Original Research

Determinants of maternal near-miss cases at two selected central hospitals in Malawi

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Abstract

Background

Maternal near-miss cases occur in larger numbers than maternal deaths hence they require comprehensive analysis when studied. However, there is scarcity of information on determinants of maternal near-miss cases in Malawi. Therefore, this study aimed at establishing the determinants of maternal near-miss cases at two selected central hospitals in Malawi.

Methods

This was a case control study that utilized a quantitative approach. A random sample of 458 case files comprising maternal near-miss cases (161) and non-cases (297) was drawn using a ratio of 1:1.8. Data were analyzed using Stata 14 to generate descriptive statistics, Chi Square values to describe the data and determine associations among variables and logistic regression was conducted to determine the determinants of maternal near-miss.

Results

We found significant differences between demographic characteristics (marital status, occupation, admission mode, means of transport and age) of maternal near-miss cases and the non-cases (P<0.05). Age and mode of birth were found to be significantly associated (P<0. 05) with maternal near-miss. Women aged 31-35 years were 3.14 times more likely to experience maternal near-miss [OR=3.14, 95% CI: 1.09, 9.02, p=0.03] compared to those aged less than 20 years. Furthermore, emergency caesarean [OR=4.08, 95% CI: 2.34, 7.09, p=0.001] and laparotomy for uterine rupture [OR=83.49, 95% CI: 10.49, 664.55, P=0.001] were significantly associated with maternal near-miss.

Conclusion

Among pregnant women, health workers need to pay close attention to factors such as age and mode of birth for them to implement targeted maternal health services in order to reduce incidence of maternal near-miss cases.

Key words; Maternal near-miss, quality of care, determinants.

Introduction

Maternal near-miss has been explored over the past twenty years[1]. According to the World Health Organization (WHO), "maternal near-miss is a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy"[2]. Several studies that have been conducted on maternal near-miss globally and within Africa have ranged from exploring incidence, prevalence to nature of maternal near-miss[3–6]. A systematic review of studies from Sub-Saharan Africa indicated a close to a hundred maternal near-miss (women with severe maternal morbidity) for every maternal death[4]. However, there are large variations on the prevalence and incidence of maternal near-miss due to the different contexts and criteria used[4].

Maternal near-miss can be determined by a number of factors including demographic characteristics. Demographic characteristics which determine maternal near-miss cases include patients' age, parity and number of previous deliveries [7,8]. Age at first pregnancy was identified as a predictor of maternal near-miss in some studies[9]. This is corroborated by Aduloju et. al 9 and Mekango et.al[10] who asserted that age <16 years is associated with maternal near-miss. In addition to demographic characteristics, maternal near miss is also associated with several obstetric characteristics.

In Malawi, few studies that have been conducted reported prevalence of near-miss cases in Thyolo to be 88% when disease specific criteria was used, 46% using intervention based criteria and 22% using organ based criteria[11]. At Kamuzu Central Hospital, 18% was reported when disease specific criteria was used[12]. However, there is scarcity of information on determinants of maternal near-miss cases in Malawi. Therefore, this study aimed at establishing determinants of maternal near-miss cases at the two selected central hospitals in Malawi.

Methods

Study design

This was a case control study that utilized a quantitative approach to investigate the demographic, socioeconomic, obstetric characteristics and determine the key factors associated with maternal near-miss cases at two selected central hospitals in Malawi.

Setting

This study was conducted at Kamuzu and Queen Elizabeth Central Hospitals. These public tertiary hospitals offer specialized services with separate maternity wings. They also serve as teaching hospitals for different cadres of medical

professionals. Each facility manages approximately 10,000 deliveries per year including multiple obstetric complications such as obstructed labour, postpartum haemorrhage, pre-eclampsia/eclampsia, anaemia and sepsis[13] thus making the hospitals suitable for the study.

Study population

The study population comprised all pregnant women who gave birth during data collection period which was between the months of February and July 2017, and were admitted to antenatal, labour, postnatal ward and high dependency unit (HDU) of Ethel Mutharika Maternity Wing (EMMW) at Kamuzu Central Hospital (KCH) and Chatinkha Maternity Wing (CMW) at Queen Elizabeth Central Hospital (QECH). The wards were selected because these are the wards where maternal near-miss cases were cared for including the HDU where women who were maternal near-miss cases and in critical condition were cared for. Review of records was done and there was no interaction with clients. Records for all women who gave birth during months of February 2017 to July 2017 when data collection was conducted were included. These were case files of women with severe haemorrhage, severe pre-eclampsia, sepsis, shoulder and uterine dystocia and clinical signs of severe anaemia (disease based criteria). Additional criteria of admission to high dependency unit were considered since this is the ward where women with obstetric complications were managed. Any woman who had severe haemorrhage, defined as vaginal bleeding of 500 milliliters or more and/or causing worsening of pulse rate and blood pressure within the first 24 hours after childbirth[14,15], severe pre-eclampsia (BP≥140/90 mmHg and protenuria), sepsis defined as a temperature ≤36 0 C or ≥38 0 C, dystocia which includes uterine rupture or impending rupture and severe anaemia ≤6g/dl or clinical signs of severe anaemia was categorized as maternal near-miss based on obstetric protocols[14-16]. Women who did not have severe haemorrhage, severe pre-eclampsia, sepsis, dystocia and severe anaemia were under the non-cases group.

Sample

We used a random sample of 458 maternal near-miss cases and non-cases which was calculated as adequate using a formula proposed by Lemeshow[17]. The key parameters used in sample size calculation were a Z value of 1.96 for a 95% confidence interval; a prevalence rate (P) value of near-miss of 0.18; and an allowable error (e) of 0.05.

Total sample comprised 161 maternal near-miss cases and 297 non-cases which represents a ratio of nearly 1:1.8. The subsamples that were drawn from each hospital were 229 for EMMW and 229 for CMW.

Case files/records on all deliveries that were conducted from February 2017 to July 2017 were randomly sampled in the records room of the postnatal ward to enhance representativeness[18]. These case files were put in two groups of maternal near-miss cases and non-cases to constitute two sampling frames from which the sample was drawn. Systematic sampling was used to select every 60th case file for maternal near-miss case while every 20th case file for non-cases was chosen for inclusion in this study. Selection of case files continued until the desired sample of 458 was achieved.

Data collection instrument

This study used an adapted questionnaire that was developed by London School of Hygiene and Tropical Medicine (LSHTM) to measure quality of maternal and perinatal care in referral facilities[19]. For the purpose of the present study, the following sections were isolated to suit the context: identification; demographic characteristics; reproductive health history, serious complications; newborn; caesareans and laparotomies; quality of care indicators; and maternal near-miss. The variables were grouped into background determinants (age, marital status, occupation); modifiable social factors (birth preparedness, transportation); reproductive health characteristics (parity, delays, referral status); obstetric history (previous caesarean section, previous eclampsia, previous antepartum/postpartum haemorrhage, previous fetal death, antenatal admission). Grouping of the variables in the maternal near-miss tool was in line with the conceptual framework for near-miss maternal morbidity used for the study[20]. The conceptual framework for near-miss maternal morbidity was originally developed by McCarthy and Maine[21] and was later adapted by Adeoye et.al.[20]. According to McCarthy and Maine[21], the conceptual framework for near-miss maternal morbidity proposes factors that reduce maternal mortality by: (a) reducing the likelihood that a woman will become pregnant; (b) reducing chances that a pregnant woman will develop a serious complication; and (c) improve the outcome for women who develop complications. The major concepts in the conceptual framework include background determinants, proximate determinants, known clinical factors and near-miss morbidity which identify critical factors in relation to maternal near-miss.

The adapted maternal near-miss tool was pre-tested on three case files (one near-miss and two non-cases) at Zomba Central Hospital (a different hospital from the study sites but with similar characteristics) to evaluate and refine the tool[18]. No major changes were made to the tool after the pre-test. To ensure that data collection instruments were valid and measured what they were supposed to measure, content validity of the adapted maternal near-miss tool was assessed by three midwifery experts and a statistician. The midwifery experts each checked relevance of individual items in the tool regarding the construct being measured i.e., maternal near-miss.

A score of 1 to 4 was given for each item on a scale of relevance to determine the Content Validity Index (CVI). A score of 1 meant not relevant, 2= somewhat relevant, 3= quite relevant, 4= highly relevant[17]. The final CVI was 0.80, which was an acceptable value. Reliability was ensured through accurate and careful phrasing of questions to avoid ambiguity and leading respondents to a particular answer.

Furthermore, reliability was tested for stability by test-retest of the instrument. This was through conducting a pre-test of 3 patient files at Zomba Central Hospital. The pre-testing was repeated 2 weeks later for consistency and accuracy to ensure stability. The Maternal near-miss tool had a good internal consistency with Cronbach's alpha of ≥0.7 and 15% interrater reliability of the coded files.

Data collection

Data collection was conducted by two research assistants (RA) who are qualified medical personnel. The RAs received a one-day training on the data collection instruments and data collection procedure. There was one research assistant at each facility. Using the sampled case files, the RA completed the questionnaire.

Table 1: Socio demographic characteristics of participants N=458

Characteristics	Maternal near-miss n=161(35.2%)	Non-case n=297(64.8%)	Chi-square	p-value
Marital status				
Married	127(78.9)	243(81.8)	11.8	0.001*
Not married	20(12.4)	13(4.4)		
Occupation of woman				
Farming	7(4.4)	4(1.4)	102.8	0.001*
Business	11(6.8)	31(10.4)		
Casual labour	3(1.9)	0(0)		
Formal employment	5(3.1)	7(2.4)		
Housewife	43(26.7)	89(30)		
Admission mode				
Referred	141(87.6)	237(79.8)	6.8	0.03*
Self-referral	19(11.8)	47(15.8)		
Means of transport				
Ambulance	128(79.5)	205(69)	28.6	0.001*
Other	8(5)	39(13.1)		
Age				
<20	28(17.4)	53(17.8)	12.2	0.03*
20-25	51(31.7)	116(38.9)		
26-30	30(18.6)	70(23.9)		
31-35	36(22.4)	40(13.7)		
≥36	16(9.9)	17(5.8)		

*Significance level set ≤0.05 Data=n (%)

Data analysis

Data were analyzed using Stata 14.0 22. Means, frequencies and percentages were computed to determine the magnitude and trend of maternal near-miss cases. Chi-Square test was used to investigate significant associations among the variables measured (age, marital status, occupation of woman, admission mode and means of transport) with maternal near-miss. Binary logistic regression model was used to generate Odds Ratios for determinants of maternal near-miss cases. We used stepwise regression analysis to investigate the effect of each variable in the regression model to come up with the best subset of the most significant explanatory variables for predicting maternal near-miss in the data set.

Ethical approval

This study received ethical approval (P.10/16/2049) from the College of Medicine Research and Ethics Committee (COMREC). Institutional clearances were also obtained from Hospital Directors, Heads of Department and ward in-charge. In addition, questionnaires did not contain names of the patients, thereby ensuring confidentiality.

Results

Socio-demographic characteristics of the participants

This study found 161 (35.2%) maternal near-miss cases and 297 (64.8%) non-cases. Marital status, occupation, admission mode, means of transport and age of maternal near-miss cases and the non-cases are presented in Table 1. In relation to reproductive health history of participants, this study found that 47 (29.1%) women in the maternal near-miss cases group had no history of attending antenatal care compared to 28 (9.5%) non-cases. Complicated labour was also found to be the most common reason for admission in both groups as depicted in Table 2.

Mode of birth among participants

This study revealed differences among the mode of birth in relation to maternal near-miss (χ^2=104.7, p<0.001) (Table 3). Vaginal mode of birth was the commonest among non-cases group (64%, n=190) while emergency caesarean section was the most common among maternal near-misses (44.1%, n=71).

Fetal presentation in relation to maternal near-miss

The findings of this study revealed that there were significant differences in fetal presentations in relation to maternal near-miss with cephalic presentation being the commonest in both maternal near-miss cases (89.5%, n=144) and non-cases (88.4%, n=263) groups (χ^2=61.3, p=0.001). There were two cases of transverse presentation of the unborn baby in non-cases group (0.7%) while there was none in the maternal near-miss cases group.

This study revealed that birth status and sex of child in relation to maternal near-miss varied. The number of children who were born alive was higher in the non-cases

Table 2: Reproductive health history in relation to maternal near-miss cases N=458

Characteristics	Maternal near-miss n=161(35.2%)	Non-case n=297(64.8%)	Chi-square	p-value
Number of pregnancies				
1	62(38.5)	107(36)	4.8	0.19
2-4	73(45.3)	152(51.2)		
>4	26(16.2)	38(12.8)		
History of caesarean or abdominal scar				
Yes	22(13.7)	46(15.6)	4.7	0.09
No	139(86.3)	251(84.4)		
History of abortion				
Yes	23(14.3)	30(10.2)	3.8	0.28
No	138(85.7)	267(89.8)		
Antenatal care				
Yes	114(70.9)	269(90.6)	29.3	0.001*
No	47(29.1)	28(9.5)		
Reason for admission				
Normal birth	3(1.9)	82(27.6)	150.6	0.001*
Complicated labour	61(37.9)	160(53.9)		
Extra-uterine Pregnancy	25(15.5)	1(0.3)		
Other complication during birth	25(15.5)	34(11.5)		
Prophylactic caesarean	0	5(1.9)		
Abortion/ miscarriage	45(28)	7(2.4)		
Postpartum Complications	1(0.6)	3(1)		

*Significance level set ≤0.05 Data =n (%)

Table 3: Mode of birth among participants N=458

Characteristics	Maternal near-miss n=161(35.2%)	Non-case n=297(64.8%)	Chi-square	p-value
Laparotomy for uterine rupture	34(21.1)	1(0.5)	104.7	0.001*
Emergency caesarean	71(44.1)	70(23.6)		
Planned caesarean	4(2.5)	27(9.1)		
Instrumental	0(0.0)	7(2.3)		
Vaginal	52(32.3)	192(64.5)		

*Significance level set ≤0.05 Data=n (%)

Table 4: Association between determinants of care and maternal near-miss

Characteristic	Outcome	Odds ratio	p-value	95% CI
Antenatal care	Yes	0.53	0.095	0.25,1.12
Previous caesarean	Yes	0.88	0.736	0.42,1.84
Previous abortion	Yes	1.39	0.424	0.62,3.15
Marital status	Married	0.49	0.146	0.19,1.28
Pregnancies	Between 2 and 4 pregnancies	0.60	0.180	0.29,1.27
	More than 4 pregnancies	0.47	0.206	0.15,1.51
Age	20-25	1.21	0.627	0.56,2.64
	26-30	0.99	0.985	0.36,2.73
	31-35	3.14	0.034*	1.09,9.02
	>36	2.56	0.179	0.65,10.09
Mode of birth	Planned caesarean	0.79	0.694	0.24,2.59
	Emergency caesarean	4.08	0.001*	2.34,7.09
	Laparotomy for uterine rupture	83.49	0.001*	10.49,664.55

*Significance level set ≤0.05

(94.4%, n=280) compared to the maternal near-miss cases (70.3%, n=113).

Key determinants of maternal near-miss

The determinants of maternal near-miss results were determined using a binary logistic regression model. The findings showed that one demographic variable (age group) and two determinants of care (Emergency caesarean and Laparotomy for uterine rupture) contained significant information (P<0.05) for predicting maternal near-miss (Table 4). Results show that women aged 31-35 years had significantly 3.14 chances of experiencing maternal near-miss [OR=3.14, 95% CI: 1.09, 9.02, p=0.03] compared to the less than 20 years age group, (P>0.05).

Discussion

This study sought to establish the determinants of maternal near-miss cases at two selected central hospitals. The study revealed a high magnitude of maternal near miss compared to that of Ethiopia (29.7%)[23]. Findings from the study suggests that demographic characteristics (marital status, occupation, admission mode, means of transport and age) of maternal near-miss cases and the non-cases significantly differ (Table 1). This is consistent with Adeoye et al.[20] who found that an unmarried woman had three times chances of having a maternal near-miss compared to a married woman. This may be partly attributed to lack of financial support which potentially disadvantages unmarried women by impeding their ability to access health and social services. Many women in Malawi lack formal employment which makes them dependent on their partners and other relations[24]. In addition to marital status and occupation, there is also evidence which indicates that age, parity and number of previous deliveries are linked to maternal near-miss[7,8]. This is consistent with the findings of this study which showed that there were significant differences in the ages of women in maternal near-miss cases and non-cases groups.

Some previous studies found that age is significant to maternal near-miss[9,10,12,20,25]. There is evidence which showed that being below the age of 16 years at first pregnancy was a determinant of maternal near-miss[10]. Younger women may be more vulnerable to obstetric complications including maternal near-miss because their bodies are not fully physically developed or they may be victims of adverse social consequences of teenage pregnancies. There is evidence which indicates that advancing maternal age is a determinant of maternal near-miss with medical conditions like hypertension and diabetes occurring in older age complicating the pregnancy[9,26]. However, some studies found that age was not significantly associated with maternal near-miss in Iraq[25,27]. This may be possible due to intervening factors including having a supportive partner which may mitigate the effects of age in relation to maternal near-miss.

The obstetric characteristics that were found to be significantly associated with maternal near-miss in this study were fetal presentation, mode of birth, birth status and sex of child. Furthermore, the reproductive health history of participants in relation to maternal near-miss varied. A study by Kumela et al.[23] found that lack of antenatal care was linked to maternal near-miss. This is consistent with the findings of this study which showed that a significant number of women in the maternal near-miss cases group (29.1%, n=47), did not attend antenatal care (Table 2). Conversely, antenatal care helps in preventing adverse maternal outcomes through early detection and treatment of conditions that may threaten the health of the fetus/newborn and/or the mother[28]. Therefore, one may argue that it is very important that all pregnant women access antenatal care for continued monitoring if maternal near-miss cases are going to be reduced.

This study suggests that age and mode of birth were the two determinants which were strongly associated with maternal near-miss. Literature indicated that age of >30 years is associated with maternal near-miss[9,26,29,30]. This is in

agreement with the findings of this study which revealed that women aged 31-35 years had 4 times higher chances of experiencing maternal near-miss compared to those less than 20 years of age. Rocha Filho et al[30] purported that women aged over 30 years had adverse maternal outcomes due to postpartum haemorrhage. This may imply that targeted perinatal care for these women is essential to reduce the occurrences of maternal near-miss cases.

In this study, women who had laparotomy for uterine rupture had 83 times higher chances of being a maternal near-miss case while those who had emergency caesarean had 4 times higher chances compared with those who had vaginal birth. These findings are in agreement with other studies from Brazil and Ethiopia which reported that caesarean section was associated with maternal near-miss[10,26,31]. This may be the situation in Malawi where sometimes patients are not taken to theatre on time because of shortage of staff and consequently are lost due to delay.

There is evidence which showed that delays at home, on the way to health facilities and at the health facility itself play substantial roles in increasing the magnitude of maternal near-miss[23] associated with caesarean section. However, previous caesarean section was not associated with maternal near-miss in this study. Consistent with this finding, Litorp et.al.[32] established that previous caesarean section was not a risk factor for severe maternal outcomes in Tanzania. On the contrary, findings from other studies[10,20,26] indicate that history of caesarean section and chronic illness are determinants of maternal near-miss. Previous caesarean section scar predisposes a woman to uterine rupture if a vaginal birth is attempted[10]. Therefore, it remains logical for clinicians to be alert of women with history of caesarean section because they may develop severe maternal outcomes including maternal near-miss in the intrapartum and postpartum periods.

Limitations of this study

This study findings might have been affected by selection bias, because it included patient records that were available at the time of data collection during the months of February to July. Incomplete availability of data on risks and confounding factors associated with maternal near-miss and the temporal sequence between exposure and disease might make it difficult to confidently attribute the identified determinants to the maternal near-miss cases. The study must have missed some seasonal variations in maternal near-miss that occurred during the months of January and August to December which were not included in the study. The disease-based criteria that was used to identify maternal near-miss cases was another limitation in that definition of conditions may not always be straight forward, e.g. not all women with pre-eclampsia nearly die). The findings of this study must be applied in other settings with caution because they may not be representative beyond the two central hospitals. Further research is needed to compare prevalence of maternal near-miss cases and maternal deaths.

Conclusion

This study sought to establish the determinants of maternal near-miss cases at two selected central hospitals. Age and mode of birth were the determinants associated with maternal near-miss. All cadres of skilled attendants at birth need to pay close attention to factors such as age and mode of birth among pregnant women for them to implement targeted maternal health services in order to reduce incidence of maternal near-miss cases.

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Conflict of interest

The authors declare no conflict of interest.

Authors' contributions

FK conducted data collection and analysis. AM guided sampling and data analysis, EC, AMM, AM and GC provided support throughout the study and reviewed the manuscript.

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