Association Between Socio-Demographic Characteristics and Birth Preparedness and Complication Readiness (BPCR) Practices Among Pregnant Women in the Tamale Metropolis: A Cross-Sectional Quantitative Study

Abstract

Introduction: Maternal health remains a significant global public health challenge, with high maternal mortality rates particularly prevalent in low- and middle-income countries such as Ghana. This study aims to assess the association between socio-demographic characteristics and birth preparedness and complication readiness (BPCR) practices among pregnant women in the Tamale Metropolis, Northern Region of Ghana.

Methods: This cross-sectional study involved 382 pregnant women from three hospitals in the Tamale Metropolis, selected using a multistage sampling method. Data were collected via a structured questionnaire. Statistical analysis was performed using SPSS version 26, and the chi-square test was used to determine associations, with a p-value of less than 0.05 considered statistically significant.

Results: The study found that 92.1% of respondents were aware of serious health problems during labor and childbirth, with severe vaginal bleeding (97.7%), convulsions (97.2%), and retained placenta (98.0%) being the most commonly recognized issues. Additionally, 83.8% were aware of postpartum health risks, notably severe vaginal bleeding (99.7%) and high fever (97.8%). Additionally, 83.0% are saving for pregnancy and childbirth expenses, and 83.5% have prepared essential items for a clean delivery. Nearly all (94.8%) opted to deliver in a health institution with a skilled provider, and 84.0% have identified transportation plans. Significant associations were found between BPCR and several socio-demographic factors. Age ($p=0.048$), marital status ($p<0.001$), religion ($p=0.001$), educational status ($p=0.043$), household monthly income ($p<0.001$), husband's occupation ($p<0.001$), and husband's educational status ($p<0.001$) all showed significant associations with BPCR.

Conclusion: The study shows significant progress in birth preparedness and complication readiness (BPCR) practices among pregnant women in the Tamale Metropolis, with most demonstrating good practices and awareness of health risks. Socio-demographic factors, such as age, marital status, education, and household income, significantly influence BPCR practices. Health education, financial readiness, and institutional delivery are crucial for maternal health. However, gaps remain in addressing poor practices and overcoming cultural, logistical, and systemic barriers. Recommendations include intensifying educational campaigns, strengthening healthcare infrastructure, introducing financial support mechanisms, and engaging with traditional birth attendants.

Keywords: Maternal health, Birth preparedness, Complication readiness, Pregnant women, Maternal mortality

Introduction

Globally, maternal health persists as a major public health challenge, with approximately 295,000 women dying from pregnancy-related causes in 2017 [1]. These fatalities often occur due to preventable or manageable complications, highlighting significant gaps in maternal health services. Low- and middle-income countries bear the brunt of this burden, with sub-Saharan Africa accounting for nearly two-thirds of all maternal deaths worldwide[1]. The World Health Organization[1] and United Nations Population Fund (UNFPA)[2] emphasize that comprehensive birth preparedness and complication readiness (BPCR) practices are essential to reducing maternal mortality rates.The high Maternal Mortality Ratio (MMR) in sub-Saharan Africa, estimated at 542 maternal deaths per 100,000 live births [3], underscores a critical need for effective BPCR interventions in this region. Socio-demographic factors, including age, educational attainment, socio-economic status, and cultural norms, significantly influence women's preparedness for childbirth and their ability to manage potential complications[4]. These disparities contribute to unequal access to essential maternal health services, exacerbating the risk of adverse outcomes for both mothers and infants.

In the context of Ghana, despite various health interventions aimed at improving maternal health, the MMR remains concerningly high at 310 deaths per 100,000 live births[5]. This figure indicates persistent gaps in maternal health services and underscores the importance of enhancing BPCR practices. The Northern Region of Ghana, particularly the Tamale Metropolis, exemplifies these challenges. This region faces significant socio-demographic disparities, including lower educational levels, higher poverty rates, and limited access to healthcare facilities relative to other parts of the country [6, 7]. These disparities critically impact BPCR practices and subsequently, maternal health outcomes.

The necessity of understanding and addressing the socio-demographic influences on BPCR practices in Tamale Metropolis forms the foundation of this study. Socio-demographic characteristics such as age, marital status, education, occupation, income, and family size have been identified as significant determinants of maternal health behaviors and outcomes. For example, studies have shown that women with higher educational attainment are more likely to recognize the importance of antenatal care and utilize skilled birth services[8–10]. Conversely, women from lower socio-economic backgrounds may face barriers to accessing these services due to cost, distance, and lack of information[11–13].

By examining the association between these socio-demographic characteristics and BPCR practices among pregnant women in the Tamale Metropolis, the study aims to identify key barriers and facilitators to effective BPCR. This insight is crucial for developing targeted interventions that address specific needs and contextual realities of women in this region. For instance, educational programs tailored to women with lower literacy levels, community-based initiatives to improve access to healthcare facilities, and economic support schemes could significantly enhance BPCR practices**.**This study aims to provide data to inform healthcare providers and policymakers in Tamale Metropolis, Ghana, to improve maternal health outcomes. The insights could be applied to the Northern Region of Ghana, contributing to broader efforts to reduce maternal mortality rates. Lessons learned could also be applied to other sub-Saharan African countries facing similar socio-demographic challenges. The study aims to address a gap in existing research by elucidating socio-demographic factors influencing BPCR practices in the Tamale Metropolis, contributing to the development of evidence-based interventions and policies to improve maternal health outcomes.

Methods

Study design

The study employed a cross-sectional design with a strong emphasis on quantitative analysis to evaluate the relationship between socio-demographic characteristics and birth preparedness and complication readiness (BPCR) practices among pregnant women in the Tamale Metropolis. This design was chosen due to its effectiveness in providing a snapshot of the current status and correlations within the population at a specific point in time, thus allowing for the efficient assessment of various socio-demographic factors and their potential influence on BPCR practices.

Study setting

The Tamale Metropolitan Assembly (TMA) is a part of the 261 Metropolitan, Municipal and District Assemblies (MMDAs) in Ghana, located in the Northern Region. Elevated to the status of Metropolis in 2004, it is the capital of the Metropolis and is situated between latitude 9.16° and 9.34° North and longitudes 00.36° and 00.57. The topography is generally rolling with shallow valleys and isolated hills, but they do not hinder physical development. The Metropolis shares boundaries with Savelugu Municipality, Yendi Municipal Assembly, Tolon District, Central Gonja District, and East Ganja Municipal. The 2021 population and housing census recorded a population of 374,744.

Study population

The study population comprised pregnant women residing in the Tamale Metropolis

Inclusion and exclusion criteria

The study employed specific inclusion and exclusion criteria to ensure the selection of a representative and relevant sample of pregnant women for assessing the association between socio-demographic characteristics and BPCR practices in the Tamale Metropolis. These criteria were designed to enhance the validity and reliability of the findings by including appropriate participants and excluding those who might confound the results.

Inclusion Criteria:

1. Pregnant women who are residents of the Tamale Metropolis.
2. Pregnant women who provided informed consent to participate in the study.
3. Pregnant women aged 18 years and above to ensure legal consent and adult perspectives.
4. Pregnant women in any trimester of pregnancy to capture BPCR practices across different stages of pregnancy.

Exclusion Criteria:

1. Women who are not permanent residents of the Tamale Metropolis to maintain population specificity.
2. Pregnant women who declined to provide informed consent to ensure ethical standards.

3. Pregnant women below the age of 18 to maintain focus on adult populations and adhere to age-specific ethical considerations.
4. Pregnant women with severe medical conditions that could impede their ability to participate in the study or influence BPCR practices independently of socio-demographic factors.

Sample size determination

The sample size was calculated using a formula in Kviz textbook [14]

$$n = \frac{z^2\sigma}{m_0 E^2}$$

- Sample size (n) =?
- Variance (σ) = P (1-P)
- A recent student study in Northern Ghana estimated that46.5% of mothers were prepared with regard to BPCR[6]. Thus, p =46.5% (0.465)

$n = 382$

The total number of pregnant to be selected for this study would be 382

Sampling techniques

In this study, a multistage sampling technique was employed. First, the total sample size of 382 was allocated proportionally among three hospitals: Northern Regional Hospital, Tamale West Hospital, and Seventh Day Adventist Hospital, Tamale. Within each facility, systematic sampling was utilized to recruit participants. Specifically, 10 individuals were systematically selected at regular intervals until the predetermined sample size for each hospital was achieved. This approach ensured a representative and unbiased selection of participants from the respective hospitals, facilitating a comprehensive assessment of BPCR practices among the pregnant women in the Tamale Metropolis.

Data collection tool

The data collection tool used in this study was a structured questionnaire developed from existing literature [6, 12, 15, 16]and modified to suit the local context and specific objectives of the research. The questionnaire comprised four sections, each designed to capture critical information relevant to the association between socio-demographic characteristics and BPCR practices among pregnant women in the Tamale Metropolis. Section 1 focused on socio-demographic information, including variables such as community location, age, marital status, religion, ethnicity, occupation, educational status, household monthly income, family size, and husband's occupation and educational status. Section 2 collected obstetric factors, including details about the current pregnancy, antenatal care attendance, obstetric history, and any complications such as stillbirths. Section 3 assessed the participants' knowledge of danger signs during pregnancy, labor, and the postpartum period, as well as their awareness and understanding of BPCR. This section probed for specific danger signs and the sources of their information on BPCR. Finally, Section 4 examined the practices of respondents regarding birth preparation, such as the planned place of delivery, the expected delivery attendant, saving money for childbirth, preparation of essential items, decision to deliver in a health institution, and identification of transportation modes. This comprehensive and systematically structured questionnaire ensured the collection of detailed and pertinent data to effectively analyze the study's research questions.

Data collection procedures

Prior to data collection, permission was obtained from the Regional Health Directorate of the Northern Region and the various hospitals involved in the study. Additionally, the in-charges of the antenatal care units granted permission for the study. During antenatal care education sessions, the rationale for the study was explained to the pregnant women in a language they understood, primarily Dagbani, and translated to Hausa for those who did not understand Dagbani. This step ensured clear communication and comprehension among the participants. Subsequently, time was allocated for questions, allowing participants to freely decide whether to participate. It was explicitly explained that participation would not give any advantage in terms of earlier consultation with the doctor.

After explaining the details, a general question was posed to gauge the number of women willing to participate. Those who provided oral consent were counted to form a sample frame, and a sampling interval was used to randomly select 10 participants each day. These selected participants were taken through a detailed consent process and required to provide written consent. Once written consent was obtained, participants were allowed to continue with their antenatal care services. Interviews were scheduled to last between 20 to 25 minutes and were conducted after the participants' antenatal visit or beforehand if they had a longer wait time.

To ensure confidentiality, a designated office within each facility was chosen for conducting the interviews. Participants were also informed of their right to terminate the interview at any point. Each hospital had two assigned enumerators who received thorough training on the data collection process, including consent procedures, ethical considerations, the study's rationale, and the participant selection process. This preparation included a pretest conducted at Fuo Hospital, where feedback was incorporated to enhance the validity and reliability of both the study and the data collection tools.

Data analysis

Data analysis was conducted using SPSS version 26. Both descriptive and inferential statistical methods were employed to examine the data. Descriptive statistics were used to summarize the demographic and baseline characteristics of the study participants. Inferential statistics, specifically the Chi-square test, were utilized to establish associations between socio-demographic characteristics and BPCR practices. A p-value of less than 0.05 was considered statistically significant.

Ethical consideration

The study prioritized ethical considerations to protect participants' rights and welfare. Approval was obtained from the Regional Health Directorate and participating hospitals. Informed consent was sought by explaining the study's purpose, procedures, risks, and benefits in understandable languages (Dagbani and Hausa). Participation was voluntary, with the option to withdraw at any time without affecting access to medical services. Oral consent was initially gathered, followed by written consent from those selected.

Confidentiality was rigorously maintained by using private offices for interviews, securely storing data, and ensuring anonymity. The study emphasized non-coercion and equal treatment, assuring participants that their involvement would not impact their access to health services. Participants were allowed to ask questions and were given time to decide on participation.

Results

Socio-demographic characteristics of the respondents

The study showed that the majority comprises individuals aged 25-34 years (63.4%), with a majority being married or in a union (75.9%). Islam is the predominant religion (70.4%), and the Mole-Dagbon ethnic group represents the most prominent ethnic category (58.6%). Employment distribution shows that 40.6% are unemployed, while 34.3% are self-employed. Nearly half of the respondents (49.2%) have at least a secondary education, though 17.5% have never attended school. Monthly household income indicates that 65.7% earn over 500 Ghana cedis, and 71.7% have families of three or more. Among husbands, 47.6% are employed, and most (64.4%) have at least a secondary education. The study respondents are slightly more urban (56.3%) than rural (43.7%) (Table 1).

Table 1-Socio-demographic characteristics of the respondents

Variables	Category	Frequency	Percentage
Age			
	<25 years	85	22.3
	25-34 years	242	63.4
	≥ 35 years	55	14.4
Marital status			
	Single	78	20.4
	Married/ in union	290	75.9
	Divorced/ separated	12	3.1
	Widowed	2	0.5
Religion			
	Islam	269	70.4
	Christian	113	29.6
Ethnicity			
	Mole-Dagbon	224	58.6
	Ga-Adangbe	23	6.0
	Akan	45	11.8
	Ewe	29	7.6
	Others	61	16.0
Occupation			
	Employed	96	25.1
	Self-employed	131	34.3
	Unemployed	155	40.6
Educational status			
	Basic school	127	33.2
	Secondary and above	188	49.2
	Never attended school	67	17.5
Household monthly income(Ghana cedis)			
	<500	131	34.3

	≥ 500	251	65.7
Family size			
	<3	108	28.3
	≥3	274	71.7
Husband's occupation			
	Employed	182	47.6
	Self-employed	173	45.3
	Unemployed	27	7.1
Husband's educational status			
	Basic school	78	20.4
	Secondary and above	246	64.4
	Never attended school	58	15.2
Location of community			
	Urban	215	56.3
	Rural	167	43.7

Obstetric Characteristics of Respondents

The obstetric factors of respondents reveal that most pregnancies fall within the 3-6 month range (42.7%), and only 34.3% are first pregnancies. A majority (61.0%) of respondents have had fewer than four pregnancies, and 94.2% attended antenatal care (ANC) during their current pregnancy, with 40.8% attending four times or more. For the first ANC encounter, 72.8% met with a health professional, while 23.9% met a community health worker. Regarding births, 55.8% have fewer than four births, and 75.3% have fewer than four live births. Stillbirths are uncommon, with 97.6% reporting none(Table 2).

Table 2: Obstetric Factors of Respondents

Variable	Category	Frequency	Percentage
How many months of pregnancy			
	<3 months	94	24.6
	3-6 months	163	42.7
	≥ 7 months	125	32.7
First pregnancy			
	Yes	131	34.3
	No	251	65.7
Number of pregnancies			
	<4	153	61.0
	≥ 4	98	39.0
Attend ANC during this pregnancy.			
	Yes	360	94.2
	No	22	5.8
Frequency of ANC attendance during this pregnancy			
	Only once	60	16.7
	Twice	48	13.3
	Three times	105	29.2

	Four times or more	147	40.8
First encounter with who at ANC			
	Community health worker	86	23.9
	Health professional	262	72.8
	Don't know	12	3.3
Number of births			
	<4	213	55.8
	≥ 4	169	44.2
Number of live births			
	<4	281	75.3
	≥ 4	101	27.1
Stillbirths			
	Yes	9	2.4
	No	373	97.6
Number of stillbirths			
	0	373	97.6
	1	4	1.0
	2	5	1.3

Knowledge of Danger Signs

The study showed that the Majority of respondents (92.1%) know about serious health problems that could occur during labor and childbirth. Common issues identified include severe vaginal bleeding (97.7%), convulsions (97.2%), and retained placenta (98.0%). Similarly, 83.8% are aware of health risks during the postpartum period, with nearly all recognizing severe vaginal bleeding (99.7%) and high fever (97.8%) as dangers. Awareness of birth preparedness is also high (92.1%), with 56.8% citing health professionals as their source of information. Key preparations include identifying a place for delivery (97.2%), saving money for emergencies (98.0%), and arranging for blood donors (99.1%) (Table 3).

Table 3: Knowledge of Danger Signs

Variable	Category	Frequency	Percentage
Knowledge of any serious health problems during labor and childbirth that could endanger the life of the pregnant woman			
	Yes	352	92.1
	No	30	7.9
Serious health problems during labor and childbirth that could endanger the life of the pregnant woman			
	Severe vaginal bleeding	344	97.7
	Convulsions	342	97.2
	Loss of consciousness	342	97.2
	Labor lasting more than 12 hours	322	91.5
	Placenta not delivered 30 minutes after birth	345	98.0
	Others(Death, miscarriage)	4	1.1
Knowledge on any serious health problems tht can occur during first 42 days after birth that could endanger the life of the mother			

	Yes	320	83.8
	No	62	16.2
Serious health problems that can occur during first 42 days after birth that could endanger the life of the mother			
	Severe vaginal bleeding	319	99.7
	High fever	313	97.8
	Loss of consciouness	315	98.4
	Foul smelling vaginal discharge	328	102.5
	Others(Death, miscarriage)	4	1.3
Heard of "birth preparedness and complication rediness"			
	Yes	352	92.1
	No	30	7.9
Source of information			
	Community health worker	152	43.2
	Health professional	200	56.8
Some things a woman can do to prepare for birth			
	Identify a place of delivery	342	97.2
	Save money for emergency	345	98.0
	Identify skilled birth provider	350	99.4
	Arrange blood donors	349	99.1
	Identify transportation for emergencies	350	99.4
	Others(eating balanced diet, exercise daily)	2	0.6

Practices of Birth Preparation & Complication Readiness

The study reveals that the majority respondents (87.4%) have a planned place of delivery, with 94.9% choosing a health institution over home births (5.1%). Most expect a health professional to assist with delivery (90.8%), while others plan for support from traditional birth attendants (12.6%), community health workers (27.2%), or family members (31.2%). A significant proportion (83.0%) are saving for pregnancy and childbirth expenses, and 83.5% have prepared essential items for a clean delivery. Nearly all respondents (94.8%) have decided to deliver in a health institution by a skilled provider, and 84.0% have identified a mode of transportation. To reach the health facility, 40.3% use a car, 23.0% take public transport, 27.7% use a motorcycle or tricycle, and 8.9% travel on foot(Table 4).

Table 4: Practices of Birth Preparation & Complication Readiness

Variable	Category	Frequency	Percentage
Have a planned place of delivery.			
	Yes	334	87.4
	No	48	12.6
Planned place of birth			
	Health institution	317	94.9
	Home	17	5.1

Expect to assist with the birth.			
	Health professional	347	90.8
	Traditional birth attendant	48	12.6
	Community health worker	104	27.2
	Mother/relative	119	31.2
	Others(friend)	2	0.5
Saving for pregnancy and childbirth			
	Yes	317	83.0
	No	65	17.0
Prepared essential items for clean delivery and postpartum			
	Yes	319	83.5
	No	63	16.5
Decided to deliver in a health institution by a skilled provider			
	Yes	362	94.8
	No	20	5.2
Identified a mode of transportation during pregnancy and delivery			
	Yes	321	84.0
	No	61	16.0
How you got to the health facility			
	Car	154	40.3
	Public transport	88	23.0
	Motorcycle/ tricycle	106	27.7
	On foot	34	8.9

Association between socio-demographics and Birth preparedness and complication readiness

Association between socio-demographics and Birth preparedness and complication readiness
Significant associations were found between birth preparedness and complication readiness (BPCR) and several socio-demographic factors. Age (p=0.048), marital status (p<0.001), religion (p=0.001), educational status (p=0.043), household monthly income (p<0.001), husband's occupation (p<0.001), and husband's educational status (p<0.001) all showed significant associations with BPCR(Table 5).

Table 5: Association between socio-demographics and Birth preparedness and complication readiness

Variables	Category	Birth preparedness and complication readiness		
		Good BPCR	Poor BPCR	P-value
Age	<25 years	71(83.5%)	14(16.5%)	P=0.048
	25-34 years	218(90.1%)	24(9.9%)	
	≥ 35 years	53(96.4%)	2(3.6%)	
Marital status				P<0.001
	Single	51(65.4%)	27(34.6%)	
	Married/ in a union	277(95.5%)	13(4.5%)	
	Divorced/ separated	12(100.0%)	0(0.0%(	
	Widowed	2(100.00%)	0(0.0%)	
Religion				P=0.001

	Islam	232(86.2%)	37(13.8%)	
	Christian	110(97.3%)	3(2.7%)	
Occupation				
	Employed	96(100.0%)	0(0.0%)	
	Self-employed	118(90.1%)	13(9.9%)	
	Unemployed	128(82.6%)	27(17.4%)	
Educational status				P=0.043
	Basic school	107(84.3%)	20(15.7%)	
	Secondary and above	175(93.1%)	13(6.9%)	
	Never attended school	60(89.6%)	7(10.4%)	
Household monthly income(Ghana cedis)				P<0.001
	<500	106(80.9%)	25(19.1%)	
	≥ 500	236(94.0%)	15(6.0%)	
Family size				P=0.627
	<3	98(90.7%)	10(9.3%)	
	≥ 3	244(89.1%)	30(10.9%)	
Husband's occupation				P<0.001
	Employed	182(100.0%)	0(0.0%)	
	Self-employed	147(85.0%)	26(15.0%)	
	Unemployed	13(48.1%)	14(51.9%)	
Husband's educational status				P<0.001
	Basic school	71(91.0%)	7(9.0%)	
	Secondary and above	243(98.8%)	3(1.2%)	
	Never attended school	28(48.3%)	30(51.7%)	
Location of community				P=0.870
	Urban	192(89.3%)	23(10.7%)	
	Rural	150(89.8%)	17(10.2%)	

Discussion

The study aimed to assess the association between socio-demographic characteristics and birth preparedness and complication readiness (BPCR) practices among pregnant women in the Tamale Metropolis. The findings indicate that a majority of respondents (92.1%) are aware of serious health problems that could occur during labor and childbirth. This aligns with previous studies that highlight increasing awareness among pregnant women in regions with active maternal health education programs[17, 18]. Such high levels of awareness can be attributed to the integration of community health education and antenatal care counseling sessions in the Tamale Metropolis. The recognition of health risks serves as a critical foundation for encouraging safe delivery practices and reducing maternal mortality. Contrary to this, studies in more rural and underserved areas, such as certain parts of Cameroon[19], report lower levels of awareness, often due to limited access to healthcare information. The contrasting findings suggest that awareness is closely linked to the availability and accessibility of healthcare resources and education. Ongoing investment in maternal health education programs, especially in underserved regions, can bridge these disparities with the utilisation of telehealth[20].

The study further reveals that 87.4% of respondents have a planned place of delivery, with 94.9% opting for a health institution over home births (5.1%). This is consistent with trends observed in similar studies [6, 7, 21], where increased institutional delivery rates were associated with improved maternal health services and national health campaigns promoting skilled birth attendance. The strong preference for health institutions in the study setting could be explained by the trust built through quality care and successful health interventions in the region.However, in contrast, studies in areas with poor healthcare infrastructure or strong cultural preferences for traditional birth settings[10, 22, 23], report higher rates of home births. This discrepancy could stem from differences in cultural practices, geographic barriers, or perceptions of healthcare quality. The implication is the need for strategies that address both cultural and systemic barriers, such as community engagement and infrastructure development, to promote institutional deliveries universally.

Most respondents (90.8%) expect a health professional to assist with delivery, which reflects the trust and reliance on skilled care. This finding aligns with global maternal health goals emphasizing the importance of skilled birth attendance[3, 24]. However, the data also indicate that a minority plan for support from traditional birth attendants (12.6%), community health workers (27.2%), or family members (31.2%). While these forms of support may complement skilled care, reliance on non-professional attendants could pose risks, especially in cases of complications.Contrary findings in some rural or underserved areas suggest a higher reliance on traditional birth attendants due to their availability, cultural familiarity, or cost-effectiveness[24]. In such contexts, the limited presence of skilled healthcare providers or distrust in formal healthcare systems may explain the preference for non-professional support. The implication is that efforts to promote skilled birth attendance should include community-level education and engagement to ensure a gradual shift toward safer delivery practices without alienating traditional caregivers.

The findings show that a significant proportion of respondents (83.0%) are saving for pregnancy and childbirth expenses, and 83.5% have prepared essential items for a clean delivery. These results reflect a strong commitment to birth preparedness and complication readiness (BPCR) among the study population. This aligns with findings from similar studies [25, 26], which emphasize the positive influence of antenatal care education on financial and material readiness. In the Tamale Metropolis, these high preparedness levels likely result from effective maternal health education programs, community engagement, and the availability of healthcare services.Contrarily, studies in lower-resource settings or areas with limited maternal health interventions, such as parts of rural Cameroon[19]report lower rates of financial and material preparedness. Economic constraints and limited access to health education are often cited as major barriers. These contrasting findings highlight the critical role of socioeconomic factors and access to healthcare in influencing preparedness. The implication is that targeted interventions, including financial support and maternal health education, are essential for ensuring universal preparedness for childbirth.

Nearly all respondents (94.8%) have decided to deliver in a health institution by a skilled provider, which is consistent with global recommendations for safe delivery practices[3]. This trend aligns with studies in regions where health system strengthening and community sensitization have improved institutional delivery rates [27, 28]. The findings suggest that women in the Tamale Metropolis perceive institutional deliveries as safer and more reliable.

Transportation preparedness was evident, with 84.0% identifying a mode of transport to health facilities. The use of cars (40.3%), motorcycles or tricycles (27.7%), public transport (23.0%), and walking (8.9%) indicates varying levels of access to transportation. These findings are consistent with studies in semi-urban areas where transportation options are more readily available[6]. In contrast, rural areas often report transportation as a significant barrier to accessing maternal health services, leading to delays in seeking care[29]. The implication is that improving transport infrastructure and access to emergency transport services can further enhance timely access to healthcare facilities[30].

Awareness of common complications, such as severe vaginal bleeding (97.7%), convulsions (97.2%), and retained placenta (98.0%), as well as postpartum risks like severe bleeding (99.7%) and high fever (97.8%), was nearly universal among respondents. This aligns with findings from previous studies emphasizing the impact of health education on recognizing danger signs during pregnancy, childbirth, and the postpartum period [15, 17].Such high awareness levels can be attributed to antenatal care services and health professional engagement. However, studies in regions with limited healthcare access often report lower awareness levels, which can result in delayed care-seeking [31]. These variations emphasize the importance of universal access to antenatal education and healthcare services.

The study also found high awareness of birth preparedness (92.1%), with 56.8% of respondents citing health professionals as their primary source of information. Key preparations, such as identifying a delivery place (97.2%), saving for emergencies (98.0%), and arranging for blood donors (99.1%), reflect comprehensive efforts toward BPCR. These findings align with studies demonstrating the pivotal role of healthcare providers in disseminating BPCR information[32]. In contrast, lower levels of preparation in underserved regions often stem from inadequate health system capacity and socioeconomic barriers. This

underscores the need for continued efforts to strengthen healthcare systems and empower women with knowledge and resources.

The study found that 89.5% of respondents demonstrated good practice of birth preparedness and complication readiness (BPCR), while 10.5% exhibited poor practice. This high level of good BPCR practice aligns with previous studies from Ethiopia[32] and Uganda [33], where the integration of maternal health education and antenatal care services has led to improved preparedness practices among pregnant women. The findings suggest that ongoing health interventions and community outreach programs in the Tamale Metropolis have been effective in promoting BPCR.Contrarily, lower levels of BPCR practice are often reported in regions with limited access to healthcare or lower maternal health literacy, such as in parts of rural Tanzania [34].These disparities can be attributed to economic barriers, cultural beliefs, and inadequate health education, highlighting the role of context-specific interventions in achieving improved BPCR practices. The implication is that efforts to promote BPCR should consider addressing systemic and cultural barriers to foster equitable maternal health outcomes.

The study also identified significant associations between BPCR practices and socio-demographic factors, including age ($p=0.048$), marital status ($p<0.001$), religion ($p=0.001$), educational status ($p=0.043$), household monthly income ($p<0.001$), husband's occupation ($p<0.001$), and husband's educational status ($p<0.001$). These findings align with existing literature, which frequently reports that socio-demographic factors play a critical role in shaping maternal health behaviors. For example, studies in Ethiopia and Nepal[11, 35] have shown that higher educational levels and income are positively associated with better BPCR practices. The influence of these factors can be explained by greater access to information, improved decision-making, and financial resources among more educated and wealthier households.In contrast, studies in regions with high poverty levels or lower educational attainment often report weaker associations between socio-demographics and BPCR practices [34]. This discrepancy may arise because economic constraints and limited healthcare access overshadow the potential benefits of education or awareness. The implication is that addressing structural inequities, such as poverty and gender inequality, is essential for enabling all women, regardless of socio-demographic background, to engage in good BPCR practices.

The significant association between marital status and BPCR practices suggests that married women may benefit from spousal support, which aligns with findings from studies in Uganda and Ethiopia[32, 33]. Spouses often contribute financially or emotionally, facilitating better preparedness. Conversely, unmarried women or those in less supportive relationships may face greater challenges in preparing for childbirth, underscoring the importance of community support systems to bridge this gap.

Religion's association with BPCR practices highlights the potential role of faith-based organizations in promoting maternal health awareness. Studies in similar contexts have found that religious leaders and institutions can influence health-seeking behaviors[36, 37]. However, cultural or religious practices that emphasize traditional methods over institutional healthcare could act as barriers, as seen in some rural settings. This underscores the need for culturally sensitive interventions that engage religious and community leaders to promote BPCR.

This cross-sectional study has several strengths and limitations. It provides a representative snapshot of birth preparedness and complication readiness (BPCR) practices among pregnant women in the Tamale Metropolis, allowing for the efficient assessment of multiple socio-demographic factors influencing these practices. The design is cost-effective and time-efficient, making it suitable for public health planning and identifying gaps in maternal health preparedness. However, as a cross-sectional study, it cannot establish causal relationships between socio-demographic factors and BPCR practices due to the simultaneous measurement of exposure and outcomes. Additionally, there is potential for recall bias, as participants may not accurately remember or report past behaviors, and the findings are limited to associations rather than causation. Despite these limitations, the study provides valuable insights that can inform targeted interventions to improve maternal health outcomes.

Conclusion and recommendation

The study highlights significant progress in birth preparedness and complication readiness (BPCR) practices among pregnant women in the Tamale Metropolis, with the majority demonstrating good practices and awareness of health risks during pregnancy, childbirth, and the postpartum period. Socio-demographic factors, including age, marital status, education, household income, and husband's occupation and education, were significantly associated with BPCR practices, emphasizing the critical influence of social and economic determinants. The findings underscore the role of health education, financial readiness, and access to institutional delivery in promoting maternal health. However, gaps remain in addressing poor practices among a minority of respondents, as well as the need to overcome cultural, logistical, and systemic barriers to equitable maternal health services.

Based on these findings, several recommendations are proposed. First, targeted educational campaigns should be intensified to address gaps in BPCR practices, particularly among women with lower educational attainment or socioeconomic status. Health education should be culturally sensitive and incorporate community leaders and religious institutions to reach diverse populations effectively. Second, policymakers should prioritize strengthening healthcare infrastructure and transport systems to ensure timely access to skilled care, especially for those reliant on less reliable transport modes. Third, financial support mechanisms, such as maternal health subsidies or emergency funds, should be introduced to alleviate economic barriers to BPCR. Finally, continuous engagement with traditional birth attendants and other informal support systems can facilitate integration with formal healthcare services, ensuring safe and culturally acceptable maternal health practices. These strategies will help sustain progress and improve maternal and neonatal health outcomes in the Tamale Metropolis.

Consent for publication

Not applicable

Data Availability

Data used to support this study are available from the corresponding author upon request.

Disclaimer (Artificial intelligence)

The authors currently declare that generative AI (ChatGPT) was used during manuscript editing(grammar).

References

[1] World Health Organization. Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division.

[2] United Nations Population Fund. The State of World Population 2018, https://www.unfpa.org/press/state-world-population-2018 (2018, accessed 1 January 2025).

[3] World Health Organization. SDG Target 3.1: Reduce the global maternal mortality ratio to less than 70 per 100,000 live births.

[4] Lawn JE, Blencowe H, Waiswa P, et al. Stillbirths: rates, risk factors, and acceleration towards 2030. *Lancet* 2016; 387: 587–603.

[5] Ghana Statistical Service (GSS), Ghana Health Service (GHS) I. Ghana maternal health survey 2017. Accra:

[6] Bapula A, Newton SK, Dormechele W, et al. Birth preparedness and complication readiness among pregnant women in resource-limited setting in rural Northern Ghana. *PAMJ-One Heal*; 6.

[7] Nachinab GT, Yakong VN, Dubik JD, et al. Perceptions on birth preparedness and complication readiness: perspectives of pregnant women. *Sage Open* 2023; 13: 21582440231207136.

[8] Alamrew A, Sisay A, Ayele M, et al. Determinants of birth preparedness and complication readiness practice among reproductive-age women in Africa a systematic review and meta-analysis. *BMC Public Health* 2024; 24: 3154.

[9] Anguzu R, Walker RJ, Babikako HM, et al. Intimate partner violence and antenatal care utilization predictors in Uganda: an analysis applying Andersen's behavioral model of healthcare utilization. *BMC Public Health* 2023; 23: 2276.

[10] Osman ASA, Ahmed MA, Mohamed MH, et al. Factors Affecting the Utilization of Antenatal Care among Married Women of Reproductive Age in Merca, Lower Shebelle, Somalia. *J Biosci Med* 2022; 10: 165–175.

[11] Karkee R, Lee AH, Binns CW. Birth preparedness and skilled attendance at birth in Nepal: implications for achieving millennium development goal 5. *Midwifery* 2013; 29: 1206–1210.

[12] Feyisa Balcha W, Mulat Awoke A, Tagele A, et al. Practice of Birth Preparedness and Complication Readiness and Its Associated Factors: A Health Facility-Based Cross-Sectional Study Design. *Inq J Heal Care Organ Provision, Financ* 2024; 61: 00469580241236016.

[13] Solnes Miltenburg A, Roggeveen Y, Shields L, et al. Impact of birth preparedness and complication readiness interventions on birth with a skilled attendant: a systematic review. *PLoS One* 2015; 10: e0143382.

[14] Kviz FJ. *Conducting health research: Principles, process, and methods*. Sage Publications, 2019.

[15] Oduro AR, Anyorikeya M, Ansah P, et al. Birth preparedness and complications readiness among women in disadvantaged rural districts of Ghana. *BMC Pregnancy Childbirth* 2023; 23: 728.

[16] Agiri Jr UA, Dienye PO, Adjugah J, et al. Relationship between Socio-demographic Characteristics and the Pattern of Birth Preparedness and Complication Readiness among the Pregnant Women Attending the Antenatal Clinic in UPTH. *Niger J Med* 2023; 32: 480–486.

[17] Tafasa SM, Bekuma D, Fikadu W, et al. Birth preparedness, complication readiness and associated factors among pregnant women attending public health facilities in Chelia District, Central Ethiopia (2022): a cross-sectional study. *BMJ Open* 2024; 14: e084945.

[18] Singh T, Tripathy B, Pandey AK, et al. Examining birth preparedness and complication readiness: a systematic review and meta-analysis of pregnant and recently delivered women in India. *BMC Womens Health* 2024; 24: 119.

[19] Ijang YP, Cumber SNN, Nkfusai CN, et al. Awareness and practice of birth preparedness and complication readiness among pregnant women in the Bamenda Health District, Cameroon. *BMC Pregnancy Childbirth* 2019; 19: 371.

[20] Asumah MN, Mohammed MY, Abubakari A, et al. Improving maternal health services utilization in Ghana: should digital health be considered? Correspondence. *Ann Med Surg* 2023; 85: 557.

[21] Teitelman Y. Pregnancy as an optimal time for health improvement: Creating interventions to benefit maternal and fetal health long-term.

[22] Fantaye AW, Gunawardena N, Yaya S. Preferences for formal and traditional sources of childbirth and postnatal care among women in rural Africa: A systematic review. *PLoS One* 2019; 14: e0222110.

[23] Dantas JAR, Singh D, Lample M. Factors affecting utilization of health facilities for labour and childbirth: a case study from rural Uganda. *BMC Pregnancy Childbirth* 2020; 20: 39.

[24] Mathewos Oridanigo E, Kassa B. Utilization of Skilled Birth Attendance among Mothers Who Gave Birth in the Last 12 Months in Kembata Tembaro Zone. *Adv Med* 2022; 2022: 8180387.

[25] Ahmed AM, Ahmed MA, Ahmed MH. Birth preparedness and complication readiness among recently delivered women in Hargeisa town, Somaliland: A community-based cross-sectional study. *PLoS One* 2024; 19: e0302168.

[26] Kamineni V, Murki AD, Kota VL. Birth preparedness and complication readiness in pregnant women attending urban tertiary care hospital. *J Fam Med Prim care* 2017; 6: 297.

[27] Ekirapa-Kiracho E, Waiswa P, Rahman MH, et al. Increasing access to institutional deliveries using demand and supply side incentives: early results from a quasi-experimental study. *BMC Int Health Hum Rights* 2011; 11 Suppl 1: S11.

[28] Thapa B, Karki A, Sapkota S, et al. Determinants of institutional delivery service utilization in Nepal. *PLoS One* 2023; 18: e0292054.

[29] Thaddeus S, Maine D. Too far to walk: maternal mortality in context. *Soc Sci Med* 1994; 38: 1091–1110.

[30] Asumah MN, Abubakari A, Abdulai AM, et al. Sociodemographic and Maternal Determinants of Postnatal Care Utilization: A Cross-Sectional Study. *SAGE Open Nurs* 2023; 9: 23779608231206760.

[31] Tesfaye G, Loxton D, Chojenta C, et al. Delayed initiation of antenatal care and associated factors in Ethiopia: a systematic review and meta-analysis. *Reprod Health* 2017; 14: 1–17.

[32] Hailu M, Gebremariam A, Alemseged F, et al. Birth preparedness and complication readiness among pregnant women in Southern Ethiopia. *PLoS One* 2011; 6: e21432.

[33] Kabakyenga JK, Östergren P-O, Turyakira E, et al. Knowledge of obstetric danger signs and birth preparedness practices among women in rural Uganda. *Reprod Health* 2011; 8: 1–10.

[34] Urassa DP, Pembe AB, Mganga F. Birth preparedness and complication readiness among women in Mpwapwa district, Tanzania. *Tanzan J Health Res*; 14.

[35] Gebre M, Gebremariam A, Abebe TA. Birth preparedness and complication readiness among pregnant women in Duguna Fango District, Wolayta Zone, Ethiopia. *PLoS One* 2015; 10: e0137570.

[36] Heward-Mills NL, Atuhaire C, Spoors C, et al. The role of faith leaders in influencing health behaviour: a qualitative exploration on the views of Black African Christians in Leeds, United Kingdom. *Pan Afr Med J* 2018; 30: 199.

[37] Boateng ACO, Sebu J, Lekwauwa R, et al. Religiosity & mental health seeking behaviors among U.S. adults. *Int J Psychiatry Med* 2024; 59: 248–264.