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ORIGINAL ARTICLE

The Burden of Severe Maternal Outcomes: Insights from a Seven-Month Survey of Obstetric Admissions at Bugando Medical Centre, Mwanza, Tanzania

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ABSTRACT

Background: Severe Maternal Outcomes (SMOs), including Maternal Near-Miss (MNM) and Maternal Deaths (MD), are critical indicators of maternal healthcare quality and remain a significant public health challenge in low-resource settings. Sub-Saharan Africa (SSA) bears the highest global burden of maternal mortality, often driven by delays in care and inadequate healthcare resources. This study analyzed SMOs among women admitted with Obstetric-Related Conditions (ORC) over seven months at Bugando Medical Centre (BMC), Mwanza, Tanzania, to provide insights into the burden, causes, and associated case fatality rates.

Methods: A retrospective cross-sectional census was conducted from November 2021 to May 2022. All women admitted with eligible obstetric-related conditions during the study period were consecutively included, resulting in 287 participants. Maternal near-miss cases and MD were identified using the WHO SMO tool. Data were summarized using frequencies and percentages. Cause-specific case fatality rates were calculated as the proportion of maternal deaths among severe maternal outcomes attributed to each condition.

Results: Out of 3,149 obstetric admissions during the study period, 287 women with obstetric-related conditions were included in the analysis. Among these, 175 (61.0%) experienced SMOs, comprising 138 maternal near-miss cases and 37 maternal deaths. Women aged 20–34 years and urban residents constituted the majority of cases, although higher proportions of deaths were observed among adolescents, rural residents, and women with no formal education. Severe maternal outcomes were frequently observed among women with parity 1–3 and those who delivered outside BMC. A relatively higher proportion of MD was observed among women who underwent operative delivery than among those who had spontaneous vaginal delivery. Direct obstetric causes accounted for most SMOs (88.0%), with hypertensive disorders (45.1%) and obstetric hemorrhage (28.0%) being the leading causes. Indirect causes accounted for 12.0%, mainly anemia. The highest case fatality rates were observed for anemia (46.2%), abortion complications (33.3%), and sepsis (28.6%).

Conclusion: Severe maternal outcomes remain a major burden at Bugando Medical Centre. Strengthening early detection of obstetric complications, improving emergency response systems, and addressing indirect conditions such as anemia are critical to reducing preventable maternal deaths.

BACKGROUND

Severe Maternal Outcomes (SMO) refer to life-threatening complications occurring during pregnancy, childbirth, or within 42 days postpartum. They include both Maternal Near-Miss (MNM) and maternal death (MD).[1] Maternal near-miss, defined as a woman surviving a life-threatening condition during pregnancy or delivery, has become an important global indicator of maternal health.[2] Obstetric-related conditions, such as medical and obstetric complications arising during pregnancy, labor, delivery, and the postpartum period, contribute significantly to SMOs.[3] Because maternal mortality represents only the "tip of the iceberg," examining near-miss cases alongside maternal deaths provides deeper insight into weaknesses within healthcare systems.

Despite global efforts to improve maternal health, maternal mortality remains a major concern, particularly in low- and middle-income countries.[4] The Sustainable Development Goals aim to reduce the global Maternal Mortality Ratio (MMR) to below 70 per 100,000 live births by 2030, with no individual country exceeding 140.[5] Recent data suggest that maternal mortality continues to be a substantial worldwide health concern, as daily rates of maternal fatalities remain intolerably high despite a 38% global decline over the past decade.[4] Although Tanzania has reduced its MMR from 556 per 100,000 live births in 2016 to 104 per 100,000 live births in 2022,[6] and

hospital-based MMR is 56 per 100,000 live births.[7] In Sub-Saharan Africa, 23.7% (95% CI 19.8–27.6%) of pregnancies are complicated by major direct maternal morbidity and the lifetime risk of experiencing a severe maternal outcome remains as high as 1 in 20 in several countries in the region.[8] These findings collectively illustrate the persistent and inequitable burden of severe maternal complications in the region.

At Bugando Medical Centre (BMC), local registry data indicate a hospital-based MMR substantially higher than the national average, increasing from 1,360 per 100,000 live births in 2019 to 1,896 per 100,000 live births in 2022. As a tertiary referral hospital receiving complicated cases from lower-level facilities, BMC faces increasing clinical demands despite improvements in facility-based deliveries nationally. A comprehensive assessment of severe maternal outcomes at this facility is therefore essential to better understand the burden, causes, and areas requiring targeted intervention.

Study Objective

This study aimed to determine the magnitude, causes, and case fatality rates of severe maternal outcomes among women admitted with obstetric-related conditions at BMC.

METHODS

Study Design, Setting, and Sample Size

A retrospective cross-sectional study was conducted at BMC in Mwanza, Tanzania, from November 2021 to May 2022. BMC is a 1,000-bed zonal referral and teaching hospital affiliated with the Catholic University of Health and Allied Sciences (CUHAS), serving a population of 21.2 million from eight regions. The hospital manages approximately 5,000 deliveries annually and offers specialized care, including advanced diagnostics, Intensive Care Units (ICUs), and surgical facilities. It boasts 14 operating theatres, a labor ward with 12 beds, and High-Dependency Units (HDUs) for critical maternal care, supported by a multidisciplinary team and reliable availability of medicines and supplies.

A retrospective census approach was used. All women admitted to Bugando Medical Centre with eligible obstetric-related conditions between November 2021 and May 2022 were consecutively included. Because the study aimed to review all eligible cases recorded during the predefined seven-month study period, no sampling procedure or minimum sample-size calculation was required. Of the 3,149 women screened, 287 met the eligibility criteria and had sufficient clinical information for outcome classification; therefore, all 287 eligible women were included in the analysis.

Eligibility Criteria

The study included women admitted to BMC with obstetric-related conditions during the study period. Eligible participants were those diagnosed with any severe pregnancy complications such as preeclampsia, eclampsia, postpartum hemorrhage, sepsis, uterine rupture, obstetric embolism and others. Women admitted during pregnancy, childbirth, or within 42 days postpartum were included. Exclusions were made for women with non-obstetric conditions unrelated to pregnancy, gynecological conditions such as ovarian cysts or fibroids, or incomplete medical records that precluded accurate classification of outcomes.

Case Identification

Maternal near-miss cases and MD were identified using the WHO Severe Maternal Outcomes (SMO) tool. The tool defines MNM as cases where women survived life-threatening complications during pregnancy, childbirth, or the postpartum period. It employs standardized clinical, laboratory, and management-based criteria to identify conditions like severe hemorrhage, hypertensive disorders, sepsis, and organ dysfunction.

Data Extraction and Analysis

Data were collected retrospectively from patients' medical records, admission registers, delivery registers, operative notes, and intensive care unit records. A structured data abstraction tool was developed based on the World Health Organization (WHO) Near-Miss Approach criteria and relevant literature. The tool captured socio-demographic characteristics, obstetric history, clinical diagnosis, type of complication, management interventions, and maternal outcomes.

Data extraction was conducted by trained medical personnel familiar with obstetric care documentation. Prior to data collection, the abstraction tool was pre-tested on a small sample of records to ensure clarity and completeness. Incomplete or illegible records lacking key outcome variables were excluded from analysis. To ensure data quality, completed forms were reviewed for consistency and accuracy before data entry. Data were entered into a password-protected database and cross-checked for errors before analysis.

Data were extracted from patient charts using a standardized abstraction tool to capture demographics, clinical findings, laboratory results, interventions, and outcomes. A coding system was used to ensure consistency, incorporating WHO criteria, ICD-10 codes, and study-specific codes for variables not covered by existing systems. Records with incomplete critical variables were excluded from analysis. Missing data were assessed and found to be minimal (<5%) and were not imputed. The data were entered into Microsoft Excel and analyzed using STATA version 15 (STATA Corp LLC, College Station, TX, USA). The analysis was primarily descriptive, focusing on frequencies, proportions, and Case Fatality Rates (CFR) to characterize the burden of severe maternal outcomes.

Ethics Approval and Consent to Participate

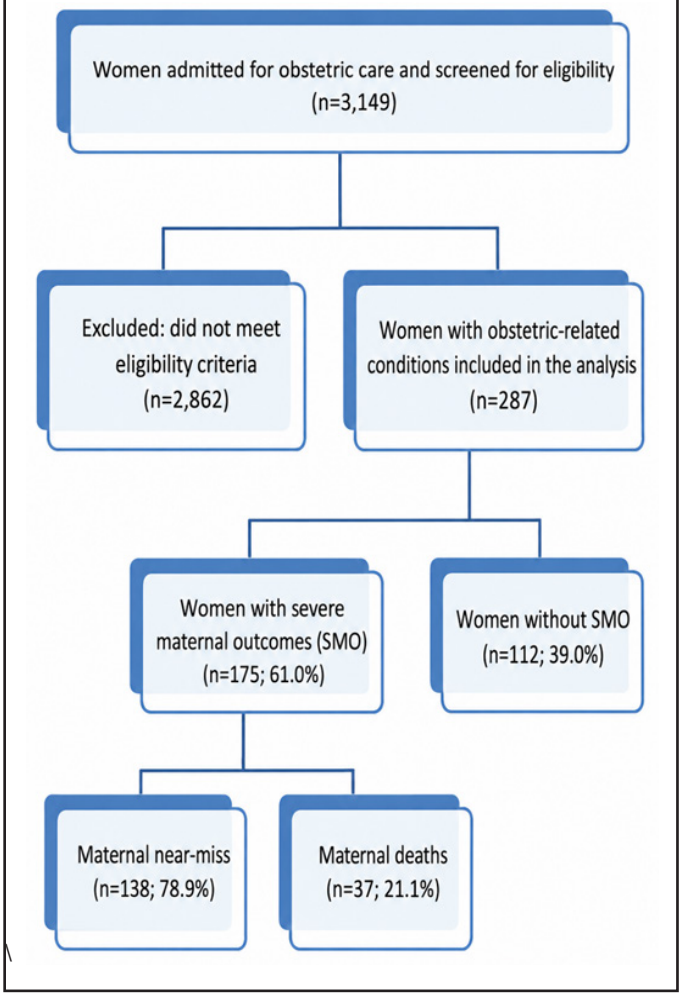
The authors confirm that this study adhered strictly to relevant guidelines and regulations during data extraction and analysis, with careful measures taken to ensure data anonymization. Ethical approval was obtained from the Joint Ethical, Research, and Publication Committee of the Catholic University of Health and Allied Sciences and Bugando Medical Centre (CUHAS/BMC), under reference CREC 507/2021. The Institutional Review Board reviewed the study's legal and ethical aspects and granted a waiver for participant consent.

RESULTS

Flow chart of women with obstetric-related conditions admitted at BMC during the study period.

During the study period, 3,149 women were admitted to BMC for obstetric care and screened for eligibility. Of these, 2,862 did not meet the eligibility criteria for an obstetric-related condition included in this study, while 287 met the criteria and were included in the analysis. Among the 287 included women, 175 (61.0%) experienced a severe maternal outcome according to the WHO SMO criteria, comprising 138 MNM cases and 37 MD. The remaining 112 (39.0%) did not experience a severe maternal outcome (Figure 1).

FIGURE 1: Flow Chart Showing the Screening, Inclusion, and Classification of Women Admitted for Obstetric Care at Bugando Medical Centre



Social-demographic characteristics

A total of 287 women with obstetric-related conditions were included, of whom 175 (61.0%) developed severe maternal outcomes, comprising 138 (78.9%) maternal near-miss cases and 37 (21.1%) MD. Women aged 20–34 years accounted for 217 (75.6%) participants and 121 (69.1%) severe maternal outcomes. Among the 41 women aged ≥35 years with SMOs, 11 (26.8%) died. Most participants were urban residents, 217 (75.6%), and married, 266 (92.7%). Among 21 women without formal education who developed a SMO, 11 (52.4%) died (Table 1).

Obstetric characteristics

Among the 175 women with SMOs, the largest proportion occurred among women with parity 1–3. A higher proportion of MDs was observed among women who delivered outside BMC than among those who delivered at BMC. The proportion of MDs was also higher among women who underwent cesarean or instrumental vaginal delivery than among those who had spontaneous vaginal delivery. These findings are descriptive and should not be interpreted as statistically established associations (Table 2).

Causes and case fatality rates of severe maternal outcomes among women admitted with obstetric-related conditions at BMC.

Direct obstetric causes accounted for 154 (88.0%) SMOs, with hypertensive disorders, 79 (45.1%), and obstetric hemorrhage, 49 (28.0%), as the leading contributors. The case fatality rates were 1 (33.3%) for abortion complications and 6 (28.6%) for sepsis. Indirect causes accounted for 21 (12.0%) SMOs, and anemia had the highest overall case fatality rate, with 6 deaths (46.2%) among 13 affected women (Table 3).

TABLE 1: Socio-Demographic Characteristics of Women with Obstetric-Related Conditions and Distribution of Severe Maternal Outcomes (N = 287)

Variable	All Obstetric Cases n (%) (N=287)	SMO n (%) (n=175)	MNM n (%) (N=138)	MD n (%) (N=37)
Age				
16–19	15 (5.2)	13 (7.4)	9 (69.2)	4 (30.8)
20–34	217 (75.6)	121 (69.1)	99 (81.8)	22 (18.2)
≥35	55 (19.2)	41 (23.4)	30 (73.2)	11 (26.8)
Residence				
Rural	70 (24.4)	59 (33.7)	44 (74.6)	15 (25.4)
Urban	217 (75.6)	116 (66.3)	94 (81.0)	22 (19.0)
Education				
Not attended school	22 (7.7)	21 (12.0)	10 (47.6)	11 (52.4)
Primary	101 (35.2)	73 (41.7)	56 (76.7)	17 (23.3)
Secondary	113 (39.4)	64 (36.6)	59 (92.2)	5 (7.8)
Higher	51 (17.8)	17 (9.7)	13 (76.5)	4 (23.5)
Marital Status				
Single	14 (4.9)	8 (4.6)	6 (75.0)	2 (25.0)
Married	266 (92.7)	162 (92.6)	127 (78.4)	35 (21.6)
Separated	7 (2.4)	5 (2.9)	5 (100.0)	0 (0.0)
Occupation				
Unemployed	129 (44.9)	81 (46.3)	62 (76.5)	19 (23.5)
Unskilled employed	103 (35.9)	74 (42.3)	62 (83.8)	12 (16.2)
Skilled employed	55 (19.2)	20 (11.4)	14 (70.0)	6 (30.0)

SMO = Severe Maternal Outcome; MNM = Maternal Near Miss; MD = Maternal Death.
Percentages in column 2 are calculated using total obstetric-related cases (N = 287).
Percentages in column 3 are calculated using total SMO (n = 175).
Percentages in columns 4 and 5 are row percentages within each SMO category

TABLE 2: Obstetric Characteristics of Women with Obstetric-Related Conditions and Distribution of Severe Maternal Outcomes (N = 287)

Variable	All Obstetric Cases n (%) (N=287)	SMO n (%) (n=175)	MNM n (%) (N=138)	MD n (%) (N=37)
Parity				
Nulliparous	67 (23.3)	36 (20.6)	33 (91.7)	3 (8.3)
Para 1–3	147 (51.3)	78 (44.6)	58 (74.4)	20 (25.6)
>Para 3	73 (25.4)	61 (34.9)	47 (77.1)	14 (22.9)
Place of Delivery				
Home	3 (1.1)	2 (1.1)	1 (50.0)	1 (50.0)
Other health facility	78 (27.2)	78 (44.6)	57 (73.1)	21 (26.9)
BMC	197 (68.6)	89 (50.9)	78 (87.6)	11 (12.4)
Died/Discharged before delivery†	9 (3.1)	6 (3.4)	2 (33.3)	4 (66.7)
Mode of Delivery				
Spontaneous vaginal delivery	130 (45.3)	80 (45.7)	69 (86.3)	11 (13.7)
Cesarean section	128 (44.6)	69 (39.4)	52 (75.4)	17 (24.6)
Instrumental vaginal delivery	6 (2.1)	6 (3.4)	3 (50.0)	3 (50.0)
Expulsion	1 (0.4)	1 (0.6)	1 (100.0)	0 (0.0)
Vacuum aspiration/D&C	3 (1.0)	3 (1.7)	2 (66.7)	1 (33.3)
Laparotomy (Ectopic/Ruptured uterus)	10 (3.5)	10 (5.7)	9 (90.0)	1 (10.0)
Died/Discharged before delivery†	9 (3.1)	6 (3.4)	2 (33.3)	4 (66.7)
Total	287 (100.0)	175 (100.0)	138 (78.9)	37 (21.1)

Percentages in the MNM and MD columns are row percentages calculated within each SMO category (MNM + MD = 100%).
Percentages in column 2 were calculated using total obstetric-related cases (N = 287). Percentages in column 3 were calculated using total SMO cases (n = 175).
† "Died/Discharged before delivery" refers to mothers who died while still pregnant or were discharged with an ongoing pregnancy after recovery from a maternal near-miss event.

TABLE 3: Causes and Case Fatality Rates of Severe Maternal Outcomes among Women Admitted with Obstetric-Related Conditions at BMC (n = 175)

Category/ Cause of SMO	Total SMO n (%) (n=175)	MNM n (%) (n=138)	MD n (%) (n=37)	Case Fatality Rate (%)
Direct causes (n = 154; 88.0%)				
Hypertensive disorders	79 (45.1)	70 (88.6)	9 (11.4)	11.4
Obstetric hemorrhage	49 (28.0)	36 (73.5)	13 (26.5)	26.5
Sepsis	21 (12.0)	15 (71.4)	6 (28.6)	28.6
Abortion complications	3 (1.7)	2 (66.7)	1 (33.3)	33.3
Ectopic pregnancy	2 (1.1)	2 (100.0)	0 (0.0)	0.0
Indirect causes (n = 21; 12.0%)				
Malaria	5 (2.9)	4 (80.0)	1 (20.0)	20.0
Anemia	13 (7.4)	7 (53.8)	6 (46.2)	46.2
Cardiovascular diseases	3 (1.7)	2 (66.7)	1 (33.3)	33.3

Percentages in the MNM and MD columns are row percentages calculated within each cause of severe maternal outcome (MNM + MD = 100%).
Percentages in the "Total SMO" column were calculated using total severe maternal outcomes (n = 175).
Case fatality rate (CFR) was calculated as the number of maternal deaths due to a specific cause divided by the total number of severe maternal outcomes from that cause × 100

DISCUSSION

The distribution of MNM cases and MD in this study demonstrates important socio-demographic disparities. Younger women, particularly those aged 16–19 years, experienced a relatively higher proportion of MD among women with SMO. Similar patterns have been reported in other settings where adolescent pregnancies are associated with increased maternal risks. Persistent inequalities in maternal mortality related to age and social determinants of health.[9] In addition, rural residents in our study experienced a higher proportion of adverse outcomes compared to urban residents. Limited access to healthcare facilities, transportation barriers, and delays in reaching appropriate care may contribute to these disparities. Similar studies have highlighted that delays in accessing emergency obstetric services are a significant contributor to maternal mortality in low-resource settings.[10, 11] Strengthening referral systems and improving access to skilled maternal healthcare in rural areas may therefore help reduce preventable maternal morbidity and mortality.

Previous studies have shown that inadequate ANC utilization increases the likelihood of maternal complications and mortality.[12,13] Limited ANC attendance is strongly associated with poor maternal health outcomes due to delayed recognition of pregnancy complications.[13] Socioeconomic barriers, education level, and accessibility to health facilities often influence ANC utilization.[14] Improving ANC coverage and strengthening early risk identification could therefore play a critical role in reducing SMOs.

Operative deliveries were common among women with SMOs, and a higher proportion of deaths was observed among women who underwent operative delivery than among those who had spontaneous vaginal delivery. This descriptive finding should not be interpreted as evidence that operative delivery caused maternal death, because the procedures may have been performed in response to complications that were already severe. In many low- and middle-income countries, emergency obstetric surgeries are often performed when patients already present with severe complications.[15] Maternal deaths following operative deliveries in resource-limited settings are frequently associated with delayed presentation, inadequate surgical infrastructure, and limited perioperative monitoring.[15] In addition, underlying medical conditions such as anemia and other indirect causes may further increase the risk of poor maternal outcomes.[16] Indirect maternal conditions significantly contribute to maternal mortality globally. Furthermore, maternal anemia has been shown to increase the risk of adverse pregnancy outcomes and complications.[16, 17] These findings emphasize the need to strengthen surgical capacity, improve perioperative care, and ensure adequate management of pre-existing maternal conditions.

The analysis of causes of SMO in this study revealed that obstetric hemorrhage, sepsis, and anemia were associated with particularly high Case Fatality Rates (CFR). These findings are consistent with previous studies conducted in low-resource settings where hemorrhage and infection remain leading contributors to maternal mortality.[18, 19] Previous studies in West Africa have reported high case fatality rates due to direct obstetric complications. Similarly, research in sub-Saharan Africa has demonstrated that severe obstetric complications are a major contributor to maternal morbidity and mortality.[18, 20] The particularly high Case Fatality Rate (CFR) observed for anemia in our study may reflect late presentation to the tertiary facility, limited availability of blood transfusion services, and underlying nutritional deficiencies. Consistent with this finding, evidence from other studies indicates that maternal anemia is strongly associated with adverse maternal and neonatal outcomes in low- and middle-income countries.[17] Additionally,

infection-related complications may be exacerbated by antimicrobial resistance. For instance, studies in Tanzania have reported a high prevalence of multidrug-resistant bacterial infections, which may complicate the management of maternal sepsis. Similarly, other studies have documented a high burden of postoperative infections in tertiary hospitals, which may further contribute to poor maternal outcomes.[21, 22]

Timely recognition and prompt management of obstetric emergencies are therefore critical for preventing maternal deaths. Previous studies have also emphasized that improving obstetric safety through early recognition and rapid response systems is essential for reducing preventable maternal mortality.[23] Delays in referral and access to specialized care may further exacerbate these outcomes. Although detailed referral analysis was beyond the scope of this study, similar challenges have been reported in Tanzania. Studies have identified delays in referral and admission to intensive care units, largely due to limited critical care capacity and triage challenges in Tanzanian tertiary hospitals.[24] These findings highlight the importance of strengthening referral coordination, improving emergency response systems, and expanding critical care services for obstetric patients.

Strengths and Limitations

The retrospective design relied on medical records, which may have contained incomplete or inaccurately documented information, potentially leading to misclassification or missing data. The single-center setting limits generalizability to other healthcare facilities. Additionally, exclusion of incomplete records may have introduced selection bias, and the descriptive analysis did not allow for identification of independent predictors of mortality. Nevertheless, the study provides important institutional data on severe maternal outcomes in a tertiary referral hospital in Tanzania.

CONCLUSION

This study demonstrates a high burden of SMOs at BMC, with hypertensive disorders and obstetric hemorrhage as leading causes, and notably high case fatality rates for anemia and sepsis. Higher proportions of maternal deaths were observed among women with delayed initiation of treatment and fewer antenatal care visits; however, these descriptive findings do not establish independent associations or causality. These findings highlight the need for strengthening emergency obstetric care, referral systems, early risk identification, and targeted management of indirect causes such as anemia to reduce maternal mortality.

RECOMMENDATIONS

Based on the persistently high maternal mortality among women with SMOs at BMC—particularly from preventable causes like anemia and abortion complications—we recommend strengthening early detection and management of obstetric complications through enhanced clinical protocols, regular Emergency Obstetric Care (EmOC) training, and improved access to essential supplies such as blood products. Additionally, hospital-based audits of SMO cases should be institutionalized to identify system gaps and guide quality improvement. Future research should focus on identifying modifiable risk factors and evaluating the effectiveness of targeted interventions to reduce SMO and maternal mortality. More studies should explore strategies to improve antenatal care utilization and address indirect causes like anemia to reduce maternal mortality and enhance health equity in similar settings.

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