

Clinical pattern, associated factors and management outcomes of maternal near-miss at the Regional Referral Hospital, Tanzania: A Cross-sectional Study

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Abstract

Background: Preventable maternal mortality cases account for up to 80% of maternal deaths posing a great obstacle in achieving the Sustainable Development Goal 3.1, whereby Low- and Middle-income countries are disproportionately affected. Potential life-threatening conditions (PLTCs) remain a public health and clinical concern globally. In Tanzania, the prevalence of maternal near miss (MNM) has been reported to be between 23.6 /1000 and 36/1000 live births among all women. This study assessed the clinical pattern, associated factors and management outcome of maternal near miss among women with potential life-threatening conditions.

Methods: This was a hospital based analytical cross-sectional study among 343 study participants. Frequencies and percentages, Chi-square and logistic regression tests were used to summarize categorical variables and factors associated with maternal near miss among study participants using SPSS, 26th Version with statistical significance at p-value <0.05.

Results: 343 (12.3% of all admissions) participants had PLTCs, 126 cases were identified to be MNM cases (institutional prevalence = 4.5%). Women with PLTCs were clinically characterized by post-partum hemorrhage (PPH) 110 (32.1%), Pregnancy Induced Hypertension 103 (30%), sepsis 31 (24.5%), ante-partum hemorrhage (9%) and ruptured uterus 15 (4.4%). Level of education and Severe anemia on admission were significantly associated with MNM. The medical intervention profile among MNM cases involved CSD (45.24%), 62.69% required blood transfusion, 31.75% required admission to the ICU, 18.25% needed a laparotomy and 10.32% underwent cesarian hysterectomy.

Conclusion: Life threatening conditions which can lead to maternal near miss, are still prevalent in Tanzania. Prevention and control of maternal anemia and other fatal conditions is essential. Comprehensive Emergency Obstetric Care (CEmOC) should be strengthened at referral hospitals. The potential role of "3 delay model" towards development of different life-threatening conditions including MNM should be explored in Tanzania.

Keywords: Delivery; Maternal Health; Maternal near-miss; Potential life-threatening Conditions; Tanzania

1. Introduction

Preventable maternal mortality cases account for up to 80% of maternal deaths posing a great obstacle in achieving the Sustainable Development Goal 3.1 (SDG) (1). The burden is disproportionately distributed where Low and Middle Countries (LMICs) contributes to 92% of global maternal deaths, and Sub-Saharan Africa having a proportion of 70% of global maternal death which are largely attributed to problems along the continuum of maternal and reproductive health services (2).

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Gaps in the pipeline of maternal care are related to social demographic, patient comorbidities, poor access to quality care and delays in receiving quality care despite being in health facilities (3–6). Collectively, the gaps out of the facility shows a delay in identifying danger signs and /or delay in reaching the health facility while those within the facility shows a limited ability of facilities to respond obstetric emergencies. Consequently, this leads to women presenting critical conditions upon arrival and receiving inappropriate care within the facility, hence ending up with obstetric related complications, adverse health outcomes and some cases death (7,8). In instances where pregnant women survive death from obstetric complication or within 42 days of pregnancy termination, they are regarded as cases of maternal near miss (MNM) (9).

In every 1000 live birth 16 to 21 women globally are exposed to life threatening condition but survive, the lowest prevalence being in Europe and highest being in Africa with a prevalence of 3 and 31 cases for every 1000 live birth respectively (10). The persistently high MNM prevalence in Africa reflects the regions relatively high Life Time Risk for MNM (LTR-MNM) and Life Time Risk for Severe Maternal Outcome (LTR-SMO) (11).

Despite a significant decline in maternal death, a lot of women in Tanzania are still exposed to life threatening conditions during pregnancy beyond proportion (11). Discussions on maternal health in Tanzania have been centered on understanding the drivers, complications and prevention maternal death (12–14). Literature of life threatening conditions during pregnancy among Tanzanian women have shown a prevalence of MNM to be between 23.6 /1000 and 36/1000 live births among all women and severe maternal outcome (SMO) prevalence of 40.23/1000 live births among women with hypertensive disorders of pregnancy who underwent invasive and resource demanding procedures (15–17). The survival rate of pregnant women remains uncertain while those who survive have reported experiences that affect their physical, mental and social health (18).

Potential life-threatening conditions (PLTCs) which can lead to maternal near miss, remain to be both a public health and clinical concern, undeniably affecting the reproductive health of women globally and increases demand for healthcare resources due to increased rate of morbidity and mortality in this population. This cause considerable increased pressure on the health system. Nevertheless, there is limited data on the subject in Tanzania whereby available data is unreliable due to high heterogeneity and the local studies focusing more on death outcome rather than survival profiles. This study assessed the clinical pattern, associated factors and management outcome for women with potential life-threatening conditions who developed maternal near miss condition. This study has been reported by following the STROCC guideline (19).

2. Methodology

2.1. Study design

This was a hospital based analytical cross-sectional study done carried out at Regional Hospital in Tanzania. The study was conducted for 4 months.

2.2. Study Population

The study involved pregnant women who presented at the study Regional Hospital during the study period with potential life-threatening condition related to delivery. These included referral cases at the study Hospital with pregnancy related complications between 28 weeks of gestation until 42 days following pregnancy termination. Study participants were recruited upon arrival to the facility (on admission) and follow-up was done for a minimum of 3 days from admission ending when the patient was discharged.

The study included; All pregnant women who came or brought to the hospital due to pregnancy-associated complications at 28 weeks and above, including those in labor, delivery, or admitted in postnatal units within 42 days of delivery or termination of pregnancy. All women with near-miss SSA criteria like pyrexia, intractable PPH, severe anemia, shock, those underwent cesarean hysterectomy, those planned for emergency obstetric laparotomy and sepsis. Using the WHO MNM criteria women with potential life threatening conditions were identified, latter the modified Sub-Saharan Africa criteria for MNM was used to identify women who were termed as MNM cases (20).

Moreover, the study excluded women with obstetric near-miss complications due to incidental or accidental causes like end stage renal disease, fulminant HIV/AIDS in palliative care, confirmed Covid19 and those who were revisiting the hospital for similar or different diagnosis within data collection time.

2.3. Sample Size and Sampling

Convenient sampling was used whereby all mothers who delivered or with related complain presented at the study Hospital were screened. During the study period, a total of 2783 patients were reviewed and 343 (12.3% of all admissions) participants were enrolled in the study.

2.4. Data collection

A pre-tested structured questionnaire was used for data collection. Independent variables involved; social demographic data like age, level of education, residency, marital status, occupation, maternal related data like gravidity, parity, gestation age, number of antenatal visits and previous caesarean delivery status (CSD), anemia status on admission, developed life threatening conditions. Moreover, medical interventions performed following life-threatening condition was collected. Dependent variable of interest was maternal near miss status/condition.

2.5. Data analysis

The collected data were analyzed by using SPSS version 26. Categorical variables were summarized using proportions and percentages. Numerical data was summarized using mean and standard deviation (SD). Chi-square was used to determine the factors associated with MNM. Moreover, logistic regression was done to quantify the strength of the associations between variables. Variables with p-value of less than 0.05 were considered significant.

3. Results

3.1. Socio-demographic and clinical characteristics of study participants.

During the study period, a total of 2783 patients were reviewed and 343 (12.3% of all admissions) participants presented with different life-threatening conditions, and were enrolled in the study. 126 cases were identified to be MNM cases corresponding with an institutional MNM prevalence of 4.5%. Participants had a mean age of 27.77 (SD7.71), majority of them had primary or informal education (47.23%), living in urban areas (54.52%), married (82.22%) and self-employed (45.48%). On their clinical characteristics, majority of participants were primigravida (37.32%), presented to the facility with gestation age of 37 weeks and above (72.59%), managed to attend more than 4 Antenatal Clinic visits (ANC) (66.47%) and had never undergone a caesarean section procedure (86.09%) (Table 1).

Table 1 Social demographic and clinical characteristics of study participants (N= 343)

Variable	Frequency (N)	Percent (%)	Mean $\pm$ SD
Age			27.77 $\pm$ 7.71
15-24	120	34.99	
25-34	147	42.86	
35and above	76	22.16	
Level of education			
Primary or informal education	162	47.23	
Secondary education	136	39.65	
College level and above	45	13.12	
Residency			
Rural	156	45.48	
Urban	187	54.52	
Marital Status			
Married	282	82.22	
Single	61	17.78	
Occupation			

Peasant	148	43.15	
Self employed	156	45.48	
Employed in formal sector	39	11.37	
Gravidity			
Primigravida	128	37.32	
Multigravida	114	33.24	
Grand multigravida	101	29.45	
Parity			
Primiparity	136	39.77	
Multiparity	110	32.16	
Grand Multiparity	96	28.07	
Gestation age during enrolment			
28 to 32 weeks GA	34	9.91	
33 to 36 weeks GA	60	17.49	
37 weeks GA and above	249	72.59	
Number of antenatal clinic visits			
1 to 4 ANC visits	115	33.52	
More than 4 ANC visits	228	66.47	
Previous Cesarean section			
Yes	48	13.99	
No	295	86.09	

3.2. Clinical Pattern of clinical diagnoses of study participants at Dodoma Regional Referral Hospital (N= 343)

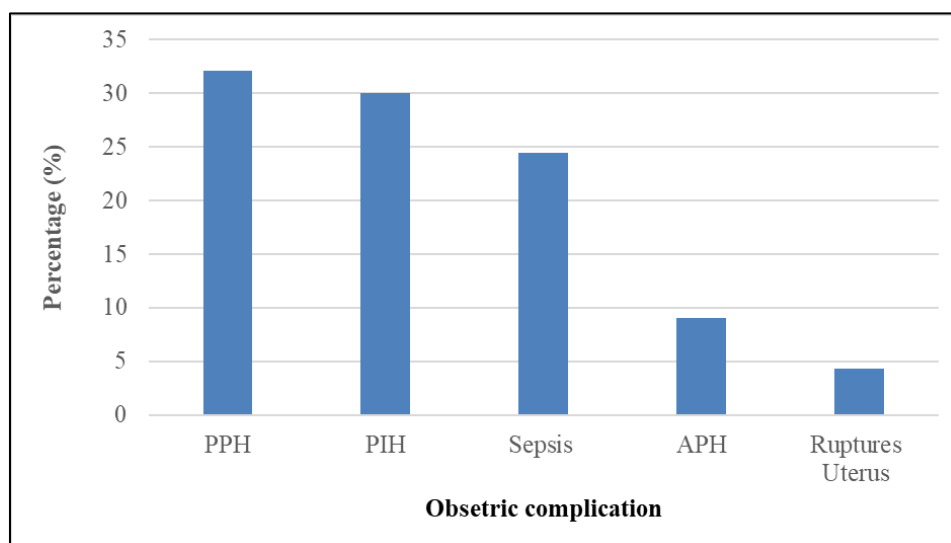


Figure 1 Clinical diagnoses of women presenting with PTLCs

Women with PTLCs were clinically characterized by post-partum hemorrhage (PPH) 110 (32.1%), Pregnancy Induced Hypertension (PIH) 103 (30%), sepsis 31 (24.5%), ante-partum hemorrhage (9%) and ruptured uterus 15 (4.4%) (Figure 1).

3.3. Factors associated with maternal near-miss at the Study Hospital

A Chi-square test to determine the association of different factors associated with MNM status showed the statistically significant factors were; education level ($p=0.0094$), occupation ($p=0.0398$) and anemia on admission ($p= <0.0001$) (Table 02). Further analysis showed that those with primary/informal education level and with peasant as their primary occupation were 2 times likely to develop MNM at (OR=2.255, 95% CI: 1.087 – 4.677, $p = 0.0289$) and (OR= 2.270, 95% CI: 1.032 – 4.995, $p = 0.0446$) respectively. Moreover, those with severe anemia on admission had 10 times likelihood of developing MNM (OR= 10.7, 95% CI: 1.556 – 20.079, $p=0.0001$) and moderate anemia were twice times to develop the condition (OR= 2.764, 95% CI: 1.488 – 5.136, $p= 0.0013$). Following adjusted logistic regression model, severe anemia was the only independent variable associated with MNM (OR= 5.590, 95% CI: 5.1556 – 20.079, $p=0.0083$) (Table 03).

Table 2 Factors Associated with maternal near-miss among women with Potential Life-Threatening Conditions (N= 343)

Variable	MNM STATUS		p-value
	Yes n (%)	No n (%)	
Age			0.3606
15-24	38 (31.67)	82 (68.33)	
25-34	58 (39.46)	89 (60.54)	
35 and above	30 (39.47)	46 (60.53)	
Level of education			0.0094
Primary or informal education	73(45.06)	89(54.94)	
Secondary education	41(30.15)	95(69.85)	
College level and above	12(26.67)	33(73.33)	
Occupation			0.0398
Peasant	65(43.92)	83(56.08)	
Self employed	51(32.69)	105(67.31)	
Employed in formal sector	10(25.64)	29(74.36)	
Residency			0.1549
Rural	64(40.76)	93(59.24)	
Urban	62(33.33)	124(66.67)	
Marital Status			0.6800
Married	105(37.23)	177(62.77)	
Single	21(34.43)	40(65.57)	
Gravidity			0.4791
First pregnancy	45(35.16)	83(64.84)	
Second or third pregnancy	39(34.21)	75(65.79)	
Fourth pregnancy and above	42(41.58)	59(58.42)	
Parity			0.4080
First delivery	49(36.03)	87(63.97)	

Second or third delivery	36(32.73)	74(67.27)	
Fourth delivery and above	40(41.67)	56(58.33)	
Gestation age at enrolment			0.2547
28 to 32 weeks GA	16(47.06)	18(52.94)	
33 to 36 weeks GA	18(30.00)	42(70.00)	
37 weeks GA and above	92(36.95)	157(63.05)	
Number of antenatal clinic visits			0.1721
0 to 4 ANC visits	48(41.74)	67(58.26)	
More than 4 ANC visits	78(34.21)	150(65.79)	
Previous Cesarean section			0.5496
Yes	21(43.75)	27(56.25)	
No	105(71.29)	190(28.71)	
Anemia on admission			<.0001
<7	20(80.00)	5(20.00)	
7-8.9	31(50.82)	30(49.18)	
9 and above	75(59.03)	182(40.97)	

Table 3 Logistic Regression analysis of factors associated with maternal near-miss in DRRH (N=343)

Variable	Maternal near miss		Unadjusted analysis		Adjusted analysis	
	Yes n (%)	No N (%)	OR (95% CI)	p- Value	OR (95% CI)	p- Value
Level of education						
Primary/informal	73 (45.06)	89 (54.94)	2.255 [1.087, 4.677]	0.0289	2.216 [0.508, 9.665]	0.2897
Secondary education	41 (30.15)	95 (69.85)	1.187 [0.557, 2.525]	0.6572	1.320 [0.325, 5.356]	0.6980
College and above	12 (26.67)	33 (73.33)	Ref		Ref	
Occupation						
Peasant	65 (43.92)	83 (56.08)	2.270 [1.032, 4.995]	0.0446	1.564 [0.311, 7.856]	0.5870
Self employed	51 (32.69)	105 (67.31)	1.408 [0.637, 3.111]	0.0416	1.222 [0.271, 5.514]	0.7938
Formal employed	10 (25.64)	29 (74.36)	Ref		Ref	
Anemia on admission						
<7	20 (80.00)	5 (20.00)	10.700 [3.763, 30.43]	<.0001	5.590 [1.556, 20.079]	0.0083
7-8.9	31 (50.82)	30 (49.18)	2.764 [1.488, 5.136]	0.0013	1.289 [0.526, 3.155]	0.5790

9-10.9	35 (31.82)	75 (68.18)	1.248 [0.727, 2.145]	0.4218	0.852 [0.434, 1.672]	0.6418
11+	40 (27.21)	107 (72.79)	Ref		Ref	

3.4. Medical interventions profile among women with Potential Life-Threatening conditions with Maternal Near Miss.

The need for medical management differed among study participants. Among women with MNM, majority delivered by SVD (54.76%), 62.69% required blood transfusion compared to 31.79% among those who did not develop MNM. Moreover, 31.75% of women who had MNM required admission to the ICU, 18.25% needed a laparotomy and 10.32% underwent cesarian hysterectomy whereby no woman among those who did not develop MNM required these interventions (Table 4).

Table 4 Medical interventions profile among women with Potential Life-Threatening conditions with Maternal Near

Variable/indicator	Maternal near miss	
	Yes n (%)	No n (%)
Mode of delivery		
C/D	57 (45.24)	90 (41.47)
SVD	69 (54.76)	127 (58.53)
Blood Transfusion		
Yes	79 (62.69)	69 (31.79)
No	47 (37.31)	148 (68.21)
Admission to ICU		
Yes	40 (31.75)	0
No	86 (68.25)	217 (100)
Laparotomy other than C/D		
Yes	23	0
No	103	217 (100)
Caesarean Hysterectomy		
Yes	13 (10.32)	0
No	113 (89.68)	217 (100)

4. Discussion

In this study, women presenting with PLTCs were 12.3% of all admission having a mean age of 27.77. Among women who presented with PLTCs, 36.4% ended up with developing MNM complication having an institutional MNM prevalence of 4.5%. The clinical characteristic of patients was dominated with women presenting with PPH (32.1%), hypertensive disorders (30%) where by the significant factors associated with developing MNM being low level of education, peasant as an occupation and having severe anemia during admission. Women who developed MNM required intensive medical care and invasive procedures compared to those who did not develop MNM.

In reference to previous studies done in Tanzania, the MNM prevalence was relatively higher compared to the previous studies (15,16). This may be due to the difference in the criteria used to identify cases where the previous cases used WHO criteria while this used the modified SSA criteria for MNM. However, regionally the prevalence was relatively lower than that reports of 61.3% in Uganda, 54.33% in Ethiopia (21,22). Maternal healthcare services are nearly similar across these countries, however there is a substantial difference in the quality and coverage of obstetric emergency services across these countries with Tanzania having a better coverage, and readiness for emergency care (23-25).

Hemorrhagic causes (PPH, APH and ruptured uterus) and PIH continue to be the leading causes of morbidity among pregnant women. This is also reflected by the fact that anemia on admission has been the only independent associated factor for the MNM status. These findings are similar even to other settings reflecting that the factors are wide spread across different countries (26–28). The level of education and occupation were not independent determinants for MNM. This observation might have been affected by the fact that majority of women attended not less than 4 ANC visits, hence being familiar with danger signs. Moreover, the influence of their spouse's level of education and income, who are referred to be decision makers and sole provider might have influenced the results.

Hypertensive disorders of pregnancy account for another major contributor of maternal morbidity. In Tanzania there is still a high proportion of SMO that are attributed to hypertensive heart disorders, however over years these disorders have a gradual decline in causing maternal death (17). Among women of reproductive age 11.2% have hypertensive disorders, and the prevalence is likely to increase as a result in the change of lifestyle and urbanization in Tanzania (29). The proportion of women with hypertensive heart diseases who end up with eclampsia or severe pre-eclampsia and what drives to these severe form remains uncertain in Tanzania. s

The need for blood transfusion was observed to be most needed medical intervention among women with PLTCs and those with MNM. This reflects the findings that were reported that Tanzania has a significantly higher burden of anemia among women of reproductive age and more than half of pregnant women have this problem despite attending clinics and getting iron supplements (30). The observation that PPH was the leading clinical diagnosis among women with PLTCs may be a reflection of the burden of pre-partum anemia, hypertensive disorders of pregnancy and poor management of the third stage of labor (31,32). Despite a good coverage of availability of blood products supply, there is unsatisfactory level in the knowledge and skills of healthcare workers in managing PPH (33–35). This highlights key gaps in the efforts for managing the longstanding problem of anemia among pregnant women.

Study Strength and Limitation

This study was done at a referral hospital which is a hub-referral facility for high-risk pregnancies and postnatal complications in central Tanzania. Therefore, data collected and results presented might reflect the actual rates of near miss in the area and can be used as baseline for other regions in the country or/and other low and middle-income countries like ours. The use of SSA criteria has helped to capture cases that might have otherwise been undiagnosed. Unfortunately, it was not possible to make follow up of these patients for longer time to find out presence of any long time physical, psychological and emotional difficulties following recovery.

5. Conclusion and Recommendations

Life threatening conditions which can lead to maternal near miss, are still prevalent in Tanzania. In this study, lower educational level, having an occupation of peasant, and severe anemia were significantly associated with maternal near misses. Post-partum hemorrhage and PIH were the main complications leading to potentially life-threatening conditions some of which progressed into maternal near miss.

Anemia prevention and control interventions including screening should be strengthened so as to reduce likelihood of developing different life-threatening conditions during delivery and maternal related complications like PPH. Moreover, detection and management of maternal conditions like gestational hypertensive disease which might complicate pregnancy should be strengthened especially during antenatal care in collaboration between health facilities and pregnant women. Comprehensive Emergency Obstetric Care (CEmOC) at referral hospitals should also be strengthened so as to enhance effectiveness of controlling different life-threatening conditions and prevent progression to maternal near miss.

Moreover, we recommend that future studies should focus on exploring the potential role of “3 delay model” in Tanzania and associated factors towards development of different life-threatening conditions including maternal near miss. This can inform underlying bottlenecks in prevention and control of potential life threatening condition during delivery and management of women of such conditions with potential to develop maternal near miss.

Compliance with ethical standards

Disclosure of conflict of interest

Authors declare no any conflict of interest.

Statement of ethical approval

Ethical clearance to conduct this study was requested from the research and publication committee of the University of Dodoma with certificate number MA.84/261/02. The permission to do the study at the regional Hospital was sought from the hospital administration.

Statement of informed consent

Participants were approached individually for a written consent and those who arrived in semiconscious or unconscious state had consent sought from their next of kin. All risks and benefits of participating to the study were explained to them prior to signing. Confidentiality was ensured through the use of unique identification numbers for every participant and data was accessible to the principal investigator and research assistants only. All enrolled patients irrespective of their participation, were given proper treatment according to the available guideline and management protocols.

Author's Contribution

Conceptualization: All authors; methodology, All authors; validation, BBK; formal analysis, BBK.; investigation, BBK, MAR.; resources, BBK, MAR.; data curation, BBK, MAR.; writing—original draft preparation, BBK, MAR; writing—review and editing, MAR, AGL; visualization, BBK; supervision, AGL; project administration, BBK. All authors have read and agreed to the published version of the manuscript.

Data availability statement

Data collected during this study are available from the corresponding author upon A reasonable request.

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