



Maternal Characteristics and Outcomes of Obstetric Complications at a Tertiary Health Facility in Northern Ghana

Rosina Darcha^{1*} and Margaret Kukeba²

¹Department of Midwifery, School of Nursing and Midwifery, C. K. Tedam University of Technology and Applied Sciences, Ghana.

²Department of Nursing, School of Nursing and Midwifery, C. K. Tedam University of Technology and Applied Sciences, Ghana.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors teamed up to complete the research. Author RD conceived the idea, performed the statistical analysis and wrote the first draft. Author MK reviewed the literature designed the questionnaire. Both authors collected data and read as well as approved the final draft of this manuscript.

Article Information

Editor(s):

- (1) Dr. Shipra Sonkusare, K. S. Hegde Medical Academy, India.
(2) Dr. Charbell Miguel Haddad Kury, Universidade Federal do Rio de Janeiro, Brazil.

Reviewers:

- (1) María Camila Mejía Guatibonza, Fundación Universitaria Juan N. Corpas, Colombia.
(2) yogeshkumar Pransukhbhai, GMERS Medical College Dharpur Patan, India.
Complete Peer review History: <https://www.sdiarticle4.com/review-history/75626>

Original Research Article

Received 13 August 2021
Accepted 26 October 2021
Published 30 October 2021

ABSTRACT

Introduction: Ghana has recorded improved access to skilled care during pregnancy (4+ visits) 89% and labour 78%, yet maternal mortality is 310 per 100 000 live births. This research was conducted to identify the socio-demographic and obstetric characteristics of women with obstetric complications in a tertiary health facility in northern Ghana to gain sight to reduce maternal deaths.

Materials and Methods: This study was a cross-sectional quantitative retrospective study. We collected data from 384 women using a structured questionnaire and analysed it using SPSS version 20.0. Inferences were made using cross-tabulations with corresponding significance set at $P = .05$.

Results: This study revealed that, the typical woman with obstetric complication is 20-35 years old, mean age 27.7 and standard deviation of 6.2; married to a salaried worker; Dagomba by tribe; no

*Corresponding author: Email: rdarcha@ckutas.edu.gh;

formal education; petty trader; earn below the minimum wage of Ghana (\$ 2.07); Moslem; resides in an urban setting; pregnant and delivering for the first time; gestational age of 37-42 weeks at labour and birth spacing of 2-3 years. Cross-tabulations revealed associations between three socio-demographic and four obstetric characteristic all with large effects sizes as follows; $X^2(3, N = 69) = 13.50, P = .004$; $X^2(65, N = 67) = 1.11, P = .000$; $X^2(2, N = 69) = 9.17, P = .010$; $X^2(12, N = 68) = 26.1, P = .010$; $X^2(3, N = 384) = 17.15, P = .001$; $X^2(4, N = 69) = 19.8, P = .001$; $X^2(65, N = 65) = 1.12, P = .000$; $X^2(1, N =) = 72.9, P = .000$ respectively.

Conclusion: Obstetric complications are universal; improving poor outcomes in the study setting will take identifying and filling gaps in the skill needs of maternal health care workers and addressing health facility challenges.

Keywords: *Obstetric complications; socio-demographic characteristics, obstetric characteristics; maternal outcomes; maternal morbidities and maternal mortalities.*

1. INTRODUCTION

Pregnancy and childbirth are natural processes in a woman's life, but it is by no means without risk. Motherhood for some women in parts of the world is tinged with uncertainty. In most developing countries, motherhood is often marred by unforeseen complications, resulting in some women losing their lives. The risk of dying during child bearing in developing countries is 1 in 41 women compared to 1 in 3300 women in developed countries. These mortalities usually arise due to obstetric complications [1]. Obstetric complications are anomalies that ensue in pregnancy, labour or postpartum [2]. These complications are unpredictable, occurring in about 15% of all pregnancies and childbirths [3,4,1].

Ghana as a country has made positive steps in increasing access to maternal health services. Antenatal care at least four-plus visits are 89%, and skilled care at birth is 78%. However, the maternal mortality rate in Ghana is 310 per 100 000 live births, which is high. The causes of these deaths are largely preventable, which hints at sub-optimal maternal care [5-6]. Therefore, this research sought to identify the socio-demographic and obstetric characteristics of women with obstetric complications; determine the diagnosis, interventions and outcomes of the obstetric complications; and determine the maternal characteristics associated with poor outcomes of the obstetric complications at a tertiary health facility in northern Ghana as part of a more extensive research that delved into factors that contribute to obstetric complications and outcomes. This study will identify women at risk for obstetric complications to chart a path to developing pragmatic solutions towards improving maternal health in Ghana.

2. MATERIALS AND METHODS

This study is a cross-sectional quantitative study spanning six months (June to December 2015). Data was purposive and gathered at convenience from 384 women on admission due to obstetric complications at a tertiary health facility in Ghana. The sample size was arrived at using the Cochrane formula [7]. The reliability coefficient for 95% confidence level was set at 1.96, and 50% was used since the population's occurrence rate of obstetric complications was unknown. The inclusive criteria are all pregnant women carrying a singleton foetus who developed obstetric complications during the third trimester of the pregnancy, during delivery or postpartum.

2.1 Data Collection Instrument

Data was collected from the study participants with a structured questionnaire with both closed and open-ended questions to answer the objectives of this study. The questionnaire was pretested on 10% of the sample who have similar characteristics to the study participants. Minor revisions were made to ensure the questionnaire was reliable.

2.2 Application Procedure and Materials

The questionnaire was administered to participants on admission at the obstetrics and gynaecological units of the health facility using face to face interviews after the necessary explanations were made and consent sought. For some of them too sick patients at data collection, the interview was postponed until they were sufficiently recovered. We also retrieved data from their folders for patients who either died or could not respond to some questions.

2.3 Statistical Analysis

Data gathered was subjected to thorough checks at the site of data collection to ensure completeness. The questionnaire were coded and entered into SPSS version 20.0 for statistical analysis. Socio-demographic, obstetric characteristics, diagnoses made, interventions, and the complications' outcomes are described using frequencies and percentages. Inferences are made using cross-tabulations with the corresponding chi-square test of significance set at $P = .05$. Results emanating from the data analysis are described with the aid of tables.

3. RESULTS

3.1 Socio-demographic Characteristics of Respondents

The first objective of this research seeks to identify the socio-demographic characteristics of women with obstetric complications at a Tertiary Health Facility in northern Ghana. It was observed that, the women had a minimum age of 16 years and the maximum age of 49 years. Their mean age was 27.7 years with a standard deviation of 6.2. Furthermore, majority of the women, 73.7%, were between the ages of 20 and 35 years. These women were mainly Muslims, 85.2%. On the part of marital status, 94.8% were married and their spouses are mostly salaried workers. These women were predominantly urban dwellers, 72.9%. Again, more than half, 69.0% of these women belonged to the Dagomba ethnic group in northern Ghana. A good number, 45.8% of the women had no formal education, were mainly petty trading 38.8%, therefore earned below the daily minimum wage for Ghana of approximately 200 Ghana Cedis a month, 56.5%.

3.2 Obstetric Characteristics of Respondents

This research also sought to identify the obstetric characteristics of women who accessed care for obstetric complications. The results indicated that women pregnant (gravida) and delivery (parity) for the first time were the majority, 29.9% and 32.3% respectively. The highest, 79.9% of the respondents reported that their pregnancy was term (37-42 weeks). Additionally, most 33.3% of the study respondents stated that the interval between their previous and the most recent pregnancy was 2 to 3 years. Still, on obstetric

characteristics, 86.5% said they were healthy during the recent pregnancy while 13.3% said they were sick. Of the respondents who reported being sick during the recent pregnancy, majority 49.0% were diagnosed with pregnancy-induced Hypertension (PIH).

3.3 Diagnoses, Interventions and Outcomes of the Obstetric Complications

Objective three sought to describe the diagnoses of the complications, the interventions to manage the obstetric complications, and the complication outcome post the interventions.

3.3.1 Diagnoses of obstetric complications

Overall, 20 obstetric complications were diagnosed for the 384 women during the period of data collection. Of the 384, 14.6% had two complications while 0.3% had three complications. The top three causes of maternal morbidity during the period were; obstructed labour, preeclampsia/eclampsia and postpartum haemorrhage, which were suffered by 56%, 14.6% and 11.5% of the respondents, respectively. Table 1 shows details of the other complications that occurred.

3.3.2 Interventions to manage obstetric complications

A total of 12 interventions were carried out to save the lives of the 384 mothers with obstetric complications. Some of the women had multiple interventions as follows; 25.5% of the respondents had two interventions, while 4.4% had three interventions. The three most frequent interventions carried out include; caesarian sections 89.3%, blood transfusions 14.3% and intensive care and treatment 14.3%. Details of the above summary are in Table 2.

3.3.3 Maternal outcomes of the obstetric complications

This research monitored the outcomes of the obstetric complications following the interventions. It was revealed that the majority, 81.8%, of the respondents said they had recovered 24 hours after the intervention. The remaining 18.2% of the respondents said they were still sick 24 hours post-intervention. Of the sick respondents, 60% became better and were discharged three days later with medications.

27.1% became better seven days post-intervention and were also discharged with medications. Unfortunately, 12.9% of the respondents died on admission. The causes of maternal deaths were preeclampsia/eclampsia 55.6%, haemorrhage (A combination of antepartum and postpartum haemorrhage (APH)/PPH) 22.2%, a combination of Preeclampsia/eclampsia and postpartum haemorrhage caused 11.1% death while ruptured uterus also caused 11.1% death. Table 3 outlines these results.

3.4 Maternal Characteristics Associated with the Outcomes of the Obstetric Complications

This research also sought to identify the maternal characteristics (socio-demographic and obstetric characteristics) associated with the maternal outcomes following the obstetric complications. Therefore, the maternal characteristics were

cross-tabulated with all the maternal outcomes. Results were as follows.

3.4.1 Socio-demographic characteristics and maternal outcomes cross-tabulation

All the nine socio-demographic characteristics of the respondents (age, marital status, ethnicity, respondent's occupation, respondent's financial status, religion, residential area, educational background and partner's occupation) were cross-tabulated with each of the maternal outcomes, namely; maternal health status 24 hours after the interventions, diagnosis of the sickness (Obstetric complications), outcomes of respondent's sickness after admission and causes of maternal deaths for those who died as a result of the sickness (Obstetric complications). It emerged that only three (age, Husband's/partner occupation and residential area) out of the nine socio-demographic characteristics were significant with the maternal outcomes.

Table 1. Diagnoses of obstetric complications

Types of Diagnosis	1 st Diagnosis n=384	2 nd Diagnosis n=56	2 nd Diagnosis n=1
Prenatal Obstetric Complications			
Obstructed labour	213	2	0
Pre-eclampsia/Eclampsia	51	5	0
Ruptured uterus	18	0	0
Oligohydraminous	17	0	0
Polyhydraminous	2	0	0
Antepartum Haemorrhage (APH)	11	0	0
Postmature Pregnancy	8	1	0
Premature Labour	3	4	0
Bad obstetric history	1	0	0
Placenta abruption	1	0	0
Bicornuate uterus	0	1	0
Postnatal Obstetric Complications			
Retained placenta	14	1	0
Postpartum Haemorrhage (PPH)	7	37	0
Severe perineal/Cervical laceration	5	0	1
Puerperal sepsis	3	0	0
Puerperal psychosis	0	1	0
Maternal Medical Complications			
Poor maternal health	1	0	0
Sickle cell crisis	0	1	0
Foetal Complications			
Foetal distress	29	0	0
Intrauterine foetal death (IUFD)	0	3	0

Table 2. Interventions to manage obstetric complications

Interventions	1 st Intervention n=384	2 nd Intervention n=98	3 rd Intervention n=17	Total
Caesarian section	336	7	0	343
Blood transfusion	6	39	10	55
Intensive care and treatment	14	35	6	55
Hysterectomy	0	9	0	9
Laporotomy/re-laporotomy	7	2	0	9
Manual removal of the placenta	7	1	0	8
Failed vacuum extraction	6	0	0	6
Repair of lacerations	4	0	1	5
Bilateral tubal ligation	0	5	0	5
Induction of labour	2	0	0	2
Vacuum extraction	1	0	0	1
Failed induction of labour	1	0	0	1

Table 3. Maternal outcomes of obstetric complications

Variable	Frequency (%) n=384
Maternal health after intervention (24 hours)	
Healthy	314(81.8)
Sick	70(18.2)
The outcome of the sickness	
Better, discharged three days with treatment	42(60.0)
Better, discharged seven days with medication	19(27.1)
Died on admission	9(12.9)
Total	70(100)
Causes of maternal deaths	
Preeclampsia/eclampsia	5(55.6)
Haemorrhage (APH and PPH)	2(22.2)
Preeclampsia/eclampsia and PPH	1(11.1)
Ruptured uterus	1(11.1)
Total	9(100)

Results of respondent's age cross-tabulation with maternal health status 24 hours after the intervention to resolve the obstetric complication was significant $X^2(3, N = 69) = 13.50, P = .004$. The association was large $\phi = .188$. The health status of women 24 hours after the intervention to resolve obstetric complications accounted for 3.5% of the variance in age. A statistical relationship was established when husband/partner occupation was cross-tabulation with the diagnoses of the sickness (Obstetric complications); $X^2(65, N = 67) = 1.11, P = .000$. Large effect size was observed $\phi = 1.29$. The occurrence of obstetric complications accounts for 166% of the respondent's husband/partner occupation variance. Also, respondent's residential area was associated with the outcomes of the obstetric complication; $X^2(2, N = 69) = 9.17, P = .010$. The effect size is large, $\phi = .364$. The outcome of the obstetric complication accounted for 13.2% of the difference in the

residential area. Details of these results can be seen in Table 4.

3.4.2 Obstetric characteristics and maternal outcomes cross-tabulation

All the obstetric characteristics (gravida, parity, gestational age at labour, birth spacing, health status at recent pregnancy and diagnoses of the sickness during or after the pregnancy) were cross-tabulated with each of the maternal outcomes of the obstetric complications. These obstetric complications include maternal health status 24 hours after the interventions, diagnosis of the sickness, outcomes of respondent's sickness after admission and causes of maternal deaths for those who died due to the obstetric complications. A relationship was established between four of the obstetric characteristics and the maternal outcomes.

Table 4. Socio-demographic characteristics and maternal outcomes cross-tabulation

Maternal outcomes	Socio-demographic characteristics							
Maternal health status 24 hours post-intervention	Age					df	χ^2	P
	14-19	20-35	36-45	46-50	Total			
	n=58	n=283	n=38	n=5	N=384			
	48	232	33	1	314			
	10	51	5	4	70			
Healthy	58	283	38	5	384	3	13.501	.004
Sick								
Total								
Diagnoses of sickness	Husband/Partner occupation					df	χ^2	P
	Unemployed	Petty trading	Farming	Salaried worker	Artisan			
PIH	0	11	5	8	9	1	65	1.114
Asthma	0	1	0	1	0	0		.000
PPH/Anaemia	0	1	9	5	4	0		
Abdominal pain	0	1	0	0	0	0		
Retained placenta	0	0	0	0	1	0		
SCD/PIH	0	0	0	1	0	0		
Peptic ulcer	0	0	1	0	0	0		
Eclampsia/psychosis	0	0	1	0	0	0		
Puerperal infection	0	0	0	0	1	0		
Weak incision site	1	0	0	0	0	0		
PIH/Anaemia	0	0	0	1	0	0		
APH/PPH/Anaemia	0	0	2	0	0	0		
Hepatitis B	0	0	0	1	0	0		
Ruptured uterus	0	0	1	0	0	0		
Total	1	14	19	17	15	1		
The outcome of the obstetric complication	Residential area				df	χ^2	P	
	urban	Rural						
	41	17	2					
	2	0						
	2	7						
Total	45	24						

Results revealed that respondent's parity (number of deliveries) and outcomes of the obstetric complication is significant. The resultant chi-square test was as follows; $X^2(12, N = 68) = 26.1, P = .010$. The effect size is large $\phi = .619$. Parity accounted for 38.3% of the variance in the outcome of the obstetric complication. A relationship was also established between the gestational age at labour and maternal health status 24 hours after the obstetric complications; $X^2(3, N = 384) = 17.15, P = .001$. The effect size is large $\phi = .211$. Gestational age accounted for 4.5% of the difference in respondent's health status 24 hours after the intervention has been carried out to resolve the obstetric complications. Again, an association was established between gestational age at labour and the outcome of the maternal obstetric complication. Chi-square test of significance; $X^2(4, N = 69) = 19.8, P = .001$. The resultant difference is large $\phi = .536$. Gestational age is accountable for 28.7% of the variance in the outcomes of the complication. Statistical significance was revealed between birth spacing and the diagnosis of the obstetric complication made during pregnancy or puerperium; $X^2(65, N = 65) = 1.12, P = .000$. Large effect size was observed $\phi = 1.31$. Birth spacing is liable for 171.6% of the difference in the diagnoses made during the obstetric complication. Finally, the chi-square test indicated significance between maternal health status at the recent pregnancy and maternal outcomes 24 hours after the intervention; $X^2(1, N = 383) = 72.9, P = .000$. The effect size is large $\phi = .436$. Maternal health status at the recent pregnancy accounted for 19.0% of the variance in the health status of respondent's 24 hours after the intervention to the obstetric complication. Table 5 contains details of these findings.

4. DISCUSSION

We investigated the socio-demographic and obstetric characteristics of women with obstetric complications; identified the diagnoses of the sicknesses making up the obstetric complications, interventions made to manage the obstetric complication, and the outcomes of the obstetric complications as well as maternal characteristics associated with poor outcomes.

Firstly, we identified in this study that the typical woman likely to get obstetric complication has a mean age of 27.7 years with a standard deviation of 6.2 years; married to a salaried worker; Dagomba by tribe; had no formal education; a

petty trader; earn below the daily minimum wage (\$2.07) in Ghana; Moslem by religion and resident in an urban area. The above findings imply that women at risk of obstetric complications are those with intended pregnancies because young women 19 years or less may still be in school or learning a trade, and those above 35 years may have had their desired number of children. Authors have reported similar deductions such [8-13] in Ghana, Hong Kong, India, Tanzania, Cameroon and Lao People's Democratic Republic.

Secondly, our study describes the classical obstetric characteristics of a woman with obstetric complications as; being pregnant and delivering for the first time, healthy during the pregnancy, having a term pregnancy at the onset of labour, and having a birth spacing of 2-3 years. Just like the socio-demographic characteristics, the obstetric characteristics also paint the picture of women who seem to have had planned pregnancies. Other researchers such as [2,8,14,9] in both developed and least developed countries identified similar characteristics of women with maternal morbidities and mortalities. Our results support obstetric complications' unpredictable nature, affecting all women in both developed and least developed alike [15,6,4,16]. Therefore, if obstetric complications are universal, the poor outcomes experienced by the least developed countries compared to the more developed regions may be due to health providers and systemic challenges, as noted by [4,17,1,5,6]. Whilst this paper did not explore the latter to be sure of the specific health provider, and system challenges, an investigation of the specific factors could contribute to designing strategies that may reduce the poor outcomes of obstetric complications [18-22].

Thirdly, the results of this study also answered the objective that sought to describe the diagnoses of the obstetric complications and interventions made to manage the obstetric complications and the outcomes of the obstetric complications as follows; almost 15% of the respondents suffered multiple complications while the rest had single complications. The top 3 causes of maternal morbidity were; obstructed labour, preeclampsia/eclampsia and PPH. Literature has described similar consequences of obstetric complications [8,1,18-20]. Twelve interventions were carried out to manage the above complications, and multiple interventions were used in 29.9% of the respondents. The

Table 5. Obstetric characteristics and maternal outcomes cross-tabulation

Maternal outcomes	Obstetric Characteristics									
The outcome of the obstetric complication	Parity (number of births)									
	Never delivered	One	Two	Three	Four	Five	≥ Six	df	X ²	P
Discharged in 3 days	0	18	10	11	8	4	7	12	26.1	.010
Discharged in 7 days	0	0	0	0	2	0	0			
Died on admission	1	1	1	3	0	2	0			
Total	1	19	11	14	10	6	7			
Health status 24 hours after intervention	Gestational age at labour									
	< 37 weeks	37-42 weeks	> 42 weeks	I don't know	df	X ²	P			
Healthy	19	258	35	2	3	17.15	.001			
Sick	15	49	6	0						
Total	34	307	41	2						
The outcome of obstetric complications	Gestational age at labour									
	< 37 weeks	37-42 weeks	> 42 weeks	I don't know	df	X ²	P			
Discharged in 3 days	8	43	7	0	4	19.8	.001			
Discharged in 7 days	0	2	0	0						
Died on admission	7	2	0	0						
Total	15	47	7	0						
Diagnoses of obstetric complication	The interval between previous and current pregnancy (year(s) (Birth spacing)									
	First Pregnancy	≤ 1	1	2-3	4-5	≥ 6	df	X ²	P	
PIH	9	0	1	12	8	3	65	1.12	.000	
Asthma	2	0	0	0	0	0				
PPH/Anaemia	6	0	0	4	7	2				
Abdominal pain	0	0	0	0	1	0				
Retained placenta	0	0	0	0	1	0				

Maternal outcomes	Obstetric Characteristics					
SCD/PIH	1	0	0	0	0	0
Peptic ulcer	0	0	0	1	0	0
Eclampsia/puerperal psychosis	0	0	0	0	0	1
Puerperal infection	1	0	0	0	0	0
Weak incision site	1	0	0	0	0	0
PIH/Anaemia	0	0	0	0	0	1
APH/PPH/Anaemia	0	0	0	0	0	1
Hepatitis B	0	1	0	0	0	0
Ruptured uterus	0	0	0	0	1	0
Total	20	1	1	17	18	8
Maternal health status 24 hours post-intervention	Maternal Health at recent pregnancy					
	Healthy	Sick	<i>df</i>	χ^2	<i>P</i>	
Healthy	294	20	1	72.9	.000	
Sick	38	31				
Total	332	51				

three most frequent interventions were; caesarian sections, blood transfusions and intensive care and treatment. Outcomes of the obstetric complications overall resulted in 97.7% survival (maternal near-miss) and 2.3% maternal deaths during the six months of data collection. These authors [20-22] also documented effects likewise with minor variations.

Finally, our research findings further clarified the maternal characteristics associated with poor outcomes. The associations were all observed to have large effect sizes. On the cross-tabulation, maternal aged 20-35 years were the majority who were still sick 24 hours after interventions to resolve the obstetric complications. Respondents married to farmers were those mostly recorded with obstetric complications. Also, of the nine women who died due to obstetric complications, seven lived in rural areas. Likewise, the four obstetric characteristics that were frequently linked to poor maternal outcomes on the cross-tabulation were as follows; respondents giving birth (parity) for the third time where the majority that died on admission. Respondents whose gestational ages were term (37-42 weeks) at labour reported remaining sick 24 hours after the interventions. Again, women with preterm pregnancies (gestational age of less than 37 weeks) were noted to contribute seven out of the total nine women who died.

On the other hand, it was revealed that women with no birth spacing, because they are pregnant for the first time, were the majority diagnosed with obstetric complications. It was also noted that respondents who reported to be healthy during the recent pregnancy were the highest who reported remaining sick 24 hours after health interventions were carried out to manage the obstetric complications. Several empirical and systematic reviews [16,23,24] conducted worldwide reported similar outcomes. However, the results of our study not only reiterated the findings of other studies but also discovered that women delivering for the third time or probably any delivery could equally die as a result of obstetric complications.

5. CONCLUSION

Our study intended to identify women at risk for obstetric complications to facilitate pragmatic solutions towards improving maternal health in Ghana. Evidence from our results strongly supported by published literature confirms the universal nature of obstetric complications, with

slight variations in numbers. However, the outcomes are widely variant, with outcomes better for women in well-resourced countries than those in less-resourced ones. Therefore, it is evident from this study and literature that maternal health care provider's skills in diagnosing and management of obstetric complications as well as health care facilities in less-resourced countries are suboptimal and need to be identified and resolved to improve maternal morbidity and mortality. This recommendation is buttressed by evidence from a South African research which discovered a significant reduction in maternal deaths after implementing "skills-and-drills emergency obstetric care (EmOC)" training.

6. LIMITATIONS

This study was conducted in a tertiary health care facility using non probability sampling methods; therefore, the findings cannot be generalized to the entire population, however, results can be helpful in the context of other health care facilities. Also, a larger sample size would have painted a better picture of the obstetric complication in the said tertiary health facility.

7. KEY POINTS FOR THIS STUDY

1. Maternal obstetric morbidities are universal and mortalities arising are primarily preventable with expert care and management.
2. Authors recommend that maternal health care providers' skills in diagnosing and managing obstetric complications need to be evaluated and gaps comprehensively resolved.
3. Health care facilities in Ghana, especially the study site, need a comprehensive evaluation of logistics and human resources to identify and solve potential areas that may lead to maternal deaths.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by

the producing company rather it was funded by personal efforts of the authors.

CONSENT AND ETHICAL CONSIDERATIONS

Ethical approval was obtained from the ethics committee of the Tamale Teaching Hospital. Informed consent was obtained from mothers or their next of kin in cases where respondents were very ill or deceased. Autonomy was ensured by assuring the respondents that participating in the study was voluntary and that they were at liberty to stop at any time they consider questions distressing. Anonymity and confidentiality were preserved by authors during this research. Respondents were informed that their responses will be published, however they were assured that no identifiable information will be added. Therefore, questionnaires were identified using numbers and placed under locked and key. During interviews, privacy was maintained at all times. Data stored on the computer was protected by a password only known by authors. Data was collected on obstetric complications and outcomes with the potential of the questions triggering emotional distress. Hence, authors postponed the interviews until the ward social worker and the respondents consented to the interview. In the case of deaths, data was retrieved from the patient folder after informed consent was sought.

ACKNOWLEDGEMENT

The authors are grateful to all the respondents and health workers who, in diverse ways, facilitated this study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

- World Health Organization. Trends in maternal mortality: 1990-2015: estimates from WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. World Health Organization; 2015. Report No.: 9241565144.
- Fraser D, Cooper M, Nolte A. Myles textbook for midwives: African edition: Churchill Livingstone; 2006.
- Ezugwu E, Onah H, Iyoke C, Ezugwu F. Obstetric outcome following free maternal care at Enugu State University Teaching Hospital (ESUTH), Parklane, Enugu, South-eastern Nigeria. *Journal of Obstetrics and Gynaecology*. 2011;31(5): 409-12.
- Knight HE, Self A, Kennedy SHJ. Why are women dying when they reach the hospital on time? A systematic review of the 'third delay'. 2013;8(5):e63846.
- Lawton B, MacDonald EJ, Brown SA, Wilson L, Stanley J, Tait JD, et al. Preventable severe acute maternal mortality. *Am J Obstet Gynecol*; 2014.
- WHO. Ghana Annual report 2019. World Health Organization; 2019.
- Israel GD. Determining sample size. University of Florida Cooperative Extension Service, Institute of Food and Agriculture Sciences, EDIS, Florida; 1992.
- Boafor TK, Ntumu MY, Asah-Opoku K, Sepenu P, Ofosu B, Oppong SA. Maternal mortality at the Korle Bu Teaching Hospital, Accra, Ghana: a five-year review. *African Journal of Reproductive Health*. 2021;25(1):56-66.
- Leung N, Lau A, Chan K, Yan W. Clinical Characteristics and Outcomes of Obstetric Patients Admitted to the Intensive Care Unit: A 10-year Retrospective Review. *Hong Kong medical journal= Xianggang yi xue za zhi*. 2010;16(1):18-25.
- Hazarika I. Factors that determine the use of skilled care during delivery in India: implications for achieving MDG-5 targets. *Maternal and Child Health Journal*. 2011; 15(8):1381-8.
- Member RN, Killewo JZ, Leshabari MT, Massawe SN, Jahn A, Mushi D, et al. Use pattern of maternal health services and determinants of skilled care during delivery in Southern Tanzania: implications for achievement of MDG-5 targets. *BMC Pregnancy and childbirth*. 2007;7(1):1-7.
- Mbuagbaw LC, Gofin R. A new measurement for optimal antenatal care: determinants and outcomes in Cameroon. *Maternal and Child Health Journal*. 2011; 15(8):1427-34.
- Manithip C, Sihavong A, Edin K, Wahlstrom R, Wessel H. Factors associated with antenatal care utilisation among rural women in Lao People's Democratic Republic. *Maternal and Child Health Journal*. 2011;15(8):1356-62.

14. Madan I, Puri I, Jain NJ, Grotegut C, Nelson D, Dandolu V. Characteristics of obstetric intensive care unit admissions in New Jersey. *The Journal of Maternal-Fetal & Neonatal Medicine*. 2009;22(9):785-90.
15. Asamoah BO, Moussa KM, Stafström M, Musinguzi G. Distribution of causes of maternal mortality among different socio-demographic groups in Ghana; a descriptive study. *BMC Public Health*. 2011;11(1):159.
16. Shah N, Hossain N, Shoaib R, Hussain A, Gillani R, Khan NH. Socio-demographic characteristics and the three delays of maternal mortality. *J Coll Physicians Surg Pak*. 2009;19(2):95-8.
17. Geller SE, Cox SM, Kilpatrick SJ. A descriptive model of Preventability in maternal morbidity and mortality. *J Perinatol*. 2006;26(2):79-84.
18. Bandeira AR, Rezende CA, Reis ZS, Barbosa AR, Peret FJ, Cabral AC. Epidemiologic profile, survival, and maternal prognosis factors among women at an obstetric intensive care unit. *International Journal of Gynecology & Obstetrics*. 2014;124(1):63-6.
19. Gupta S, Naithani U, Doshi V, Bhargava V, Vijay BS. Obstetric critical care: A prospective analysis of clinical characteristics, predictability, and fetomaternal outcome in a new dedicated obstetric intensive care unit. *Indian journal of anaesthesia*. 2011;55(2):146.
20. Chhabra P. Maternal near miss: an indicator for maternal health and maternal care. *Indian journal of community medicine: official publication of Indian Association of Preventive & Social Medicine*. 2014;39(3):132.
21. Tunçalp Ö, Hindin M, Souza J. The prevalence of near maternal miss: a systematic review. *An International Journal of Obstetrics & Gynaecology*. 2012;119(6/P. 653-661).
22. Abha S, Chandrashekhar S, Sonal D. Maternal near miss: A valuable contribution in maternal care. *The journal of obstetrics and Gynecology of India*; 2016.
23. Fawad A, Naz H, Islam A, Zaffar S. Maternal mortality in a tertiary care hospital. *Journal of Ayub Medical College Abbottabad*. 2011;23(1):92-5.
24. Baruah C. A comparative study of obstetric complications among primigravida and multigravida attending labour room of a tertiary care hospital. *Indian Journal of Basic and Applied Medical Research*. 2016;5:147-53.

© 2021 Darcha and Kukeba; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<https://www.sdiarticle4.com/review-history/75626>