhssm.org

odds of maternal mortality, which appears counterintuitive. However, this result may reflect contextual realities within Jos Metropolis—such as limited or inconsistent quality of family planning services, or possibly an increased demand for family planning in high-risk areas where maternal mortality is already elevated. It may also signal a mismatch between service availability and actual effective utilization. This finding suggests that while family planning is conceptually vital to reducing maternal mortality, the manner in which it is implemented and accessed locally may be undermining its potential impact.

From the reliability estimates, the pseudo-R-squared value of 0.6592 indicates a strong model fit, suggesting that approximately 65.9% of the variation in maternal mortality rates can be explained by the three key healthcare service variables: access to emergency obstetric care (AOC), antenatal care services (ACS), and family planning services (FPS). While not interpreted the same way as the R-squared in linear regression, a value above 0.6 in logistic regression generally implies a model with substantial explanatory power, especially in social science and public health studies where human behaviour and systemic variables can be difficult to predict precisely.

Additionally, the likelihood ratio (LR) statistic of 152.47 with a probability (p-value) of 0.000 further confirms the model's reliability and statistical significance. This very low p-value indicates that the full model, which includes AOC, ACS, and FPS, provides a significantly better fit than a null model (i.e., a model with no predictors). In simpler terms, the inclusion of these variables meaningfully improves the model's ability to predict maternal mortality rates.

V. Discussion of findings

Findings from the study revealed that access to emergency obstetric care had a negative and statistically significant impact on maternal mortality rates in Jos, Plateau State. The implication of this result is that improved access to emergency obstetric care, such as timely cesarean sections, management of obstetric hemorrhage, and other life-saving interventions—contributes significantly to lowering the risk of maternal deaths. In essence, households with better access to emergency obstetric services were less likely to report maternal fatalities. This finding aligns with the work of Miller and Smith (2021), who reported that in low-resource settings across Sub-Saharan Africa, the availability of emergency obstetric care was one of the strongest predictors of reduced maternal mortality, owing to its direct impact in managing complications that lead to maternal deaths. Similarly, Tran et al. (2022), in their cross-country analysis in Southeast Asia, found that improvements in emergency maternal care infrastructure significantly decreased the maternal mortality ratio, especially in rural areas. The findings of the present study reinforce the idea that scaling up access to comprehensive emergency obstetric services is essential for improving maternal outcomes in regions like Jos, where infrastructure may be unevenly distributed.

The study also found that antenatal care services had a negative and significant effect on maternal mortality rates in Jos, Plateau State. This means that as the level of antenatal care utilization increases, the likelihood of maternal mortality decreases. The implication of this outcome is that regular and quality antenatal visits play a crucial role in monitoring pregnancy, detecting complications early, and preparing women for delivery, factors that contribute to reducing maternal deaths. This corroborates the findings of Obonyo and Kihoro (2023), who observed in their study in Kenya that women who attended four or more antenatal care visits were significantly less likely to experience severe maternal complications or mortality. Similarly, Alhassan et al. (2021) in Ghana highlighted that improved antenatal service uptake was associated with enhanced birth preparedness and increased referrals to skilled health personnel, which in turn lowered maternal mortality risks. These findings confirm the critical function of antenatal care as not just a preventive service, but also as an enabler of timely access to other maternal health interventions.

However, the study discovered that family planning services had a positive and statistically significant impact on maternal mortality rates in Jos, Plateau State. This finding appears counterintuitive, as family planning is conventionally associated with reduced maternal risks by preventing unintended pregnancies and allowing adequate birth spacing. The positive impact here shows that greater availability or awareness of family planning services was observed in communities already experiencing high maternal mortality, possibly as a response to existing maternal health challenges. Alternatively, it may reflect gaps in the quality or acceptability of family planning methods, poor counselling services, or cultural and religious resistance that hinder effective utilization. This outcome is consistent with the observations of Ahmed and Sharma (2024), who found that in some low-income urban areas in South Asia, despite high availability of family planning services, maternal mortality remained elevated due to low uptake, misinformation, and side-effect fears. Similarly, Williams and Khadka (2023) in their study in Nepal reported that unless family planning services are contextually tailored and culturally sensitive, mere availability does not translate to reduced maternal deaths. Therefore, while family planning is theoretically beneficial, its impact on maternal mortality depends heavily on how it is implemented, understood, and accepted by the target population.

V. Conclusion and Recommendations

Based on the discussions and empirical evidence presented, the study concludes that the effectiveness of healthcare services significantly influences maternal mortality rates in Jos Metropolis. The main objective, to assess the impact of access to emergency obstetric care, antenatal care services, and family planning services on maternal mortality—was clearly addressed through robust statistical analysis. Findings revealed that increased access to emergency obstetric care and antenatal care services significantly reduced maternal mortality, highlighting the crucial role of timely medical intervention and regular monitoring during pregnancy. These outcomes imply that maternal survival is highly dependent on responsive healthcare systems and early detection of complications. Conversely, family planning services showed a positive but significant association with maternal mortality, suggesting gaps in effective utilization despite availability. This may reflect issues of cultural resistance, misinformation, or service quality. Together, these findings underscore the complexity of maternal health challenges and the importance of addressing both service delivery and socio-cultural dynamics.

In light of the study's findings, several targeted recommendations are necessary to address the key determinants of maternal mortality in Jos Metropolis.

i. Given the significant negative relationship between access to emergency obstetric care and maternal mortality, it is imperative that the Plateau State Ministry of Health, in collaboration with the National Primary Health Care Development Agency (NPHCDA), expand the reach and functionality of emergency obstetric services. This includes equipping health centres, especially in underserved areas like Busa-Buji and Rukuba, with 24-hour emergency response capabilities and trained personnel capable of handling obstetric complications such as hemorrhage and obstructed labor. Strategic investments should also be made by the Federal Ministry of Health to improve ambulance services and referral systems across the metropolis.

ii. Regarding antenatal care services, which were also found to significantly reduce maternal mortality, the Jos University Teaching Hospital (JUTH) and Plateau State Specialist Hospital (PSSH) should lead in strengthening ANC outreach programs. These institutions must collaborate with community-based organizations to ensure early registration for antenatal care, consistent follow-up, and health education. The Plateau State Health Insurance Scheme (PSHIS) should also be engaged to reduce financial barriers, ensuring that more women can access these services without cost-related delays. Training and periodic refresher courses should be provided for midwives and primary healthcare workers by the Nursing and Midwifery Council of Nigeria (NMCN), focusing on patient communication and early complication detection.

iii. Given the shocking positive relationship between family planning services and maternal mortality, the Plateau State Primary Health Care Board and the Federal Ministry of Women Affairs should critically re-evaluate how these services are delivered. It is essential to address the socio-cultural barriers that limit effective utilization of family planning, especially in conservative communities within Jos Metropolis. The National Population Commission (NPC), in collaboration with faith-based organizations and traditional leaders, should design culturally sensitive advocacy campaigns aimed at correcting misconceptions, reducing stigma, and promoting informed contraceptive choices. Additionally, the National Agency for Food and Drug Administration and Control (NAFDAC) should ensure that the family planning commodities distributed are of high quality and suitable to diverse physiological needs, minimizing adverse effects that may discourage continued use.

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