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Determinants of Maternal Mortality in North Eastern Nigeria: A Population Based Study

Mustapha A. Kolo[1], Yusuf M. Adamu[2], Muhammad Chutiyami[3*], Abdulkarim G. Mairiga[4] and Buba S. Mshelia[5]

[1]Department of Geography, University of Maiduguri, Nigeria.
[2]Department of Geography, Bayero University, Kano, Nigeria.
[3]College of Nursing and Midwifery, Damaturu, Nigeria.
[4]University of Maiduguri Teaching Hospital, Maiduguri, Nigeria.
[5]State Specialist Hospital, Maiduguri, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. Author MAK designed the study, performed the statistical analysis, wrote the protocol and managed data collection. Author YMA supervised and managed the analyses of the study. Author MC managed the literature searches and wrote the first draft of the manuscript. Authors AGM and BSM assisted in data collection and supervision. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The aim of this study is to explore the determinants of maternal mortality across urban and rural areas of Borno State, North Eastern Nigeria.
Method: A cross-sectional study design was used. Data were sourced from in-depth interview of women of reproductive age sampled across the state. 300 women of reproductive age were interviewed in urban areas, 100 each from the three senatorial districts of the state. Whereas 123 women were selected from three villages in each of the three senatorial districts. SPSS v16 was used for data analysis.
Results: It was identified that early marriage is prevalent in both urban and rural areas of the state as more than 60% of the respondents in each area were married between 13 to 19 years of age.

**Corresponding author: E-mail: Mchutiyami@gmail.com;*

Similarly, about half of the respondents had their first pregnancy before 20 years of age, but no statistical significant difference was found between age at first pregnancy and pregnancy complications (x^2= 19.4, df18, P>.05 in Urban Borno, x^2= 11.2, df10, P>.05 in Rural Borno, α=0.05). Although, utilization of antenatal care (ANC) services were relatively high, but 17% (urban) and 29% (rural) of the women were found not to be attending ANC. Home delivery was also a common feature constituting 39% for urban Borno and 49% for rural Borno. A statistically significant relationship was found between level of education and maternal health/mortality in both urban and rural areas (P<.05). Accordingly, ethnicity is significantly associated with maternal health seeking behavior in Urban Borno (P<.05), as high parity was found to increase pregnancy complications in rural Borno state (P<.05).

Conclusion: Major determinants of maternal deaths in urban/rural Borno state were poor access to basic obstetric care services, financial difficulty and illiteracy. The study thus recommends increase in awareness as well as a sustainable free maternal health services in the state.

Keywords: Determinants; maternal; mortality; Borno; Nigeria.

1. INTRODUCTION

A number of literatures established a link between maternal health seeking behavior and maternal mortality in Nigeria [1,2] and other parts of the world [3,4,5,6,7]. This is confounded by traditional beliefs as well as customs, values and religion of women particularly in Sub-Saharan African countries [8,9,10,11]. Nigeria ranks second to India in terms of high number of maternal deaths in the world [2]. The maternal Mortality Ratio (MMR) in the country varies from one geopolitical region to the other, while it was 2420/100000 in 2003 in Kano, North West Nigeria, [12] another study in 2011 in the North West (Kano & Kaduna) found 940/100000 [13]. Similarly, it was 1260/100000 in 2011 in Jos, North central Nigeria [14] while 518/100000 was found in 2008 in Benin City, Southern Nigeria [15].

Despite strong advocacy efforts, political leaders have either ignored the call or failed to make the health of pregnant women a priority in resource poor countries like Nigeria [16]. This significantly contributed to the apparent failure of the safe motherhood in Nigeria. The striking lack of progress, despite maternal mortality reduction being awarded its own Millennium Development Goal (MDG-5) in 2000, has been a source of puzzlement and embarrassment to the global health.

Most studies in this subject area are either community based [17,18,19] or clinical based confined to health facilities [20,21]. This study on the other hand was aimed at conducting a state-wide population based study on maternal health seeking behavior, with a view of identifying the determinants of maternal mortality in Borno state. This study build on the researcher's previous study on the spatial and temporal variations of maternal deaths in Borno state. The study will therefore, not only shed more light on the situation in the study area but also describe and compare the determinants of maternal mortality in both rural and urban areas of the state.

2. METHODS

2.1 Design

A cross-sectional study design was used to survey women of child bearing age in selected urban and rural areas of Borno state of Nigeria. In-depth interview was used in data collection.

2.2 Area of the Study

The state (Borno) has 27 Local Government Areas LGAs, which were stratified according to the three senatorial zones that form each state in Nigeria, namely Central Borno, Northern Borno and Southern Borno (Fig. 1). Out of these, three local governments' areas of the state, one from each of the three Senatorial Districts constituted the Urban Study Area. In each of the three LGAs, the largest settlements in terms of population and social amenities were selected. Three villages, one each from the remotest LGAs in the three Senatorial Districts form the Rural Study Area. Finally, a total of six places, three (3) in the urban settlements and three (3) in the rural settlements were used as the setting for this study. The urban area settlements include Biu, Maiduguri, and Monguno cities, while the rural settlements include Gashagar, Gulumba and Kubo towns. The average distance of the three rural settlements from Maiduguri, the state capital is about 180 km. Each of the rural settlements has a total population of approximately 4,500, which places them under the rural category in line with

the specification of Nigerian National Population Commission NPC [22], which states that any settlement with less than 20,000 people is considered rural.

2.3 Sampling Technique and Sample Size

For the urban study area, the towns were subdivided into five sub zones based on their socio-economic, health seeking behavior and ethnic composition. In each sub zone, 20 women were systematically sampled using purposive sampling method for the interview. Systematic sampling was employed considering the large population size of the urban study areas, thus every fifth household was chosen for the interview. Consequently, a married woman of reproductive age in every fifth house was interviewed. A total of three hundred (300) women were interviewed in the urban area of the study, one hundred (100) from each of the three selected urban centers of Biu (Southern Borno), Maiduguri Metropolitan Council (Nentral Borno) and Monguno (Northern Borno).

As for the rural area, a direct purposive sampling method was used because the population size is not as big as that of urban areas. In all, one hundred and twenty three (123) women were interviewed in the three rural settlements. The settlements are Gashagar (Northern Borno), Gulumba (Central Borno) and Kubo (Southern Borno).

2.4 Data Collection

In each of these six areas (Fig. 1), women of reproductive age were interviewed. The interview was conducted by trained research assistants and Nurse/Midwifes who helped in filling the responses and propped further if additional clarifications were required. This is necessary due to the low literacy level of the respondents in both rural and urban locations. The interview process was guided by set of questions which covered aspects of maternal health and mortality. Each of the interviewers were served with a copy of the in-depth interview guide ahead of time in order for them to get prepared and familiarize themselves with the issues. This strategy has helped in conducting a very rich and fruitful interview with maximum benefit.

2.5 Data Analysis

The results of the interviews and focus group discussions were transcribed for the purpose of interpretation and analysis. In some cases it has to be translated because the interview was conducted in the local languages (Kanuri and Hausa) of the participants. The data was coded with the assistance of a specialist data analyst to determine ranges and imputed into Micro Soft Excel (Version 2007) and transferred to SPSS (Version 16.0) for computation, descriptive and inferential statistical analysis.

3. RESULTS AND DISCUSSION

3.1 Determinants of Maternal Mortality in Urban Borno State

3.1.1 Age as a determinant of maternal death

The reported age at first marriage and at first pregnancy for this study shows a downward trend (Table 1). More than half of the women got married before 19 years of age, while about one quarter between 20-24 years. Those above 25 years are quite few (8.7%), which is in line with the study of Adamu et al. [12] in urban Kano State, Nigeria. This therefore indicates how prevalent early marriage occurs even in Nigerian urban areas. Similarly, more than half of the women had their first pregnancy between the ages of 13 and 19 years, a time when pregnancy complications are greatest for both the mother and the unborn baby. Age is an important determinant of maternal mortality and a number of literatures linked maternal death with women's age at marriage and at first pregnancy [12,23,24].

3.1.2 Parity

Parity of mothers as shown in Table 2 revealed about half of the respondents having 1-3 children. This indicates that majority of women in the urban areas of Borno state do not bear large number of children. However, about 46% have at least 4 children, which reflect existing literatures that states women in developing countries have higher fertility, associated with factors such as early marriage, cultural relevance of children, or what has been seen as ignorance and tempering with the rights of women [12,25].

3.1.3 Ethnic composition

About one-third of the respondents in urban Borno are Kanuri, reflecting the nature of the major ethnic group in the State. Babur/Bura ethnic groups constitutes about one quarter of the total number (Table 3). A similar study in

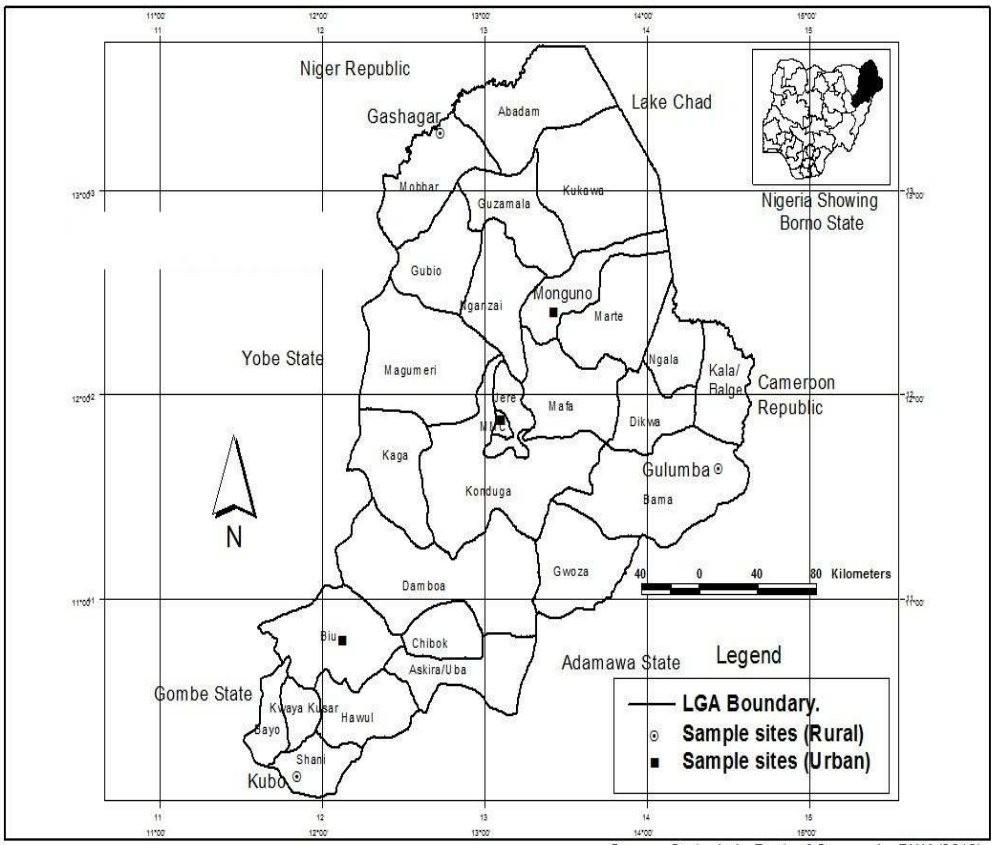
northern Nigeria by Ujah et al. [26] has found ethnicity to be a significant factor contributing to maternal mortality. Accordingly, this study established a link between ethnicity and maternal health seeking behavior (Table 7).

3.1.4 Level of western education for women

According to the results of this study (Table 4), non-formal education constituted nearly half of the responses in urban Borno, while secondary education constituted nearly one quarter of the total responses. This reflects the study by Walker, [27] who found low literacy level of (21%) among women in North Eastern Nigeria where Borno is situated.

3.1.5 Antenatal care (ANC)

Table 5 suggests that majority of women (79%) in urban Borno attend regular antenatal care, with only one-sixth who do not. This higher antenatal attendance could be associated with better access to health care facilities and high literacy rates that characterized majority of the women in urban areas. Ante-natal care visit is



Source: Carto. Lab, Dept. of Geography BUK (2012)

Fig. 1. Sample sites

Table 1. Age distribution

Age group	Current age		Age at marriage		Age at first pregnancy	
	Frequency	%	Frequency	%	Frequency	%
13-19	44	11.03	190	63.3	166	55.3
20-24	42	14	84	28.0	97	32.3
25-29	67	22.3	18	6.0	26	8.7
30-34	48	16	5	1.7	10	3.3
35 +	109	36.2	3	1	1	.3
Total	**300**	**100%**	**300**	**100%**	**300**	**100%**

Source: Field work, 2011

very crucial to expectant mothers as it gives them the chance to be examined and advised against any foreseeable complications [12]. Even though direct relationship has not been established between ANC attendance and safe delivery, women who access and attend antenatal clinics stand a better chance of safe delivery as compared to women who don't attend such clinics [28].

Table 2. Parity of respondents

Parity	Frequency	Percentage
1-3	115	48
4-6	88	23.7
7-10	59	15.3
11 and above	19	6.73
Not indicated	19	6.3
Total	300	100%

Source: Field Work, 2011

Table 3. Ethnic composition

Ethnic groups	Frequency	Percentage
Kanuri	105	35
Babur/Bura	78	26
Hausa/Fulani	58	19.3
Marghi/Chibok	19	6.3
Shuwa Arab	9	3.0
Gwoza/Mandara	3	1.0
Others	28	9.4
Total	**300**	**100%**

Source: Field Work, 2011

3.1.6 Place of delivery

More than half of the respondents indicated delivery at the health facility while about one-third indicated delivering at home (Table 6). However, the large number of the hospital deliveries is associated with better access to health care services in the urban Borno areas. Similarly, access to skilled health workers and TBA's at home also encourages home delivery according to the findings of this study, which is in line with the study of Ujah et al. [26].

Table 4. Level of education

Level of western education	Frequency	Percentage
Primary	22	7.3
Secondary	83	27.7
Diploma/NCE	53	17.7
Degree	13	4.3
Non formal	129	43.0
Total	**300**	**100%**

Source: Field work, 2011

Table 5. Antenatal care visits

Response	Frequency	Percentage
Yes	238	79.3
No	50	16.7
Not indicated	12	4.4
Total	300	100%

Source: Field work, 2011

Table 6. Place of delivery

Place of delivery	Frequency	Percentage
Hospital	177	59
Home	118	39
Not indicated	5	1.6
Total	**300**	**100%**

Source: Field work, 2011

3.1.7 Discussion of chi square (χ^2) test

Chi-square test was conducted for some selected variables as shown in table 7 at 0.05 level of significance (α).

3.1.7.1 Age at first pregnancy and pregnancy complications

The result shows a non-statistical significant difference between the present age of respondents and pregnancy complications (χ^2= 19.4 df = 18, P>0.05). Since the P-value of (0.365) is greater than the significance level (0.05), the null hypothesis is accepted. Thus, there is nosignificant relationship between

Table 7. Summary results of chi-square test in urban Borno (SPSS v16)

S/No	Variables	χ^2	df	P-value
1	Age at first pregnancy and pregnancy complications	19.4	18	0.365
2	Parity and pregnancy complications	12	12	0.428
3	Ethnicity and antenatal care visits	52	24	0.001
4	Level of education of mothers and antenatal care visits	41	12	0.000
5	Ethnicity and hospital delivery	68	24	0.000
6	Level of education of mothers and place of delivery	75.5	12	0.000

Source: Field work, 2011

age at first pregnancy and pregnancy complications in Urban Borno.

3.1.7.2 Parity and pregnancy complications

The findings is not statistically significant (X^2= 12.2 df= 12 P>0.05). Since the P-value of (0.428) is greater than the significance level (0.05), the null hypothesis is accepted. Thus, there is no relationship between parity and pregnancy complications.

3.1.7.3 Parity and action taken due to pregnancy complications

Results of parity and action taken due to pregnancy complications in urban Borno is not statistically significant (X^2= 24 df= 24, P>0.05). Since the P-value of (0.440) is greater than the significance level (0.05), the null hypothesis is accepted. Thus, there is no relationship between parity and action taken due to pregnancy complications.

3.1.7.4 Ethnicity and antenatal care visits

The result shows a statistically significant relationship the two variables ($_x^2$= 52 df = 24, P<0.05). Since the P-value of (0.001) is less than the significance level (0.05), the null hypothesis is rejected. Thus, the two variables are dependent of one another i.e. antenatal care visits depend on ethnicity of women in urban Borno.

3.1.7.5 Level of Western education of mothers and antenatal care visits

The findings with respect to the variables is statistically significant (X^2=41 df=12, P<0.05). Since the P-value of (0.000) is less than the significance level (0.05), the null hypothesis is rejected. Thus, there is a relationship between level of education of mothers and antenatal care visits in urban Borno State.

3.1.7.6 Ethnicity and hospital deliveries

Result of the cross tabulation shows a statistically significant relationship between the two variables ($_x^2$= 68 df = 24, P<0.05). Since the P-value of (0.000) is less than the significance level (0.05), the null hypothesis is rejected i.e. there is a relationship between ethnicity and hospital delivery in urban Borno State.

3.1.7.7 Level of education of mothers and place of delivery

The finding is statistically significant (X^2=75.5 df 12, P<0.05). Since the P-value of (0.000) is less than the significance level (0.05), the null hypothesis is rejected. Thus, there is a relationship between the level of Western education of mothers and place of delivery in urban Borno State.

3.2 Determinants of Maternal Mortality in Rural Borno State

3.2.1 Age as a determinants of maternal mortality

Like in urban Borno, the ages at marriage and at first pregnancy shows a downward trend (Table 8). More than half of the respondents in rural Borno were married before their 19th birthday, out of which most of them give birth before their reproductive organs were matured enough for child bearing. The Child Right Act in 2003 set the minimum age of marriage to be 18 years. However, majority of girls particularly in rural Nigeria get married before 18 years and start bearing children before their reproductive organs are fully prepared to do so [29]. This therefore indicates that both urban and rural Borno state experience the problem of early marriage, which requires urgent attention to safeguard the lives of women in the state.

Table 8. Age distribution in rural Borno

Age group	Current age		Age at marriage		Age at first pregnancy	
	Frequency	%	Frequency	%	Frequency	%
13-19	3	2.4	79	64.2	64	52
20-24	14	11.4	32	26.0	41	33.3
25-29	20	16.3	9	7.3	15	12.2
30-34	30	24.4	3	2.4	3	2.4
35 +	56	45.5	0	0	0	0
Total	**123**	**100%**	**123**	**100%**	**123**	**100%**

Source: Field work, 2011

Table 9. Parity of respondents in Rural Borno

Parity level	Frequency	Percentage
1-3	40	32.6
4-6	43	35
7-10	26	21
11 and above	14	11.3
Total	**123**	**100%**

Source: Field work, 2011.

3.2.2 Parity

Findings on parity of mothers in rural Borno (Table 9) indicated that majority of the respondents have parity of 4-6 unlike in urban Borno, where most of the women were para three or less. Similarly, those that are para 11 and above in rural Borno (11.3%) almost double those in urban Borno (6.3%). This therefore indicates that child bearing is much higher in rural Borno, which is in line with the findings of Adamu et al. [12] in Kano state of Nigeria.

Table 10. Ethnic composition in rural Borno

Tribal groups	Frequency	Percentage
Kanuri	55	44.7
Kanakuru	21	17.6
Babur/Bura	18	14.6
Hausa/Fulani	12	10
Marghi/Chibok	2	1.6
Gwoza/Mandara	2	1.6
Others	13	10.5
Total	**123**	**100%**

Source: Field Work, 2011

3.2.3 Ethnic composition in rural Borno

About half of the respondents in rural Borno are Kanuri just as in the case of urban Borno, which reflects the nature of the major ethnic group in the State. While Babur/Bura and Kanakuru ethnic groups, each constitutes about one fifth of the total responses. Hausa/Fulani, Marghi, Chibok make up the remaining ethnic groups (Table 10). Unlike in urban Borno, no significant relationship was found between ethnicity and maternal mortality in rural Borno (Table 14).

3.2.4 Level of education

Out of the total number of participants interviewed, those with primary and secondary education constitute a significant percentage (34%), while nearly half (44.7%) do not have any form of formal education (Table 11). This is similar to the figures identified in urban Borno, which shows 43% of the total respondents to be uneducated.

Table 11. Level of education in rural Borno

Level of western education	Frequency	Percentage
Primary	21	17.1
Secondary	21	17.1
Diploma/NCE	23	18.7
Degree	2	2.4
Non formal	55	44.7
Total	**123**	**100%**

Source: Field work, 2011

Table 12. Antenatal care visits in rural Borno

Response	Frequency	Percentage
Yes	87	71
No	36	29
Not indicated	0	0
Total	**123**	**100%**

Source: Field work, 2011

3.2.5 Antenatal care visits

Majority of women attend regular antenatal visits in rural Borno (71%), which is similar to antenatal visits rate in urban Borno (79%). Despite this, significant number of the women do not attend antenatal care (Table 12). The poor attendance/ non-attendance according to the women interviewed were associated with distance of health facilities, financial difficulty, poor awareness and most commonly lack of husband approval. Culturally, most communities in the northern Nigeria are male dominated and women are not allowed to go out of the family without the permission of their husbands [12,26].

Table 13. Place of delivery in rural Borno

Place of delivery	Frequency	Percentage
Hospital	59	48
Home	60	48.7
Not indicated	4	3.3
Total	**123**	**100%**

Source: Field work, 2011.

3.2.6 Place of delivery

As indicated in Table 13, home delivery is the commonest practice in Borno rural communities as opposed to urban Borno, where majority of people prefer hospital delivery. Home deliver is preferred in the rural areas because it is cheaper

and convenient to most women interviewed. Some women and husbands complained lack of functional amenities in most health facilities and therefore cannot compromise their privacy. Distance of health facilities was also indicated while some husbands prefer home delivery because they don't want their wives to be examined by a male health worker. These findings were similar to the findings of Adamu et al. [12] in Kano state of Nigeria, where a number of women particularly in the rural areas give preference to home delivery.

3.2.7 Discussion of chi square (χ^2) test

Chi-square test for independence was conducted for some selected variables as shown in table 7 at 0.005 level of significance (α).

3.2.7.1 Age at first pregnancy and pregnancy complications

Chi square result of the above variables shows a non-statistically significant difference between age at first pregnancy and pregnancy complications (χ^2= 19.4 df = 18, P>.05). Since the P-value of (0.365) is greater than the significance level (0.05), the null hypothesis is accepted. Thus there is no dependent relationship between the two variables.

3.2.7.2 Parity and pregnancy complications

Cross tabulation result of the two variables shows that they are statistically significant (X^2= 34 df= 12, P<0.05). Since the P-value of (0.000) is less than the significance level (0.05), the null hypothesis is rejected. Thus, it was concluded that there is a dependent relationship between parity and pregnancy complications in rural Borno State.

3.2.7.3 Ethnicity and antenatal care visits

The result shows a statistically non-significant relationship between the two variables (χ^2= 17 df = 14, P>05). Since the P-value of (0.242) is greater than the significance level (0.05), the null hypothesis is accepted, indicating an independent relationship between ethnicity and antenatal care visits.

3.2.7.4 Level of western education of mothers and antenatal care visits

The test compared the level of education of mothers and antenatal care visits in rural Borno State and found statistically significant difference (X^2=31 df =8, P<0.05). Since the P-value of (0.000) is less than the significance level (0.05), the null hypothesis is rejected. Thus, there is a relationship between level of education of mothers and antenatal care visits in rural Borno State. The implication of this result is that the higher the level of education of mothers, the more likely they attend antenatal care visits.

3.2.7.5 Ethnicity and hospital deliveries

Cross tabulation result shows a statistically non-significant relationship between ethnicity and hospital delivery (χ^2= 29 df = 21, P>05). Since the P-value of (0.103) is greater than the significance level (0.05), the null hypothesis is accepted, which indicates that the two variables are independent of one another.

3.2.7.6 Level of education of mothers and place of delivery

The test compared the level of education of mothers and their choice of place of delivery in the rural Borno State, which is statistically significant (X^2= 30 df 12, P<0.05). Since the P-value of (0.002) is less than the significance level (0.05), the null hypothesis is rejected. Thus, there is a dependent relationship between level of western education of mothers and place of delivery in rural Borno State.

Comparing the chi-square test for urban and rural Borno, only level of education has significant impact on antenatal care visit

Table 14. Summary of chi square test in rural Borno (SPSS v16)

S/No	Variables	χ^2	df	P
1	Age at first pregnancy and pregnancy complications	11.2	10	0.342
2	Parity and pregnancy complications	34	12	0.000
3	Ethnicity and antenatal care visits	17.2	14	0.242
4	Level of education of mothers and antenatal care visits	31	8	0.000
5	Ethnicity and hospital delivery	29.4	21	0.103
6	Level of education of mothers and place of delivery	30	12	0.002

Source: Field work, 2011

as well as place of delivery among women in both urban and rural Borno state. This is an indication that education is a key determinant of maternal health/mortality in Borno state of Nigeria, which influences healthy decision making among women. This is in line with the study of Adamu et al. [12] in Kano state of Nigeria, Greenaway et al. [30] in Ghana and Karlsen et al. [31] in a cross-sectional WHO Global survey on maternal health. Karlsen et al. [31] further identified that women with no education had 2.7 times and those with between one and six years of education had twice the risk of maternal mortality of women with more than 12 years of education. It therefore becomes imperative to improve the educational status of women in Borno state of Nigeria, in order to reduce the increasing maternal deaths in the state.

4. CONCLUSION

Based on the findings of this study, it was concluded that the major determinants of maternal deaths in urban and rural Borno state were lack of access to basic obstetric care services, financial difficulty and illiteracy. Accordingly, ethnicity is significantly associated with maternal health seeking behaviour in urban Borno, as high parity was found to increase pregnancy complications and eventually maternal deaths in rural Borno state. However, age was not found to be a significant determinant of maternal mortality in the state. The study thus recommend increase in awareness as well as a sustainable free maternal health services in the state.

ETHICAL AND CONSENT

This study was initially approved by research and ethical committee of Bayero University Kano, Nigeria. Before the commencement of the study, application was addressed to the Borno State Ministry of Health seeking permission to conduct the study in the state, after which a written permission was granted. Furthermore, a formal permission was sought from all the community leaders that agreed to participate in the studies. In addition, informed consent was gained from each participant prior to data collection.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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