



**SAINT PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE
DEPARTMENT OF PUBLIC HEALTH**

**MATERNAL NEAR MISS: MAGNITUDE AND CONTRIBUTING FACTORS
AMONG MOTHERS ADMITTED TO OBSTETRICS AND GYNECOLOGY
DEPARTMENT AT SAINT PAUL'S HOSPITAL MILLENNIUM MEDICAL
COLLEGE, ADDIS ABABA, ETHIOPIA: SIX MONTHS REVIEW**

By- Genet Hailu Nadew (medical intern)

**A thesis submitted to Saint Paul's Hospital Millennium Medical College
Public health department, in partial fulfillment for the degree of doctor of
medicine**

**AUGUST, 2018
ADDIS ABABA, ETHIOPIA**

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Acronyms and Abbreviations

SPHMMC	St. Paul’s Hospital Millennium Medical College
MNM	Maternal Near Miss
MNMR	Maternal Near Miss Ratio
SMOR	Severe Maternal Outcome Ratio
LB	Live Births
EDHS	Ethiopian Demographic and Health Survey
SDG	Sustainable Development Goals
ICU	Intensive Care Unit
WHO	World Health Organization
GTD	Gestational Trophoblastic Disease
HELLP	Hemolysis Elevated Liver Enzymes, And Low Platelets
PIH	Pregnancy Induced Hypertension
SVD	Spontaneous Vaginal Delivery
C/S	Cesarean Section

Abstract

Background: The transition from studying mortality to studying maternal morbidity has followed a worldwide trend because the absolute number of deaths is relatively small as compared to number of cases of maternal near miss which generate more information and data on maternal morbidity are more accessible, reliable and provide useful information about the strengths and weaknesses of the emergency obstetric care provided at a facility.

Objective: of this study is to assess magnitude and contributing factors of maternal near miss among mothers admitted to obstetrics and gynecology department at saint Paul hospital millennium medical college over six months from July 1, 2017-December 31, 2017.

Method: A retrospective hospital based descriptive cross sectional study was carried out to determine magnitude and contributing factors of maternal near miss. Information from medical records of mothers that admitted to obstetrics and gynecology department of SPHMMC over six month period from July 1, 2017-December 31, 2017 were reviewed. Analysis was done with Statistical Package by Social Sciences (SPSS) version 21. Descriptive statistics such as frequency, graphics and cross tabulations were calculated for dependent and independent variables; and also association between dependent and independent variables were made.

Result: During the six month period, a total of 155 maternal near-miss cases and 4869 live births were reported in total, which produced a total maternal near miss prevalence ratio of 31.83 per 1000 live births. The underlying cause for the majority of maternal near-miss cases was hypertensive disorder (34.8%), followed by obstetric haemorrhage (18.7%), pregnancy with abortive outcome (11.6%), and pregnancy related infections (1.9%). The major contributing causes of maternal near-miss were anaemia (43.9%) followed by prolonged/obstructed labour (6.5%).

Conclusion: The study demonstrated a higher maternal near-miss incidence ratio compared to previous studies. Underlying and contributory causes of maternal near-miss are the same to previous study. Evidence-based interventions designed to optimize management during pregnancy, intra partum and postpartum life threatening obstetric complications, specifically hypertensive disorders and obstetric hemorrhage could reduce the occurrence of maternal near-miss problems.

Keywords: maternal near miss, Maternal Near Miss Events, magnitude

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1. Introduction

1.1. Background

Maternal near miss is defined as a woman who nearly died and survived a complication that occurred during pregnancy, childbirth, or within 42 days of termination of pregnancy [1]. Different identification criteria for maternal near miss have been applied in different context until 2009 GC [1, 2, 3]. WHO maternal near miss tool has become a standardized method to identify women at the severe end of the morbidity spectrum [1]. This tool has three groups of criteria with clinical, laboratory and management based parameters that focus on the presence of organ dysfunction is present on [annex 1](#) of this proposal [1]. WHO's maternal near miss definition and set of identification criteria for near miss cases aiming to facilitate the routine use of near miss reviews for monitoring and improving quality of obstetric care [1, 3]. Though the WHO MNM tool has been widely used since its introduction including in sub-Saharan Africa, some laboratory based and some management-based criteria reflecting organ dysfunction turned out to be of limited relevance in resource-limited settings in sub-Saharan Africa [3]. Adaptation of WHO MNM tool suggested six parameters of WHO MNM tool were deemed to not be applicable and an additional eight parameters were suggested for inclusion into an adapted sub-Saharan African MNM tool [3].

In addition to the number of maternal near miss cases, there are indicators can be calculated [1, 2, 3]. Maternal Near Miss ratio refers to the number of maternal near miss cases per 1,000 live births. $[MNM\ ratio = MNM/LB]$ [1,3]. Severe maternal outcomes are maternal near miss cases and maternal deaths. Severe Maternal Outcome Ratio (SMOR) refers to the number of women with life threatening conditions per 1,000 live births (LB) [1, 3]. Maternal near-miss mortality ratio (MNM: MD) refers to the ratio between maternal near miss cases and maternal deaths, [1]. Mortality index refers to the number of maternal deaths divided by the number of women with severe maternal outcomes expressed as a percentage $[MI = MD / (MNM + MD)]$ [1,2,3]. The higher the index the more women with life-threatening conditions die, where as the lower the index the fewer women with life-threatening conditions die and there is better quality of care [1]. Such indicators are expected to facilitate comparing the situation over time and across settings [1, 3].

Maternal mortality is “Just the tip of iceberg” has vast base to the iceberg maternal morbidity [4, 5, 6]. The near miss are more common than maternal deaths, their review is likely to yield useful information on the pathways that lead to severe morbidity and death [2, 3]. In light of the global reduction in maternal mortality, assessment of maternal near miss has become more common [3].

Maternal mortality has decreased worldwide [2]. Falling numbers of maternal deaths in developed countries have stimulated an interest in investigating cases of maternal near miss [1, 2, 3].

Ethiopia has a high rate of maternal mortality [6, 7, 8]. The top five causes of maternal mortality during 1990-2013 were direct maternal causes such as complications of anesthesia, embolism (air, amniotic fluid, and blood clot), and the condition of peripartum cardiomyopathy, complications of abortions, maternal hemorrhage, hypertensive disorders, and maternal sepsis and other maternal infections such as influenza, malaria, tuberculosis, and hepatitis[6, 7, 8]. Most of maternal mortality happened during the postpartum period and majority of the deaths occurred at the age group of 20–29 years [6].

According to the 2011 Ethiopian Demographic and Health Survey(EDHS),the maternal mortality ratio(MMR) of the country was 676 per100,000 live births, and according to the 2016 EDHS recorded 412 deaths per100,000livebirths[7, 8]. An estimated 2.9 million women] give birth every year in Ethiopia, and only 26.2% of them deliver in a health facility[7].According to the 2016 EDHS report, the percentage of women who received Antenatal care(ANC) was 62.4%,delivery care was27.7% and postnatal check- up from a skilled provider was 16.5% [8].

Near miss cases share many characteristics with maternal deaths and can directly inform on obstacles that had to be overcome after the onset of an acute complication [2, 3]. Corrective actions for identified problems can be taken to reduce related mortality and long-term morbidity [1, 2, 3].

1.2. Statement of the Problem

According to Sustainable Development Goals (SDGs) by 2030, every country should reduce its maternal mortality ratio (MMR) by at least two thirds from the 2010 baseline, and no country should have an MMR higher than 140 deaths per 100 000 live births (twice the global target) [9].

The transition from studying death to studying maternal morbidity has followed a worldwide trend because the absolute number of deaths is relatively small as compared to number of cases of MNM which generate more information. Secondly, data on maternal morbidity are more accessible and reliable as the woman is herself a source of information. Thirdly, MNM has a greater acceptability among individuals and institutions since death did not occur. MNMs, therefore, provide useful information to health practitioners and policy makers about the strengths and weaknesses of the emergency obstetric care provided at a facility [1, 2, 3, 9].

The purpose of the near-miss approach is to improve clinical practice and reduce preventable morbidity and mortality through the use of best evidence-based practices [1, 3]. Research related to maternal near-miss is crucial when examining quality of obstetric care [3].

Lack of standard definition and lack of uniform case identification criteria has limited routine and wider implementation of MNM for improving obstetric care until WHO initiated a process in agreeing on a definition in 2009[1,3 9, 10].

Because there were heterogeneity of criteria for the identification of near-miss cases and no standard definition for maternal near-miss until 2009, a heterogeneous estimate of prevalence was observed in different published literatures around the world [9, 10, 11].

In Ethiopia, maternal near-miss complications are common [3]. In Ethiopia, the prevalence has reached as high as 7.9% [9]. Based on research on facility-based cross-sectional study conducted on incidence and causes of MNM in five selected public hospitals of Addis Ababa, from May 1, 2015 to April 30, 2016, there were a total of 238 maternal near-miss cases and maternal near-miss incidence ratio of 8.01 per 1000 live births [9]. Based on an institution-based cross-sectional study done on the prevalence of maternal near misses and associated factors in Amhara Regional State Referral Hospitals, conducted from March 1, 2013 to August 30, 2013, the overall proportion of maternal near miss was 23.3% [13]. Based on research done on assessment of maternal near miss at Debre Markos hospital from 1st January 2008 to 30 December 2012 out of 1355, 403 (29.7%) were near miss cases [10].

Causes of maternal near miss differ in different set up. Based on literatures from different country, underlying causes of the majority of maternal near-miss cases were hypertensive disorders and obstetric hemorrhage. In Ethiopia most literatures shows that hypertensive disorders and obstetric hemorrhage are common causes of MNM [9, 10, 13].

However, magnitude and causes of maternal near miss events among admitted mothers are not documented at SPHMMC. Thus, this study aimed to assess the magnitude and cause of maternal near-miss among mothers admitted to obstetrics and gynecology department of SPHMMC over six months period.

1.3. Justification of the study

The Federal Ministry of Health of Ethiopia is striving to reduce the rate of maternal mortality of the country. Despite all of these efforts maternal mortality is high in Ethiopia. Near miss cases share many characteristics with maternal deaths and can directly inform on obstacles that had to be overcome after the onset of an acute complication. Therefore there is a need to assess the magnitude and causes that contribute to maternal mortality. Study of maternal near-miss is also complement to evaluate and improve the quality of obstetric care.

Because most critical maternal cases are referred to St. Paul's Hospital Millennium Medical College which is known to provide emergency caesarian section, hysterectomy and other surgical intervention, ICU, maternity ward and blood transfusion services, study of maternal near miss at this hospital is very important.

Beside this there was no research done on magnitude and causes of maternal near miss at this hospital despite, research done on incidence and causes of maternal near miss at selected five public hospitals in Addis Ababa. This research also helps take corrective actions for identified problems to reduce related mortality and long-term morbidity.

2. Literature Review

Magnitude of maternal near miss

In world

Based on descriptive cross sectional study conducted on maternal near miss of patients admitted to the obstetric intensive care unit of a tertiary hospital in Recife (Brazil) over a period of four years 255 cases of maternal near miss were identified, with an overall ratio of maternal near miss of 12.8/1,000 live births [11].

Based on cross-sectional study severe maternal morbidity and near misses in tertiary hospitals, Kelantan, Malaysia in 2014, out of 21,579 live births, 395 women with severe maternal morbidity, 47 women with maternal near miss and two maternal deaths were analyzed. The severe maternal morbidity incidence ratio was 18.3 per 1000 live births and the maternal near miss incidence ratio was 2.2 per 1000 live births. The maternal near miss to mortality ratio was 23.5 and the mortality index was 4.1 % [12].

Based on Cross sectional study in four hospitals in two districts in Ban ten province, Indonesia to identify the numbers and causes of near miss and death between November 2003 and October 2004, the prevalence of near miss was much greater in public than in private hospitals (17.3% versus 4.2%, $p = 0.000$). The occurrence of maternal deaths was 1.6%. Majority (70.7%) of near miss in public hospitals was in a critical state at admission but this proportion was much lower in private hospitals (31.9%) [14].

In Africa

Based on Cross sectional study of all women admitted to the tertiary care University Hospital in Kigali, Rwanda with severe maternal morbidity and mortality from October 2011 until October 2012, the prevalence of severe maternal outcomes was 11 per 1000 live births. The maternal near miss ratio was 8 per 1000 live births. Majority of patients were found to be of lower socioeconomic status, referred from district hospitals to the tertiary care center, and resided in the eastern part of the country [15].

Based on cross sectional study of maternal near-miss cases in major public hospitals in Egypt, Lebanon, Palestine and Syria on maternal near-miss cases in the four contexts beginning in 2011, out of total 9,063 live birth deliveries across the four settings, with total of 77 cases of severe maternal outcomes (There were 71 maternal near-miss cases and 6 maternal deaths). Higher indices for the maternal mortality index were found in Egypt (8.6 %) and in Syria (14.3) [16].

Based on cross sectional study conducted on maternal near miss and mortality at a rural tertiary centre in southern Nigeria from September 2014 to August 2015 in Madonna University Teaching Hospital Elele, Rivers State, Nigeria, out of 262 deliveries, 5 women died and 52 women had near miss event. The maternal mortality rate was 1908/100,000. The maternal near miss mortality ratio was 11.4: 1 while the mortality index was 8.8%. Three out of the five deaths that occurred were in the age category of 20–24 years [17].

Based on research done on Magnitude and pattern of maternal near-miss cases admitted to Women's Health Hospital, Assiut University, MNM incidence ratio was 20 per 1000 live births. The mean age of MNM cases was 28.4 ± 8.5 , whereas the mean gestational age of MNM was 35.66 ± 8.6 weeks. [18].

Based on research done on incidence of maternal near miss and quality of care in hospital based study in Accra, Ghana between October 2010 and March 2011 MNM incidence ratio was 28.6 per 1000 live births and anemia contributed to most of MNM cases [19].

In Ethiopia

Based on research on facility-based cross-sectional study conducted in five selected public hospitals of Addis Ababa, Ethiopia from May 1, 2015 to April 30, 2016, there were a total of 238 maternal near-miss cases and 29,697 live births in all participating hospitals, which provides a maternal near-miss incidence ratio of 8.01 per 1000 live births [9].

Based on research done on assessment of maternal near miss at Debre Markos hospital from 1st January 2008 to 30 December 2012 out of 1355,403 (29.7%) were near miss cases [10].

Based on case-control facility based study done on Determinants of maternal near miss among women in six public hospital maternity wards in Tigray Region, Northern Ethiopia, from January 30-March 30, 2016. Roughly 90% of cases and controls were married and 25% experienced their first pregnancy before the age of 16 years [20].

Based on An Institution based cross sectional study done on the prevalence of maternal near misses and associated factors in Amhara Regional State Referral Hospitals, Northwest Ethiopia, conducted from March 1, 2013 to August 30, 2013, the overall proportion of maternal near miss was 23.3 % [13].

Contributing factors of maternal near miss

Based on descriptive cross sectional study conducted on maternal near miss of patients admitted to the obstetric intensive care unit of a tertiary hospital in Recife (Brazil) over a period of four years, the most common causes of maternal near miss was hypertensive disorders (62.7%), many of which were complicated by HELLP syndrome (41.2%). The laboratory near miss criteria were the most often observed (59.6%), due mainly to the high frequency of acute thrombocytopenia (32.5%) [11].

Based on cross-sectional study severe maternal morbidity and near misses in tertiary hospitals, Kelantan, Malaysia in 2014, Hemorrhagic disorders were the most common event for severe maternal morbidity (68.6 %) and maternal near miss (80.9 %) and management-based criteria accounted for 85.1 % [12].

Based on Cross sectional study in four hospitals in two districts in Banten province, Indonesia to identify the numbers and causes of near miss and death between November 2003 and October 2004, Hemorrhage and hypertensive diseases were the

most common diagnoses associated with near miss, and vascular dysfunction was the most common criterion of organ dysfunction[14].

Based on Cross sectional study of all women admitted to the tertiary care University Hospital in Kigali, Rwanda with severe maternal morbidity and mortality from October 2011 until October 2012, The majority of severe obstetric morbidity and mortalities resulted from sepsis/peritonitis (30.2 %) primarily following caesarean deliveries, hypertensive disease (28.6 %), and hemorrhage (19.3 %).

Based on cross sectional study of maternal near-miss cases in major public hospitals in Egypt, Lebanon, Palestine and Syria on maternal near-miss cases in the four contexts beginning in 2011, Hemorrhage-related complications were the most frequent conditions among maternal near-miss cases. Coagulation dysfunctions (76.1 %) were the most prevalent dysfunction among maternal near-miss cases, followed by cardiovascular dysfunctions [16].

Based on cross sectional study conducted on maternal near miss and mortality at a rural tertiary centre in southern Nigeria from September 2014 to August 2015 in Madonna University Teaching Hospital Elele, Rivers State, Nigeria, Abortive outcome was the leading cause of maternal mortality. Severe maternal outcome ratio was 218/1000 and maternal near miss incidence ratio was 198/1000. Hypertensive disorders of pregnancy contributed 16(28.1%) of the 57 cases with severe maternal outcome while Obstetrics hemorrhage and abortive outcome each contributed 14(24.6%) and 6(10.5%) respectively [17].

Based on research done on Magnitude and pattern of maternal near-miss cases admitted to Women's Health Hospital, Assiut University, Main direct obstetric causes of MNM were hypertensive disorders of pregnancy (49.8%), obstetric hemorrhage (38.3%) and dystocia (32.5%). On the other hand, cardiovascular disorder was the most prevalent non obstetric cause among MNM cases (48.8%). The peak frequency of the cases occurred during the summer season [18].

Based on research on facility-based cross-sectional study conducted in five selected public hospitals of Addis Ababa, Ethiopia from May1, 2015 to April30, 2016, The underlying causes of the majority of maternal near-miss cases were hypertensive disorders and obstetric hemorrhage. Anemia was the major contributing cause reported for maternal near-miss. [9].

Based on research done on assessment of maternal near miss at Debre Markos hospital from 1st January 2008 to 30 December 2012, the most common types of near miss events were obstructed labor and hemorrhage[10].

Based on case-control facility based study done on Determinants of maternal near miss among women in six public hospital maternity wards in Tigray Region, Northern Ethiopia, from January30-March30, 2016, severe obstetric hemorrhage (44.7%), hypertensive disorders (38.8%), dystocia (17.5%), sepsis (9.7%) and severe anemia (2.9%) were leading causes of MNM. [20].

3. Objective of the study

3.1 General objective

- To assess magnitude and contributing factors of maternal near miss among mothers admitted to OBGYN department of saint Paul's hospital millennium medical college from july1, 2017- December 31, 2017.

3.2 Specific objectives

- To assess magnitude of maternal near miss among mothers admitted to OBGYN department of saint Paul's hospital millennium medical college from july1, 2017- December 31, 2017.
- To assess contributing factors of maternal near miss among mothers admitted to OBGYN department admitted of saint Paul's hospital millennium medical college from july1, 2017- December 31, 2017.

4. Methodology

4.1. Study Area

This study was carried out in St Paul's hospital millennium medical college OBGYN department. Addis Ababa is the capital city of Ethiopia. Addis Ababa lies at elevation of 2,200metres, located at 9degree 1'48"N38degree44'24"E. The city is divided into 10 sub cities and 99 kebeles. St Paul's hospital millennium medical college is found in gullele sub city, 2km from piazza. St. Paul's Hospital Millennium Medical College is the largest referral hospital in Addis Ababa under the Ethiopian Federal Ministry of Health (FMOH). It is the second largest public hospital in the nation, built by the Emperor Haile Selassie in 1961 with the help of the German Evangelical Church. The hospital was established to serve the economically under privileged population, providing services free of charge to about 75% of its patients. In 2007, it became a medical college and its core services include the provision of medical care, teaching and research. It has new integrated curriculum stands out in comparison to the country's other medical schools. The OBGYN department is one of the older departments in the hospital to meet the United Nation's Millennium Development Goals and sustainable developmental goals. OBGYN residency training program at St. Paul Hospital Millennium Medical College (SPHMMC) in Addis Ababa, Ethiopia was launched on July 1st, 2012. The department has regular OPD, Emergency gynecology OPD, ANC follow up clinic, labor ward and maternity ward, gynecology ward, procedure room and Michu clinic.

4.2 Study Design and Period

A retrospective hospital based descriptive cross sectional study was carried out to determine magnitude and causes of maternal near miss among admitted mothers at OBGYN department over six months from july1, 2017- december31, 2017. Information from medical records of mothers that are admitted to OBGYN of SPHMMC over the six months period from july1, 2017-december 31, 2017 were reviewed.

4.3. Population

4.3.1 Source Population

Mothers who were admitted to OBGYN department of SPHMMC for any pregnancy related health services during pregnancy, childbirth, or within 42days of termination of pregnancy.

4.3.2. Study Population

Mothers who were admitted to OBGYN department of SPHMMC over the six months period from july1, 2017 -December 1, 2017 for any pregnancy related health services during pregnancy, childbirth, or within 42days of termination of pregnancy.

INCLUSION CRITERIA

- Record's of all mothers who were admitted to OBGYN department of SPHMMC for any pregnancy related health services over the six months

period from July 1, 2017- December 1, 2017 who fulfill operational definition of the study.

EXCLUSION CRITERIA

- Incomplete records in which important variables were not recorded
- Maternal near miss complications due to accidental or incidental causes

4.5. Variables

Dependent variables

- maternal near miss event

Independent variables

- age
- gravidity
- parity
- ANC follow up
- condition at arrival

4.6 Sample Size Determination and Sampling

Sample size

All admitted mothers who fulfill operational definition of the study during study period were included

Sampling technique

All records of admitted mothers were selected from the HMIS and studied. The first card in the HMIS of admitted mothers who fulfill operational definition of the study on July 1, 2017 were taken as the first sample.

4.7. Operational Definitions

- Maternal near miss is defined as a woman who nearly died but survived a complication that occurred during pregnancy, childbirth, or within 42 days of termination of pregnancy. The following are maternal near miss criteria operational definition for this study based on WHO definition criteria and adaptation of WHO MNM for sub-Saharan Africa and who fulfilled at least one of the conditions:-
 - Acute severe azotemia- creatinine $\geq 300 \mu\text{mol/l}$ or $\geq 3.5 \text{ mg/dl}$.
 - Oliguria $< 30 \text{ ml/hr}$ non-responsive to fluids or diuretics
 - Dialysis for acute renal failure
 - Cardiac arrest or Cardiopulmonary resuscitation
 - A persistent systolic blood pressure $< 90 \text{ mmHg}$ with a pulse rate at least 120 bpm despite aggressive fluid management $> 2 \text{ L}$.
 - The continuous use of any dose of dopamine, epinephrine or norepinephrine
 - Intubation and ventilation not related anesthesia
 - Severe bradypnea [Respiratory rate less than six breaths per minute].
 - Severe tachypnea [Respiratory rate of more than 40 breaths per minute].
 - Pulmonary edema

- Prolonged unconsciousness (Glasgow coma Scale <10)>12hrs
- Refractory, persistent convulsions, Status epilepticus
- Eclampsia
- The complete or partial paralysis of both sides of the body
- Severe acute hyper bilirubinemia (bilirubin>100umol/L or >6.0mg/dL)
- Severe acute thrombocytopenia [platelets in the blood to <50 000 platelets/ml].
- Massive transfusion [transfusion of ≥2 units of blood or red blood cells].
- Prolonged prothrombin time (>6s, PT 1.5 times normal)
- Hysterectomy following infection or hemorrhage
- Uterine rupture
- Severe malaria
- Sepsis
- Septic incomplete abortion
- Complicated gestational trophoblastic disease with anaemia
- Laparotomy other than caesarian section
- Admission to Intensive Care Unit

4.8. Data Collection Procedure

Data collection tool: Data were collected by retrospective chart review by investigator and fourth year medical students. Records for all pregnant and within 42days of postpartum mothers who were admitted to OBGYN department of SPHMMC during the study period were reviewed. A checklist was used to identify patient information ([Annex 2](#)).

Methods of data collection: The data were collected by the data collectors at the hospital record room using the checklist.

4.9. Data Quality Management

We processed the data by first Checking of gathered data for utility and completeness.

4.10. Data Processing and Analysis

We managed data by proper entry in to our spread sheet. Analysis subsequently was done with Statistical Package by Social Sciences (SPSS) version 20. Descriptive statistics such as frequency and graphics were calculated for dependent and independent variables.

4.11. Ethical Consideration

Ethical clearance was obtained from the public health department of the college. Permission was also obtained to review the records from HMIS unit. Information from patient's document was not used for other purposes.

5. Result

5.1. Socio-demographic characteristics of study participants

The age of the mothers was between 16 and 45 years, with a mean of 27.46 ± 6.164 years and the median age is 26. Majority of mothers (37.4%) are aged between 25 and 29 while 25.8% are mothers of age between 20 and 24 (figure 1). 92.3% of mothers are married and 3.9% of them are divorced. Most of mothers are from Oromia region (76.8%) and 18.3% from Addis Ababa. Muslims constitute (36.8%) of mothers and followed by protestant (30.3%) (table 1).

Table 1: socio demographic characteristics of study participants at obstetrics and gynecology department, SPHMMC, from july1-december 31, 2017 GC

Variables		Frequency	Percent
marital status	Married	143	93.3
	Divorced	6	3.9
	Others	6	3.9
Place of residency	Out of Addis Ababa	127	81.7
	Addis Ababa	28	18.3
Religion	Muslim	57	36.8
	Protestant	47	30.3
	Orthodox	32	20.6
	Other	8	5.2
	Not documented	11	7.1

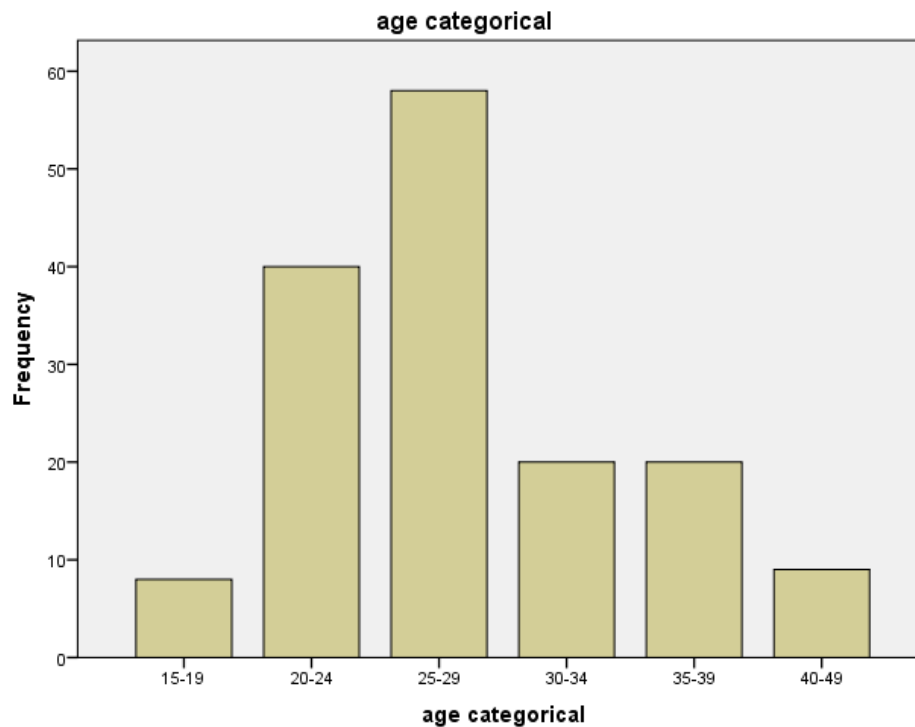


Figure 1

5.2. Obstetrics characteristics of study participants

With respect to obstetric history, 28.4% of patients were primigravid, 14.8% had a history of abortion, and 5.8% had a history of previous C/S. An analysis of ANC follow up revealed that 32.9% women did not attend ANC follow up. SVD and C/S was the main delivery method, with 40.6% and 35.5% respectively. 39.4% of mother do not remember last menstrual period and 31% come after delivery or abortion to the hospital. (Table 2) Mean length of hospital stay of hospital stay is 9.32 days, with minimum stay of 2 days and maximum stay of 63 days.

Table 2: Obstetric characteristics of study participants at OBGYN department, SPHMMC, from July 1-December 31, 2017 GC

Variables		Frequency	Percent
Mode of delivery	SVD	63	40.6
	C/S	55	35.5
	Vacuum/curettege	12	7.7
	Instrumental delivery	11	7.1
	Others	11	7.1
	Women discharged pregnant	2	1.3
condition at arrival	Pregnant	103	66.4
	come after delivery or abortion	48	31
	Others	4	2.6
Referral process	Referred from other health facility	141	91.0
	Come by her self	12	7.7
	Referred to higher health facility	3	1.3
Vital status of neonate	Alive	95	61.3
	Dead	42	27.1
	Abortion/ectopic	16	10.4
	Women discharged pregnant	2	1.6

5.3. Magnitude of maternal near miss

During the six month period, a total of 155 maternal near-miss cases and 4869 live births were reported in total, which produced a total maternal near miss ratio of 31.83 per 1000 live births and Severe Maternal Outcome Ratio (SMOR) of 34.7 per 1000 live births. Maternal near-miss mortality ratio (MNM: MD) of this study become 11.1 and Mortality index is 8.3%.

5.4. Underlying contributory factors of maternal near-miss

The underlying cause for the majority of maternal near-miss cases was hypertensive disorder (34.8%), followed by obstetric haemorrhage (18.7%), pregnancy with abortive outcome (11.6%), and pregnancy related infections (1.9%).

Table 3: Organ dysfunction and underlying causes of MNM of study participants at OBGYN department, SPHMMC, from July 1-December 31, 2017 GC

Variables		Frequency	Percent
Organ dysfunction	Cardiovascular	99	63.9
	Neurology	50	32.3
	Uterine	20	12.9
	Respiratory	16	10.3
	Renal	14	9.03
	Coagulation	11	7.1
	Hepatic	8	5.2
Causes	PIH	56	34.8
	Obstetrics hemmorrhage	29	18.7
	PIH and Obstetrics hemmorrhage	28	18.1
	Other	21	13.5
	pregnancy with abortive outcome	18	11.6
	Pregnancy related infections (1.9%).	3	1.9

The major contributing causes of maternal near-miss reported were anaemia (45.8%) followed by prolonged/obstructed labour (6.5%). Around 34.2% of maternal near-miss cases did not have identified contributing causes.

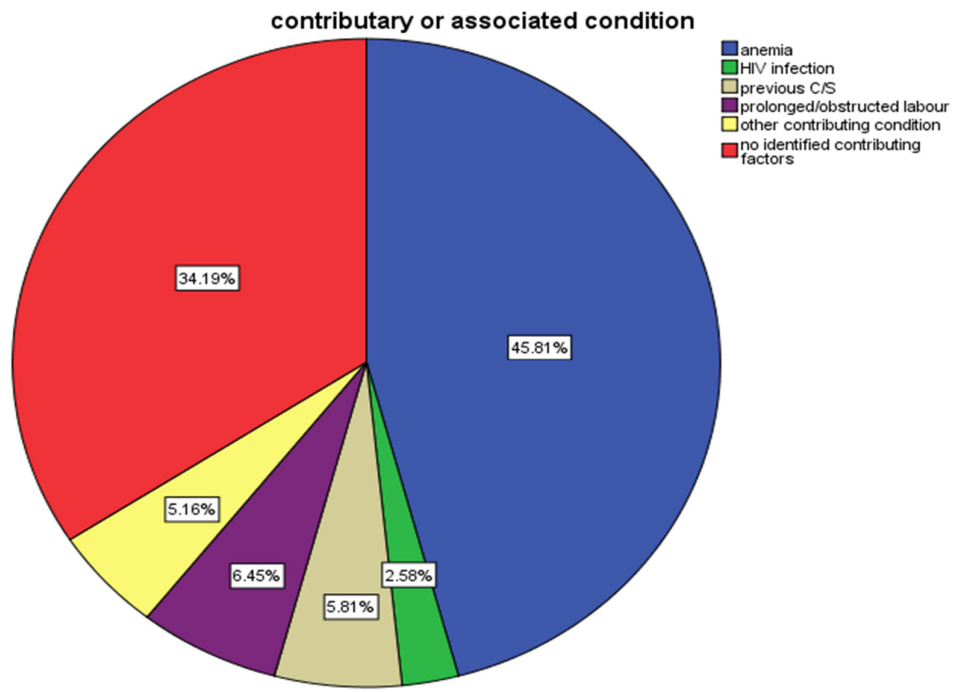


Figure 2: Contributory and associated condition of MNM of study participants at OBGYN department, SPHMMC, from july1-december 31, 2017 GC

6. Discussion

During the six month period, maternal near miss ratio was 31.83 per 1000 live births. The underlying cause for the majority of maternal near-miss cases was hypertensive disorder (34.8%), followed by obstetric haemorrhage (18.7%), pregnancy with abortive outcome (11.6%), and pregnancy related infections (1.9%).

Magnitude of maternal near-miss

During the six months period of the study, the magnitude of maternal near-miss was 31.83 per 1000 live births. Previous studies in Ethiopia have documented a prevalence rate of 8.01 per 1000 delivery [9], 29.7 per 1000 deliveries [10] and 23.3 per 1000 live births [18]. Our finding is considerably higher than that given in previous three reports and the observed variation could be a result of disparity in the case definitions used by the researchers, the study design used, and the time at which the study was conducted. We used the newly developed WHO criteria and adaptation of WHO MNM for sub-Saharan Africa. However, previous studies used only WHO criteria on the first study and disease-based criteria on the later two studies and the follow-up time used by the WHO to define Maternal near-miss has a duration of 42 days postpartum; However, follow up time was limited to only the length of the hospital stay which might have caused to underestimate the magnitude of maternal near-miss in previous study. The magnitude was also higher than some other African countries such as Malaysia, Egypt, Rwanda, Indonesia and southern Nigeria for same reason [12,13, 14, 15, 16].

Contributing factors of maternal near miss

The leading underlying contributing cause of maternal near-miss in our study was hypertensive disorder (eclampsia and pre-eclampsia), followed by obstetric hemorrhage. When we compare this finding with most studies from high and middle-income countries and other African countries results are comparable [11, 14, 17, 18, 19]. A previous study in Ethiopia also reported hypertensive disorder as the leading cause, and obstetric hemorrhage as the second leading cause of maternal near-miss [9, 10, 13]. High percentages of hypertensive disorder and obstetric hemorrhage might be indicative of some form of delay in managing obstetric complications. Pregnancy with abortive outcome and Pregnancy-related infection was the least mentioned cause of maternal near-miss in our study and was also reported to be the least likely cause in most of the studies completed in developed countries, some of the other African countries and on previous study in Ethiopia [9, 15, and 17].

Anemia was the major contributory cause of maternal near-miss in our study. The study finding was also in line with studies conducted in Ethiopia and other countries such as Ghana [9, 20]. Hence, there is a need to deeply assess the causes of anemia in women with a maternal near miss case to determine the most appropriate action.

Limitation of the study

However, our study had certain limitations. The major limitation of the present study is that because study was based on chart review some relevant variables were not registered in the chart. Moreover, the study has confined itself in only one referral hospital. The other limitation of the study was that our study was carried out only in public hospital. Hence, it does not represent cases of maternal near-miss that occur in private health facilities.

7. Conclusion

The study demonstrated a higher maternal near-miss incidence ratio compared to previous studies. Underlying contributing factors of maternal near-miss are hypertensive disorder of pregnancy followed by obstetrics hemorrhages. Anemia is the most contributing factor.

8. Recommendation

Obstetrician and gynecologist and other health professional

Evidence based interventions designed to optimize management during pregnancy, intra partum and postpartum life threatening obstetric complications, specifically hypertensive disorders and obstetric hemorrhage could reduce the occurrence of maternal near-miss problems. Contributing factors such as anemia should be treated early during follow up based on causes.

Health policy makers

This effort needs to continue in a sustainable manner to avoid preventable causes of severe maternal outcomes in Ethiopia. Work should be continued to educate women and providers about common causes and associated factors of MNM. These efforts should be carried out at the health facility, community, and at individual levels.

Researchers

Causes and contributing factors associated with maternal near should be further studied.

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ANNEX 1: Table 4: WHO MATERNAL NEAR MISS DEFINITION CRITERIA

Acute severe azotemia	creatinine $\geq 300 \mu\text{mol/l}$ or $\geq 3.5 \text{ mg/dl}$.
Cardiac arrest	Sudden absence of pulse and loss of consciousness.
Cardiopulmonary resuscitation	A set of emergency procedures including chest compressions and lung ventilation applied in cardiac arrest victims.
Failure to form clots	The clinical inability to form clots/disseminated intravascular coagulation. Clinically, absence of clotting from the IV site or suture after 7–10 minutes. It can be assessed by the bedside clotting test (failure of a clot to form after 7 minutes or a soft clot that breaks down easily suggest coagulopathy) or other laboratory tests (acute thrombocytopenia ($<50\,000$ platelets), low fibrinogen ($<100 \text{ mg/dl}$), prolonged prothrombin time ($>6\text{s}$, PT 1.5 times normal), or elevated D-dimer ($>1000 \text{ ng/ml}$)). The bedside clotting test is a clinical test to assess the clotting status (Instructions: (1) Take 2 ml of venous blood into a small, dry, clean, plain glass test-tube (approximately $10 \text{ mm} \times 75 \text{ mm}$); (2) Hold the tube in your closed fist to keep it warm ($+37^\circ\text{C}$); (3) After 4 minutes, tip the tube slowly to see if a clot is forming. Then tip it again every minute until the blood clots and the tube can be turned upside down; (4) Failure of a clot to form after 7 minutes or a soft clot that breaks down easily suggests coagulopathy).
Gasping	A terminal respiratory pattern. The breath is convulsively and audibly caught.
Hysterectomy	In the maternal near-miss context, surgical removal of the uterus following infection or haemorrhage.
Life-threatening condition	A severe health condition usually associated with organ dysfunction. In the maternal near-miss context, a condition that can only result in a near-miss case or in a maternal death.
Massive transfusion	Transfusion of considerable amount of blood or red cells, i.e. transfusion of ≥ 5 units of blood or red blood cells.
Maternal near-miss	A woman who nearly died but survived a complication that occurred during pregnancy, childbirth or postpartum up to 42 days
Metabolic coma	loss of consciousness and the presence of glucose plus ketoacids in urine.
Oliguria non-responsive to fluids or diuretics	A urinary output $<30 \text{ ml/h}$ for 4 hours or $<400 \text{ ml/24 h}$ non-responsive to fluids or diuretics.
Prolonged unconsciousness	Any loss of consciousness lasting more than 12 hours, involving complete or almost complete lack of responsiveness to external stimuli. A state compatible with Coma Glasgow Scale <10 .
Severe acidosis	a blood pH <7.1 .
Severe acute hyperbilirubinemia	Bilirubin $>100 \mu\text{mol/l}$ or $>6.0 \text{ mg/dl}$.
Severe acute thrombocytopenia	An acute reduction in the number of platelets in the blood to $<50\,000$ platelets/ml.
Severe bradypnea	Respiratory rate less than six breaths per minute.
Severe hypoperfusion	Lactate $>5 \text{ mmol/l}$ or 45 mg/dl .

Severe hypoxemia	Oxygen saturation <90% for ≥60 minutes or $\text{PaO}_2/\text{FiO}_2 < 200$. The $\text{PaO}_2/\text{FiO}_2$ index is the relation between the arterial oxygen saturation (PaO_2) and the fraction of inspired oxygen (FiO_2). Arterial oxygen saturation is determined by performing an arterial blood gasometry. The inspired oxygen fraction may vary according with patient need and should be recorded at the moment of blood collection for the gasometry. It can be precise (for instance during mechanical ventilation, 0.21–1.00) or estimated (without oxygen supplementation, 0.21–0.25; oxygen nasal catheter, 0.25; facial oxygen mask, 0.25–1.0).
Severe tachypnea	Respiratory rate of more than 40 breaths per minute.
Shock	A persistent systolic blood pressure <80 mmHg or a persistent systolic blood pressure <90 mmHg with a pulse rate at least 120 bpm.
Total paralysis	The complete or partial paralysis of both sides of the body. Usually, an extreme neuromuscular global weakness associated with critical illness. This condition is also known as critical illness polyneuromyopathy.
Uncontrollable fit	Refractory, persistent convulsions. Status epilepticus.
Use of continuous vasoactive drugs	The continuous use of any dose of dopamine, epinephrine or norepinephrine. In the context of vasoactive drugs infusion, continuous refers to the uninterrupted infusion of a solution containing a vasoactive drug. It is opposed to the intermittent or in bolus injection of a vasoactive drug.

ANNEX 2: DATA ABSTRACTION FORM FOR ASSESING MAGNITUDE AND CAUSES OF MATERNAL NEAR MISS AMONG MOTHERS ADMITTED TO OBGYN DEPARTMENT OF SPHHMMC FROM JULY1, 2017 -DECEMBER31, 2017

A. PERSONAL IDENTIFICATIONS

1. Questionnaire number
2. hospital number
3. Age..... (years)
4. Place of residence
 1. Region
 2. Woredas.....
5. Religion
6. Marital status
 1. Married 2. Divorced 3. Widowed 4. Single

B. OBSTETRIC CHARACTERISTICS

1. Gravidity.....
2. Parity.....
3. Abortion.....
4. Gestational age in weeks.....
5. ANC follow up
 1. yes
 2. no

C. CONDITIONS AT ARRIVAL

1. Delivery or abortion occurred before arrival at home
2. Delivery or abortion occurred before arrival at health facility
3. Laparotomy done in other hospital before arrival
4. pregnant

D. THE REFERRAL PROCESS

1. Woman referred from other health facility
2. come by herself
3. Woman referred to higher health facility

E. maternal near miss criteria

No	maternal near miss criteria	yes	no
1	Acute severe azotemia- creatinine $\geq 300 \mu\text{mol/l}$ or $\geq 3.5 \text{ mg/dl}$		
2	Oliguria $< 30 \text{ ml/hr}$ non-responsive to fluids or diuretics		
3	Dialysis for acute renal failure		
4	Cardiac arrest or Cardiopulmonary resuscitation		
5	A persistent systolic blood pressure $< 80 \text{ mmHg}$ or a persistent systolic blood pressure $< 90 \text{ mmHg}$ with a pulse rate at least 120 bpm despite aggressive fluid management $> 2 \text{ L}$		
7	The continuous use of any dose of dopamine, epinephrine or norepinephrine		
8	Intubation and ventilation not related anesthesia		
9	Severe bradypnea [Respiratory rate less than six breaths per minute] or Severe tachypnea [Respiratory rate of more than 40 breaths per minute]		
10	Pulmonary edema		
11	Prolonged unconsciousness (Glasgow coma Scale < 10) $> 12 \text{ hrs}$		
12	Refractory, persistent convulsions, Status epilepticus		
13	Eclampsia		
14	The complete or partial paralysis of both sides of the body		
15	Severe acute hyper bilirubinemia (bilirubin $> 100 \mu\text{mol/L}$ or $> 6.0 \text{ mg/dL}$)		
16	Severe acute thrombocytopenia [platelets in the blood to $< 50\,000$ platelets/ml]		
17	Massive transfusion [transfusion of ≥ 2 units of blood or red blood cells]		
18	Prolonged prothrombin time ($> 6 \text{ s}$, PT 1.5 times normal)		
19	Hysterectomy following infection or hemorrhage		
20	Uterine rupture		
21	Severe malaria		
22	Sepsis		
23	septic incomplete abortion		
24	complicated gestational trophoblastic disease with anaemia		
25	Laparotomy other than caesarian section		
26	Admission to Intensive Care Unit		

F. UNDERLYING CAUSES OF NEAR MISS

1. Pregnancy with abortive outcome (abortion/ectopic pregnancy,GTD)
2. Obstetric haemorrhage a. APH b. PPH
3. Hypertensive disorders
4. Pregnancy-related infection
5. Other obstetric disease or complication
6. Medical/surgical/mental disease or complication
7. Unanticipated complications of management
8. Coincidental conditions
9. Unknown

G. CONTRIBUTORY / ASSOCIATED CONDITION

1. Anaemia
2. HIV infection
3. Previous caesarean section
4. Prolonged/obstructed labour
5. others
6. not identified

H. Final mode of delivery / end of pregnancy

1. Vaginal Delivery (SVD)
2. Instrumental delivery
3. Caesarean section
4. Complete abortion
5. Curettage / vacuum
6. Medical methods for uterine evacuation
7. Laparotomy for ectopic pregnancy
8. Laparotomy for ruptured uterus
9. Women discharged still pregnant
10. Unknown/ other

I. Vital status of the neonate 1=Alive 2=Dead 3=other

J. Length of hospital stay.....

K. Total number of live birth.....