Research Article

The magnitude of maternal near-miss cases in public hospitals of Hadiya zone, southern Ethiopia

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Abstract

Background: Reducing the maternal mortality ratio below 70 per 100,000 live births for all countries by the year 2030 is one of the targets of the UN's sustainable development goals. Hence, knowing the magnitude of maternal near-miss would tell us the scope of planning to accelerate the achievement of this target as women who survive severe obstetric complications have many characteristics in common with maternal death events. However, studies are limited on the magnitude of maternal near-miss in Ethiopia in general and in the study area in particular.

Objective: To determine the magnitude of Maternal Near-Miss (MNM) cases at public hospitals in the Hadiya zone, southern Ethiopia using the adapted sub-Saharan Africa MNM tool.

Methods: Facility-based prospective cohort study was conducted over 6 months from February 17 to August 16, 2019. A total of 2724 live births with 70 MNM cases were identified. A record review followed by a structured interviewer-administered questionnaire of the cases was used to collect data. A descriptive analysis of the results was carried out.

Results: This study was based on an adapted sub-Saharan Africa MNM tool for MNM cases detection and accordingly the most common maternal near-miss cause was severe pre-eclampsia (41.4%) followed by sepsis (31.4%), severe PPH (25.7%), eclampsia (8.6%) and uterine rupture (1.4%). The maternal near-miss ratio in the study area was 25.7 per 1,000 live births.

Conclusion: The maternal near-miss ratio at public hospitals in Hadiya Zone was 25.7/1000 live births and severe pre-eclampsia was identified as the most common aetiology.

Keywords: Maternal near-miss; Magnitude; Hadiya zone; Southern Ethiopia.

Background

The World Health Organization (WHO) has defined a Maternal Near-Miss (MNM) as "a woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy". World Health Organization proposes an "MNM approach" to monitor and improve the quality of obstetric care using a tool that classifies women according to severe (potentially) life-threatening conditions. The classification is based on three different types of criteria: disease-, intervention- and organ dysfunction-based [1]. However, a study conducted to validate the WHO maternal near-miss tool indicated that applying solely organ dysfunction-based criteria may lead to underreporting of Severe Maternal Outcome (SMO) especially in low resource settings and recommend refined disease-based criteria [2].

Maternal Near-Miss is a more valuable indicator for the analysis of obstetric care than Maternal Mortality (MM) [3]. It has a higher incidence rate than MM. Hence MM is frequently described as "Just the Tip of the Iceberg" with a vast base of maternal morbidity that remains largely undescribed [4]. The study in low resource settings showed that maternal near misses occurred 26 times more frequently than maternal death [3,5]. In Ethiopia, 20,000 women die each year from complications related to pregnancy, childbirth and postpartum. For every woman that dies, 20 more experience injury, infection, disease, or disability [6]. Thus, the Maternal Near-Miss study allows rigorous quantitative analysis of etiologies leading to severe maternal morbidity and maternal mortality [5]. Moreover, it offers a good opportunity for data collection as a woman herself can be a source of information [7]. Recognizing these facts, World Health Organization called for increased study of Maternal Near-Miss [1,5].

According to WHO disease-specific criteria, women who have been considered near-miss are those women who survived one or more life-threatening conditions (i.e. severe postpartum haemorrhage, severe pre-eclampsia, eclampsia, sepsis or ruptured uterus) [1]. Nevertheless, there seems to be an inverse trend in prevalence with the development status of a country. Based on disease-specific criteria 4-8% of pregnant women who deliver in the hospitals in resource-poor settings experienced MNM compared to 1% in developed country settings [8]. Particularly in sub-Saharan Africa, the incidence/prevalence ratio for maternal near misses ranged from 1.1%-10.1% and the commonest causes were ruptured uterus, sepsis and haemorrhage [9]. The overall near-miss rate in Ethiopia was 9079 per 100,000 live births, whereas the overall case fatality rate was 8% where the government attempts to reduce severe maternal outcomes using different strategies including free-of-charge maternity services [10,11].

Although the concept of maternal near misses has been explored in maternal health as an adjunct to maternal death in the last 20 years [12], few studies have examined maternal near misses in Ethiopia. So this study aimed to determine the magnitude of maternal near-miss cases at public hospitals in the Hadiya zone, southern Ethiopia using the adapted sub-Saharan Africa MNM tool, particularly disease-specific criteria.

Material and methods

Study design

A facility-based prospective cohort study was conducted.

Study setting and period

The study was conducted in the Hadiya zone, which is one of the 16 administrative zones in Southern Nations, Nationalities and Peoples Regional State, Ethiopia. Hadiya zone has 10 districts and two town administrations. Hossana is the capital town of the Hadiya zone which is located 230 kilometres Southwest of Addis Ababa, the capital of Ethiopia. There are four hospitals in the zone (one referral and three district hospitals). All hospitals provide comprehensive emergency obstetric care services. The study was conducted from February 17 to August 16, 2019. The details of settings have been described elsewhere as part of the project not yet published.

Participants included

All women who were pregnant, in labour, or who delivered or aborted up to 42 days ago and admitted to obstetric wards and/or obstetric intensive care units of the study hospitals during the study period were included.

Exclusion criteria

The exclusion criteria considered was having had records that missed pertinent obstetric information. However, no mother fulfilled the exclusion criteria.

Study variables

Maternal Near-Miss: Woman admitted to public hospitals in the Hadiya zone and survived at least one diagnosed criteria of the adapted sub-Saharan Africa MNM tool was labelled as "Yes" and otherwise "No". The diagnosis of these life-threatening conditions was declared from the client records by one physician from each hospital who was recruited as supervisor each day to identify eligible cases and then trained midwives conducted the interviews and reviewed medical records using pre-coded questionnaires. The maternal near-miss ratio was calculated by dividing the number of maternal near-miss cases by the total number of live births as in 1000 live births [1].

Other variables included were socio-demographic profile (age, residence, marital status, educational level, maternal occupation, monthly income); and obstetric and reproductive health profile (female genital mutilation, birth interval, gravidity, antenatal care, ever give birth by cesarean section, previous pregnancy complications).

Diagnostic criteria

Table 1: Adapted sub-Saharan Africa maternal near-miss tool used in this study [13].

Data collection procedure

Data were collected using a structured interviewer-administered pre-coded questionnaire and MNM checklist with diagnostic criteria that were developed based on WHO maternal near-miss tool adapted for sub-Saharan Africa with minor modifications [13]. Face-to-face interviews of MNM cases and client record review techniques were employed to gather data.

Table 1: Adapted sub-saharan Africa maternal near-miss tool used in this study [13].

Category related to WHO maternal near-miss criteria	Adapted sub-Saharan Africa maternal near-miss criteria	Definitions
Clinical criteria	Acute cyanosis	Acute cyanosis is the blue or purple colouration of the skin or mucous membranes due to low oxygen saturation.
	Gasping	Gasping is a terminal respiratory pattern and the breath is convulsively and audibly caught.
	Respiratory rate > 40 or <6/min	
	Shock	Shock is persistent severe hypotension, defined as a systolic BP <90 mmHg for ≥60 min with a pulse rate of at least 120 despite aggressive fluid replacement (>2 L).
	Oliguria non responsive to fluids or diuretics	Oliguria is urinary output <30 ml/h for 4 h or <400 ml/24 hours.
	Failure to form clots	Failure to form clots can be assessed by the bedside clotting test or absence of clotting from the IV site after 7–10 minutes.
	Loss of consciousness lasting more than 12 hours	Loss of consciousness lasting >12 h is a profound alteration of mental state that involves complete or near-complete lack of responsiveness to external stimuli. It is defined as a Glasgow Coma Scale <10 (moderate or severe coma).
	Cardiac arrest	
	Stroke	A stroke is a neurological deficit of cerebrovascular cause that persists beyond 24 hours or is interrupted by death within 24 hours.
	Uncontrollable fit/ total paralysis	Uncontrolled fits/total paralysis is refractory, persistent convulsions or status epilepticus.
	Jaundice in the presence of pre-eclampsia	Pre-eclampsia is defined as the presence of hypertension associated with proteinuria. Hypertension is defined as a BP of at least 140/90 mmHg on at least two occasions and at least 4-6 h apart after the 20th week of gestation in women known to be normotensive beforehand. Proteinuria is defined as the excretion of 300 mg or more of protein every 24 h. If 24-h urine samples are not available, proteinuria is defined as a protein concentration of 300 mg/l or more (≥1 on dipstick) in at least two random urine samples taken at least 4–6 h apart.
Other additional adapted sub-Saharan Africa maternal near-miss clinical criteria other than WHO maternal near-miss criteria	Eclampsia	Eclampsia is diastolic BP≥90 mmHg or proteinuria +3 and convulsion or coma.
	Uterine rupture	Uterine rupture is a complete rupture of the uterus during labour and/or confirmed later by laparotomy.
	Sepsis or severe systemic infection	Sepsis or severe systemic infection is defined as a clinical sign of infection and 3 of the following: temp >38°C or <36°C, respiration rate >20/min, pulse rate >90/min, WBC>12,000.
	Pulmonary oedema	Pulmonary oedema is an accumulation of fluids in the air spaces and parenchyma of the lungs.
	Severe abortion complications	Severe abortion complications are defined as septic incomplete abortion or complicated gestational trophoblastic disease with anaemia.
	Severe malaria	Severe malaria is defined as major signs of organ dysfunction and/or high-level parasitemia or cerebral malaria.
	Severe pre-eclampsia with ICU admission	Severe pre-eclampsia: Persistent systolic blood pressure of 160 mmHg or more or a diastolic blood pressure of 110 mmHg; and either proteinuria of 5 g or more in 24 hours; or oliguria of <400 ml in 24 hours; or HELLP syndrome.
	Severe postpartum haemorrhage	If a woman experience genital bleeding after delivery with at least hypotension or result in blood transfusion.
Laboratory-based criteria	Oxygen saturation < 90% for >60 min	
	Creatinine ≥300 µmol/l or ≥3.5 mg/dL	
	Acute thrombocytopenia (<50,000 platelets/ml)	
	Loss of consciousness and ketoacids in urine	
Management based criteria	Hysterectomy following infection or haemorrhage	
	Transfusion of ≥2 units of red blood cells	
	Intubation and ventilation for ≥60 min not related to anaesthesia	
	Cardio-pulmonary resuscitation	
	Laparotomy other than caesarean section	

Clients' record review was used to identify near-miss diagnoses and attendants of the current delivery; otherwise, other variables were assessed directly by interviewing women by well-trained midwives. The interview was held in a private area and near discharge from the hospital. The overall data collection process was supervised by a trained general practitioner working in the respective hospitals. The Obstetrics and gynaecology ward and obstetric intensive care units of each hospital were visited for data collection.

Data quality management

The questions prepared in English were translated into Amharic and back-translated to English by different expert translators to check for consistency. A pre-test was carried out at Worabe comprehensive hospital on 5% of the sample size for one week and any inconsistencies in the tool were corrected. Data collectors were trained for two days on the objectives of the study, data collection techniques and tools and the data

consistency and completeness were checked daily by trained supervisors and the principal investigators and spot corrections were taken.

Data processing and analysis

Each questionnaire was checked for completeness, coded and entered into Epi-data Version 4.4 and exported to SPSS for Windows version 24 for analysis. Frequencies, proportions and measures of variation were used to describe the study population concerning socio-demographic and other relevant variables.

Ethical considerations

Ethical clearance was obtained from Jimma University, Faculty of Public Health Institution Review Board (IRB). Permission was granted from the Hadiya zone health department and the participating hospitals. The respondents were informed about the objective and purpose of the study, their right not to participate in the study or with-draw in the middle and informed verbal consent was obtained from each respondent. Confidentiality of the information was assured and data de-identified and de-linked was stored in a secure location.

Results

Table 2: Socio-demographic characteristics of MNM cases admitted to public hospitals in Hadiya zone, southern Ethiopia, 2019 (n=70).

Variables	Categories	Frequency (%)	Percent
Age	18 – 29 years	43	61.4
	30 – 41 years	27	38.6
Occupation	Housewife	54	77.1
	Civil Servant	11	15.7
	Merchant	4	5.7
	Other (daily labourer)	1	1.4
Level of education	No formal education	28	40.0
	Primary school (1-8)	25	35.7
	Secondary school (9-12)	5	7.1
	Tertiary or higher (12+)	12	17.1
Monthly income	≤2,500 birr	51	72.9
	>2,500 birr	19	27.1

Socio-demographic characteristics

A total of 2724 live births with 70 MNM cases were identified during the 6 months (February 17 to August 16, 2019). The mean age of the MNM cases was 27.7 (5.4 SD) years. Currently, married cases were 92.9% while more than three fourth of cases (77.1%) were housewives their occupation. The percentage of cases coming from rural areas was 72.9% (Table 2).

Obstetric and reproductive health profile of the MNM cases

About 89% of MNM cases were circumcised. The median number of pregnancies among MNM cases was 3.5 (IQR 1 to 6) with 38.6% of grand multigravida (>5 pregnancies). Regarding birth interval, the mean interval between the last birth and current pregnancy in years was 1.7 (0.7 SD) and the percentage of birth interval <2 years among cases was 43.8%. About 32.9% of cases ever gave birth by cesarean section. About 41% of cases had experienced previous pregnancy complications. Seventy-three per cent of cases received ANC in their current pregnancy (Table 3).

Table 3: Reproductive health and obstetric profile of MNM cases admitted to public hospitals in Hadiya zone, Southern Ethiopia, 2019 (n=70).

Variables	Categories	Frequency	Percent
Female Genital Mutilation	Yes	55	78.6
	No	15	21.4
Gravidity	Primigravida	22	31.4
	Multigravida	21	30.0
	Grand multigravida	27	38.6
Birth interval	< 2 years	31	43.8
	≥ 2 years	39	56.2
Ever give birth by Cesarean Section	Yes	23	32.9
	No	47	67.1
Previous pregnancy complications	Yes	29	41.4
	No	41	58.6
Receive ANC in the current pregnancy	Yes	51	72.9
	No	19	27.1

The magnitude of maternal near-miss events

This study was based on an adapted sub-Saharan Africa MNM tool for MNM cases detection and accordingly, the most common maternal near-miss aetiology was severe pre-eclampsia (41.4%) followed by sepsis (31.4%), severe postpartum haemorrhage (25.7%), eclampsia (8.6%) and uterine rupture (1.4%). The maternal near-miss ratio in the study area was 25.7 per 1,000 live births. The most common time of diagnosis was during postpartum/postoperative (42.9%). The major diagnostic criteria for severe postpartum haemorrhage used was postpartum bleeding with hypotension while Proteinuria >5gm over 24 hours / >+2 was the most common diagnostic criteria used for severe pre-eclampsia (Table 4, Figure 1).
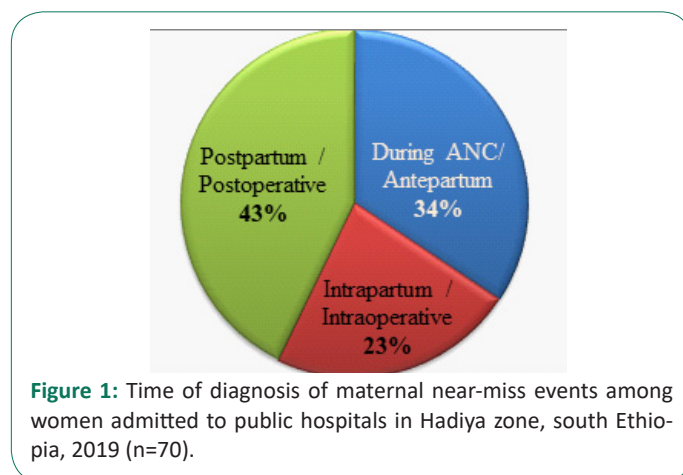

Figure 1: Time of diagnosis of maternal near-miss events among women admitted to public hospitals in Hadiya zone, south Ethiopia, 2019 (n=70).

Discussion

MNM ratio in this study was 25.7 per 1,000 live births. The ratio is higher than studies conducted in Sudan, London, and Brazil indicated the Maternal Near Miss Ratio (MNMR) of 22.1, 12, and 5.8 per 1,000 live births respectively [14-16]. But it is lower than studies conducted in Nigeria and the Amhara region of Ethiopia where it was 12% and 23.3% respectively [17,18]. These differences might be due to seasonal variation and study duration as our study was conducted over six months compared to those studies conducted over twelve months. Another possible explanation may be due to the use of different definitions and criteria for MNM cases detection or it could reflect the true epidemiological reality.

Table 4: Magnitude of maternal near misses among women admitted to public hospitals in Hadiya zone for obstetric reasons, Southern Ethiopia, 2019 (n=70).

Variable	Category	Frequency	Percent
Maternal Near-Miss events (n = 70) for each category	Severe postpartum haemorrhage	18	25.7
	Severe Pre-eclampsia	29	41.4
	Eclampsia	6	8.6
	Sepsis or severe systemic infection	22	31.4
	Ruptured uterus confirmed	1	1.4
Diagnostic criteria for severepostpartum haemorrhage (n = 18) for each category	Postpartum bleeding with hypotension	17	94.4
	Postpartum bleeding results in blood transfusion	8	44.4
Diagnostic criteria for severe Pre-eclampsia (n = 29) for each category	Blood pressure >160/110 mmHg	22	75.9
	Proteinuria > 5gm over 24 hours / > +2	26	89.7
	Oliguria <400 ml over 24 hours	6	20.7
	HELLP syndrome	5	17.2
Diagnostic Criteria for Sepsis (n = 22) for each category	Postpartum fever (body T° > 38°C)	10	45.5
	Confirmed or suspected infection	14	26.9
	Heart rate >90	10	45.5
	Respiratory rate >20	8	36.4
	Leucopenia (WBC count <4,000)	3	13.6
	Leukocytosis (WBC count >12,000)	7	31.8
Time MNM event occurred	Had occurred before the arrival	49	70.0
	After admission	21	30.0

This study was based on an adapted sub-Saharan Africa MNM tool for MNM cases detection and accordingly, the most common near-miss event was severe pre-eclampsia followed by sepsis and severe PPH. Our study was in line with studies conducted in India, Syria, South Africa, and Egypt where severe pre-eclampsia is the most common MNM event [19-22]. But it was different from a study conducted in the Amhara region of Ethiopia where a ruptured uterus was the most common MNM event followed by severe pre-eclampsia and severe postpartum haemorrhage [23]. These variations could be due to the difference in the clinical definition of severe pre-eclampsia. Our findings inform the interventions that need priority attention for prevention and curious modern management for the identified severe maternal obstetric complications.

The WHO maternal near-miss approach set criteria for MNM cases detection based on clinical, laboratory, and management-based criteria [1], but some of the diagnoses indicated in the criteria set required sophisticated laboratory equipment. This is why the current study used the adapted sub-Saharan Africa MNM tool for MNM case detection [13]. Our study was prone to limitations in that it was conducted at public hospitals in the Hadiya zone of the southern region of Ethiopia, but further studies were required for the national magnitude of MNM for a longer period to plan interventions broadly and nationally. Further study is also needed for validation of the WHO maternal near-miss criteria in Ethiopia to be applied by future research.

Conclusion

The maternal near-miss ratio at public hospitals in Hadiya Zone was 25.7/1000 live births and severe pre-eclampsia was identified as the most common etiology. In light of the attainment of the SDG of reducing MMR below 70 per 100,000 live births by 2030, it is imperative that findings from this study be used to inform planning interventions.

Declarations

Contributors: SK participated in the conception and design of the study, performed statistical analyses and wrote the first version of the manuscript. GT and AT participated in the design of the study, and read and revised the draft versions of the manuscript. All authors contributed to all sections of the manuscript and approved the final version.

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Conflicts of interests: Authors declared that there is no conflict of interest.

Ethics approval: The study has been approved by Jimma University, Faculty of Public Health Institution Review Board.

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Data availability statement: Data may be obtained from a third party.

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