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Prevalence and Risk Factors of Sepsis Among Women of Reproductive Age in Bauchi Metropolis

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Abstract

Introduction: Sepsis among women of reproductive age remains a major public health concern, particularly in low- and middle-income countries where maternal morbidity and mortality are high. Puerperal sepsis contributes substantially to maternal deaths globally and remains an important challenge in Nigeria.
Objective: This study assessed the prevalence and risk factors of sepsis among women of reproductive age in Bauchi Metropolis, Nigeria.
Methods: A descriptive cross-sectional community-based study was conducted among 854 women aged 15–49 years residing in three selected communities in Bauchi Metropolis. Data were collected through face-to-face interviews using structured questionnaires administered by trained research assistants. Data analysis was performed using Statistical Package for the Social Sciences (SPSS) version 20.
Results: Most respondents (46.4%) were aged 25–34 years, while 75.1% were married. Overall, 18.2% reported a previous clinical diagnosis of sepsis, and 24.4% experienced at least one sepsis-related symptom within six months preceding the study. Fever (82.4%) was the most commonly reported symptom, followed by abdominal pain (68.6%), vaginal discharge (66.7%), and chills (43.1%). Caesarean section (34.0%) was the most frequently reported obstetric risk factor, followed by prolonged labor (28.2%), instrumental delivery (17.7%), poor wound care (15.8%), and retained products of conception (12.0%). Significant associations were observed between puerperal sepsis and educational level ($p = 0.010$), occupation ($p = 0.020$), and place of residence ($p = 0.016$).
Conclusion: Sepsis remains prevalent among women of reproductive age in Bauchi Metropolis. Improved postnatal care, health education, and early identification of obstetric risk factors are essential to reduce the burden of sepsis.

Keywords: Sepsis; women of reproductive age; puerperal sepsis; risk factors; Bauchi Metropolis.

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Introduction

Sepsis is a life-threatening condition that occurs when the body's response to infection causes injury to its own tissues and organs. It remains a major public health concern globally and contributes significantly to maternal morbidity and mortality, particularly in low- and middle-income countries (Singer et al., 2016). Women of reproductive age (15–49 years) are especially vulnerable to sepsis during pregnancy, childbirth, and the postpartum period because of increased exposure to infections associated with obstetric complications and invasive procedures (World Health Organization, 2022). Maternal sepsis not only threatens maternal survival but also contributes to adverse neonatal outcomes, prolonged hospitalization, and increased healthcare costs.

Puerperal sepsis, a form of maternal sepsis occurring after childbirth, accounts for approximately 10.7% of maternal deaths globally (World Health Organization, 2020). The burden of puerperal sepsis is high-

est in low- and middle-income countries where limited healthcare infrastructure, inadequate infection prevention practices, and delayed access to quality maternal healthcare services persist (World Health Organization, 2020). In sub-Saharan Africa, studies continue to report high prevalence of puerperal sepsis among postpartum women. In Tanzania, a study conducted at Kilimanjaro Christian Medical Centre reported a prevalence of 11.5%, while other studies in Dar es Salaam documented prevalence rates ranging from 20% to 30% among postnatal women (Kajeguka et al., 2020). These findings indicate that maternal sepsis remains a persistent challenge in many African settings despite improvements in maternal healthcare services.

In Nigeria, maternal sepsis remains an important contributor to maternal morbidity and mortality. Poor healthcare infrastructure, inadequate infection prevention practices, and delays in seeking healthcare continue to worsen maternal outcomes in many parts of the country (Adesegun et al., 2020). National reports indicate that maternal mortality remains high in Nigeria, with sepsis identified as one of the leading causes of maternal deaths (Federal Ministry of Health, 2019). The burden is often greater in northern Nigeria where poverty, low literacy levels, poor access to healthcare facilities, and cultural barriers affect maternal healthcare utilization (National Population Commission, 2023). Bauchi Metropolis, located in northeastern Nigeria, faces additional challenges including inadequate healthcare infrastructure, high fertility rates, and limited access to quality maternal healthcare services, all of which may increase the risk of maternal infections and sepsis (National Population Commission, 2024).

Several obstetric and socio-demographic factors have been associated with increased risk of sepsis among women of reproductive age. Obstetric complications such as prolonged labor, postpartum hemorrhage, caesarean section, retained products of conception, poor wound care, and unsafe delivery practices are recognized risk factors for puerperal sepsis (Ahmed et al., 2021; Onakewhor et al., 2024). Caesarean section has been consistently associated with increased risk of postoperative infections, particularly in settings where infection prevention measures are inadequate. Moderate to severe anemia has also been identified as a significant risk factor because it weakens maternal immunity and increases susceptibility to infections (Demilew & Alem, 2020). Common bacterial organisms implicated in maternal sepsis include *Staphylococcus* species, *Escherichia coli*, and *Streptococcus* species (Aliyu et al., 2023).

Socio-economic factors such as poverty, unemployment, low educational attainment, and poor awareness of maternal health services further increase women's vulnerability to sepsis and other adverse reproductive health outcomes (Okereke et al., 2021; Yaya et al., 2024). Women with lower educational levels are less likely to recognize early signs of infection or seek timely healthcare services, thereby increasing the risk of complications. In many communities, use of unskilled birth attendants and poor hygiene practices during childbirth also contribute substantially to maternal infections.

Despite the public health significance of maternal sepsis, there is limited evidence regarding its prevalence and associated risk factors among women of reproductive age in Bauchi Metropolis. The scarcity of local data limits effective planning and implementation of targeted interventions aimed at preventing maternal infections and improving reproductive health outcomes. Understanding the burden and determinants of sepsis among women of reproductive age is therefore essential for strengthening maternal healthcare services, improving infection prevention strategies, and reducing preventable maternal morbidity and mortality in Bauchi Metropolis.

Methods

This study employed a descriptive cross-sectional community-based survey design to examine the prevalence and risk factors associated with puerperal sepsis among women of reproductive age in Bauchi Metropolis.

The study was conducted in Bauchi Metropolis, Bauchi State, located in northeastern Nigeria. Bauchi is a major urban center with a population approaching one million people and serves as an important administrative and commercial hub within the region. Data were collected from selected communities and healthcare facilities within the metropolis.

The study population consisted of 854 women of reproductive age (15–49 years) residing in three selected communities of Bauchi Metropolis: Bakin Kura, Kofan Ran, and Dawaki. Women within this age range are recognized by the *World Health Organization* (WHO) as being of reproductive age and are particularly vulnerable to pregnancy- and childbirth-related complications, including puerperal sepsis. Focusing on this population enabled the study to generate context-specific findings regarding prevalence, associated risk factors, and health-seeking behaviors.

Participants were eligible for inclusion if they were

women aged 15–49 years, had resided in Bauchi Metropolis for at least six months, and consented to participate in the study. Women younger than 15 years or older than 49 years were excluded. Individuals who had resided in Bauchi Metropolis for less than six months were excluded to minimize variations in exposure to local healthcare services and environmental conditions. Women who declined informed consent, were critically ill, mentally incapacitated, or unable to communicate effectively during data collection were also excluded. In addition, women who could not communicate in either English or Hausa were excluded because of potential communication barriers that could compromise data quality.

The sample size was determined using the Krejcie and Morgan sample size determination table for finite populations. From a total population of 854 women of reproductive age across the selected communities, a minimum sample size of 256 respondents was considered statistically adequate at a 95% confidence level.

A multistage sampling technique was adopted to enhance representativeness and efficiency. In the first stage, three communities within Bauchi Metropolis—Bakin Kura, Kofan Ran, and Dawaki—were purposively selected based on population size, accessibility, and relevance to maternal health issues. In the second stage, proportional allocation was used to distribute the sample size across the selected communities according to their population sizes. Consequently, 103 respondents were selected from Bakin Kura, 64 from Kofan Ran, and 89 from Dawaki.

Data were collected using a structured questionnaire developed based on extensive review of relevant literature, the Health Belief Model, and previously validated instruments used in maternal health and sepsis research. The questionnaire was designed to obtain information on socio-demographic characteristics, obstetric history, awareness of sepsis, clinical symptoms, healthcare-seeking behavior, and potential risk factors associated with puerperal sepsis. The instrument was prepared in English and translated into Hausa to improve comprehension among participants.

Trained research assistants administered the questionnaires through face-to-face interviews to ensure accuracy and completeness of responses. Completed questionnaires were checked daily for consistency and completeness before data entry.

The collected data were cleaned, coded, and entered into Microsoft Excel before being exported to Statistical Package for the Social Sciences (SPSS) version 24 for analysis. Descriptive statistics including frequencies, percentages, means, and standard deviations were used to summarize participants' characteristics and study variables. Bivariate analysis using the Chi-square test was conducted to assess associations between potential risk factors and puerperal sepsis. Statistical significance was set at $p \leq 0.05$.

Ethical approval for the study was obtained from the appropriate ethical review authority prior to data collection. Verbal informed consent was obtained from all participants before participation in the study. Participants were assured of confidentiality and anonymity, and all information collected was treated with strict confidentiality. Participation was voluntary, and respondents were informed of their right to withdraw from the study at any stage without consequences.

Results

Out of the 256 questionnaires administered to women of reproductive age in the selected communities, 209 were correctly completed and returned, resulting in a response rate of 81.6%. The age distribution of respondents shows that the majority (46.4%) were within the 25–34 years age group, followed by those aged 35–44 years (24.9%). Most respondents were married (75.1%), while only 13.4% were single. A significant proportion of respondents had at least secondary (36.4%) or tertiary education (35.4%). Occupational status showed a fairly even distribution across unemployed, employed, and self-employed categories, with self-employed women forming the largest group.

Prevalence of Sepsis

The prevalence of sepsis diagnosis and symptoms among respondents is presented in Table 2.

As shown in Table 2, 18.2% of respondents reported a prior clinical diagnosis of sepsis, while 24.4% experienced at least one sepsis-related symptom within the six months preceding the study. Among respondents who reported symptoms, fever (82.4%) was the most commonly reported symptom, followed by abdominal pain (68.6%) and vaginal discharge (66.7%).

Risk Factors Associated with Sepsis

The frequency and percentage distribution of risk factors associated with puerperal sepsis are presented in Table 3.

Table 1: Socio-Demographic Characteristics of Respondents ($N = 209$)

Variables/Categories	Frequency (n)	Percentage (%)
Age Group (years)		
15–24	44	21.1
25–34	97	46.4
35–44	52	24.9
45+	16	7.6
Total	209	100
Marital Status		
Single	28	13.4
Married	157	75.1
Divorced	14	6.7
Widowed	10	4.8
Total	209	100
Educational Level		
No formal education	18	8.6
Primary	41	19.6
Secondary	76	36.4
Tertiary	74	35.4
Total	209	100
Occupation		
Unemployed	62	29.7
Employed	57	27.3
Self-employed	64	30.6
Student	26	12.4
Total	209	100
Residence		
Urban	132	63.2
Rural	77	36.8
Total	209	100

Percentages may not sum exactly to 100 due to rounding.

The data in Table 3 reveal that several clinical and obstetric risk factors associated with puerperal sepsis were prevalent among respondents. Caesarean section (34.0%) was the most frequently reported risk factor, followed by prolonged labor (28.2%). Instrumental delivery, poor wound care, and retained products of conception were also reported among respondents.

Association Between Demographics and Puerperal Sepsis

The association between selected demographic variables and puerperal sepsis was assessed using the Chi-square test. The Chi-square analysis showed statistically significant associations between puerperal sepsis and educational level ($p = 0.010$), occupation ($p = 0.020$), and place of residence ($p = 0.016$). Women with lower educational attainment were more likely to experience puerperal sepsis, possibly because of poor health literacy and limited access to quality maternal healthcare services. Occupational status was also significantly associated with puerperal sepsis, suggesting that unemployed women or those engaged in informal employment may face financial and healthcare accessibility barriers.

Table 2: Self-Reported Sepsis Diagnosis and Symptoms Among Respondents

Variables/Categories	Frequency (n)	Percentage (%)
Ever Diagnosed with Sepsis		
Yes	38	18.2
No	171	81.8
Experienced Symptoms of Sepsis in Past 6 Months		
Yes	51	24.4
No	158	75.6
Symptoms Experienced ($n = 51$)		
Fever	42	82.4
Abdominal pain	35	68.6
Vaginal discharge	34	66.7
Chills	22	43.1

Multiple responses were allowed for symptoms experienced.

Table 3: Exposure to Risk Factors Associated with Sepsis

Risk Factor	Frequency (n)	Percentage (%)
Prolonged labor	59	28.2
Instrumental delivery	37	17.7
Caesarean section	71	34.0
Retained products of conception	25	12.0
Poor wound care	33	15.8

Multiple responses were allowed.

Residence was significantly associated with puerperal sepsis, with women residing in rural areas appearing more vulnerable to infection-related complications compared with their urban counterparts. Although marital status was not statistically significant ($p = 0.064$), the association was marginal and may warrant further investigation in larger studies.

These findings highlight the important influence of socio-economic and geographic factors on maternal health outcomes within the study area.

Table 4: Association Between Demographics and Puerperal Sepsis

Variable	χ^2 Value	df	*p*-value	Significant
Marital Status	7.26	3	0.064	No
Educational Level	11.43	3	0.010*	Yes
Occupation	9.87	3	0.020*	Yes
Residence	5.83	1	0.016*	Yes

*Statistically significant at $p \leq 0.05$.

Discussion

The findings of this study revealed that 18.2% of women of reproductive age in Bauchi Metropolis reported a previous clinical diagnosis of sepsis, while 24.4% experienced one or more sepsis-related symptoms within the six months preceding the study. These findings indicate that puerperal sepsis remains a significant maternal health concern in the study area. The observed prevalence is consistent with global and regional evidence identifying maternal sepsis as a leading cause of maternal morbidity and mortality, particularly in low- and middle-income countries (World Health Organization, 2021). In Nigeria, studies have reported maternal sepsis prevalence rates ranging from 10% to 30% among women attending tertiary healthcare facilities, especially among women with inadequate antenatal care and unskilled birth attendance (Adesegun et al., 2020). Similarly, a study conducted in northern Nigeria reported a puerperal sepsis prevalence of approximately 20% among postnatal women, which is comparable to the findings of this study (Aliyu et al., 2023).

The finding that a higher proportion of respondents experienced sepsis-related symptoms than those who had received clinical diagnosis suggests possible gaps in early recognition, healthcare access, and diagnosis of maternal infections. Delayed healthcare seeking, self-medication, socio-cultural barriers, and limited diagnostic capacity at primary healthcare facilities may contribute to underdiagnosis and delayed treatment of sepsis in the study area. Women residing in rural or underserved communities may also experience additional barriers to accessing timely maternal healthcare services.

This study also identified several obstetric and clinical risk factors associated with puerperal sepsis. Caesarean section was the most frequently reported risk factor, followed by prolonged labor, instrumental delivery, poor wound care, and retained products of conception. These findings are consistent with previous studies demonstrating that obstetric interventions and postpartum complications significantly increase the risk of maternal infections (Lumbiganon et al., 2024; World Health Organization, 2020). Caesarean section has been shown to substantially increase the risk of puerperal sepsis, particularly in settings where infection prevention and aseptic measures are inadequate. Similarly, prolonged labor increases exposure of the uterus and birth canal to infectious organisms, thereby increasing susceptibility to postpartum infections (Wagner et al., 2023). A multicenter Nigerian study similarly reported high prevalence of caesarean section and prolonged labor among women diagnosed with puerperal sepsis (Onakewhor et al., 2024).

The high prevalence of these risk factors reflects broader systemic weaknesses within maternal healthcare services in many low-resource settings. Inadequate infection prevention protocols, limited availability of sterile surgical supplies, shortages of trained healthcare workers, and poor postpartum follow-up may compromise the quality and safety of maternal healthcare services. These findings highlight the need for improved infection prevention practices and strengthened maternal healthcare systems within Bauchi Metropolis and similar settings.

The Chi-square analysis demonstrated statistically significant associations between educational level, occupation, place of residence, and puerperal sepsis. Women with lower educational attainment were more likely to experience puerperal sepsis compared with women who had higher levels of education. This finding is consistent with previous studies reporting that maternal education significantly influences health literacy, healthcare utilization, and recognition of danger signs during pregnancy and the postpartum period (Demilew & Alem, 2020; Yaya et al., 2024). Educated women are more likely to seek antenatal care, deliver in healthcare facilities, and recognize symptoms requiring prompt medical attention.

Occupation was also significantly associated with puerperal sepsis. Women who were unemployed or financially dependent may experience greater challenges accessing quality maternal healthcare services because

of financial constraints and reduced autonomy in healthcare decision-making. Similar findings have been reported in northern Nigeria where employed women were more likely to utilize antenatal and skilled delivery services compared with unemployed women (Okereke et al., 2021). Financial independence therefore plays an important role in improving women's access to maternal healthcare services and reducing the risk of infection-related complications.

Place of residence was another significant determinant of puerperal sepsis. Women residing in rural communities appeared more vulnerable to maternal infections than their urban counterparts, likely because of limited healthcare infrastructure, poor transportation systems, and reduced access to skilled birth attendants. These disparities highlight the continuing inequities in maternal healthcare access between rural and urban populations in Nigeria.

Conclusion

This study concludes that puerperal sepsis remains a significant but underrecognized public health concern among women of reproductive age in Bauchi Metropolis. The prevalence observed in this study is consistent with national and regional evidence, reflecting persistent gaps in maternal healthcare delivery and infection prevention practices. Important obstetric risk factors identified included caesarean section, prolonged labor, poor wound care, and instrumental delivery, demonstrating the need for improved clinical practices and postpartum care services.

The study further established that socio-demographic factors such as educational level, occupation, and place of residence significantly influence women's vulnerability to puerperal sepsis. These findings suggest that maternal sepsis is not only a clinical condition but also a socio-economic and health system challenge influenced by poverty, limited healthcare access, low health literacy, and inequities in maternal healthcare services.

Strengthening infection prevention practices, improving maternal healthcare access, enhancing women's education and economic empowerment, and promoting early recognition of maternal infections are essential for reducing the burden of puerperal sepsis and improving maternal health outcomes in Bauchi Metropolis and similar settings.

Recommendations

Policy and Health System Reforms

1. Strengthen infection prevention and control protocols in all health facilities, particularly for caesarean deliveries and postnatal care services.
2. Implement routine postpartum follow-up and home visits for early detection and management of maternal infections.

Health Worker Capacity Building

1. Provide regular training for skilled birth attendants, nurses, and midwives on aseptic techniques, recognition of early signs of puerperal sepsis, and proper wound care practices.

Community Engagement and Health Education

1. Develop targeted maternal health education programs focusing on danger signs of sepsis, particularly among women residing in rural communities.
2. Involve spouses, community leaders, and religious leaders in maternal health promotion activities aimed at reducing harmful cultural practices and delays in seeking healthcare.

Infrastructure and Logistics

1. Improve access to sterile surgical supplies, clean water, sanitation facilities, and essential maternal healthcare equipment in healthcare facilities.
2. Strengthen referral systems and establish better follow-up mechanisms for postnatal women, especially those who undergo surgical delivery.

Socio-Economic Empowerment

1. Promote vocational training and economic empowerment programs for women to improve financial independence and access to quality maternal healthcare services.

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Conflict of Interest Statement

The authors declare no competing financial interests or personal relationships that could have influenced this work.

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