



**QUALITY OF MATERNAL HEALTH CARE AND FACTORS
ASSOCIATED WITH MATERNAL DEATH AT JIMMA
UNIVERSITY MEDICAL CENTER, SOUTH WEST ETHIOPIA
A RETROSPECTIVE STUDY USING NEAR-MISS APPROACH**

By:

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**A RESEARCH PAPER TO BE SUBMITTED TO JIMMA
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OF PUBLIC HEALTH, DEPARTMENT OF POPULATION AND
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Jimma, Ethiopia

JIMMA UNIVERSITY, INSTITUTE OF HEALTH

FACULTY OF PUBLIC HEALTH

DEPARTMENT OF POPULATION AND FAMILY HEALTH

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Abstract

Background: *“Poor quality of maternal health care becomes a paramount roadblock to end preventable maternal mortality and morbidity worldwide. Thus, maternal mortality is a significant public health problem with high burden in developing countries such as Ethiopia. Thus, world health organization recommended quality of maternal health care should be evaluated with certain maternal near miss indicators as it is better than using maternal mortality alone for designing, monitoring, follow up and evaluation of quality of maternal health care*

Objective: *To assess quality of maternal health care and factors associated with maternal death at Jima University Medical Center using near-miss approach from January 1/2017 to December 30/2017*

Methods: *Facility based retrospective cohort study was conducted from March to April 2018. All individual records in Obstetrics and gynecology department from January 1/2017 to December 30/2017 included. Data were extracted using structured checklist adopted from tool validate in sub Saharan Africa and entered in to Epi Data version 3.1 and then analyzed using SPSS version 21. Descriptive statistics and maternal near miss indexes were computed. Logistic regressions analysis was done to assess factors associated with maternal death. Results are presented using narration, tables, figures and graphs.*

Results: *3835 records reviewed of which 400(10.43%) were near miss. Maternal near miss ratio was 107:7 whereas Mortality index was 6.54% and mortality rate 0.73%. For all 150(25.09%) near misses with hypertensive disorders either magnesium sulfate or other anti-convalescent was given. 89.1% of sepsis treated with parenteral antibiotics and Prophylactic antibiotics given for 93.8% before cesarean section. Laparotomy was done for 80.36% of uterine rupture within three hours of arrival. Prophylactic antibiotics (AOR 0.1, CI= 0.02-0.5), shock (AOR 9.9, CI=2.29-42.81) and severe pre-eclampsia(AO 7.3, CI=1.49-35.87) associated with maternal death.*

Conclusion: *Low mortality index (<20%), maternal mortality rate (<5%), higher Maternal near miss ratio and first line drug given for all hypertensive disorders show good quality maternal health care. But, parenteral antibiotics for infection, prophylactics for caesarean delivery and laparotomy for ruptured uterus within 3 hours of arrival done <95% shows poor maternal health care quality. Thus, case management process needs upgrading of the services at study institution.*

Key words: *Retrospective study, health care quality, maternal health care, maternal near miss*

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Abbreviations and Acronyms

EDHS -	Ethiopia demographic and health survey
JUMC –	Jimma University Medical Center
LB –	Live birth
MD –	Maternal death
MDG -	Millennium development goal
MI –	Mortality index
MMR -	Maternal mortality ratio
MNM –	Maternal near miss
MNMR –	Maternal near miss mortality ratio
NMMR –	Near miss mortality ratio
SDG –	Sustainable development goal
QoMHS -	Quality of maternal health service
SMOR –	Sever maternal outcome ratio
SB -	Still birth
WHO –	World health organization

Chapter One

1.1 Introduction

Maternal health care services are health services that encompass antenatal care (ANC) services, delivery care services and postnatal care (PNC) services. In the availability of right information it is possible to avoid maternal mortality even in resource-poor countries. In addition to the level of maternal mortality it is important to understand the underlying factors that led to the deaths as each maternal death or case of life-threatening complication has a story to tell and can provide indications on practical ways of addressing the problem (1,2).

Being unaccomplished goal of the millennium development goal (MDG) in many countries including Ethiopia, reducing maternal mortality remains as the heart point of sustainable development goal (SDG) which targeted at reducing maternal mortality ratio below 70 /100,000 births with no country having a maternal mortality rate more than twice of the global average (3). Accordingly, maternal mortality is a current significant public health problem with especial concern in developing countries such as Ethiopia. According to the Global Health Observatory data, around 830 women died every day in 2015 from pregnancy and child birth related complications of which almost all of these deaths occurred in low-resource settings regardless of most of the causes are preventable. Among these 830 of maternal daily deaths 550 occurred in sub-Saharan Africa (4).

World Health Statistics 2014 reveals that, maternal mortality ratio (MMR) is 210 and 500 per 100,000 live births globally and in Africa respectively. From this report, the ratio is 17 maternal deaths per 100,000 live births in Europe. According to this data, 30 maternal deaths occur in in Africa for 1 death occurred in developed country. Specific to Ethiopia, maternal mortality ratio is 420 per 100,000 live births from this statistical data report (5).

Quality of maternal health care is “the degree to which maternal health services increases the likelihood of timely and appropriate treatment for the purpose of achieving desired outcomes that are both consistent with current professional knowledge and uphold basic reproductive rights”.

So far in the past, it was tried to focus on the four pillars (family planning and access to other reproductive health services, skilled care during pregnancy and delivery and postnatal care for mothers as a supporting strategies to achieve MDG4 and reduce maternal death. Even though it remained un successful, during that time quality of care was a crucial requirement for all of these four ‘pillars ideally (6).

Reduction in maternal mortality has traditionally been used as a critical measure of progress in improving maternal health care services (7). However, maternal death is as the tip of the iceberg and maternal morbidity as the base everywhere on the world. So far study in West Africa indicates that, “for every woman who dies of pregnancy-related causes, 20 to 30 others women experience acute or chronic morbidity, often with permanent sequel that undermine their normal functioning” (8). This shows the importance of further study and intervention on the area of maternal health is unquestionable and mandatory. Using this innovative approach, i.e. maternal near-miss is a good alternative way to evaluate and improve the quality of maternal health care.

The concept of near miss approach was developed on the assumption that, severe complications that women develop during pregnancy are almost similar in pathological and circumstantial factors at everywhere and all maternal deaths involve at least one similar life-threatening condition. Some women with severe pregnancy complication escape death while others die from similar cause because of reasons related to service provided and/or others conditions. This in turn implies that, the causes for maternal near miss and maternal death are similar. Consequently, assessing and addressing the causes of maternal near miss is taken as complimentary approach to investing on the causes of maternal death (9).

Maternal near miss cases can be selected based on World Health Organization criteria. Those criteria are disease specific related (severe complications), organ dysfunction (life threatening conditions) and/or management-based method (10). Severe maternal complications/potentially life-threatening conditions which can happen during pregnancy, child birth and postpartum period can be used for identification of eligible cases (9). Maternal near-miss is ample opportunity to address maternal health problem other than mortality and as well as mortality. For this fact, it is better to conduct this study using the recommended WHO tool. Accordingly, the

main objective of this study was to assess the quality of maternal health care and factors associated with maternal death at Jimma University Specialized Hospital using a near-miss approach retrospectively.

1.2. Statement of the problem

World health organization 2015 reported, at the end of MDG, “poor quality of care (QoC) in many facilities becomes a paramount roadblock in our quest to end preventable maternal mortality and morbidity” (11). Furthermore, UNICEF in its “Innovative Approaches to Maternal and Newborn Health working paper” 2013 shows, in most of the developing countries, maternal health care services are poor (12).

In five African countries 2013 more than 40% of facility deliveries occurred in primary care facilities where basic measures of maternal care quality used for assessment have scored poorly. In three of these countries (Burkina Faso, Ghana and Tanzania) quality of ANC and deliver care is satisfactory (13). In Ethiopia, quality of service in managing obstetric complication (especially, the management of pre-eclampsia and eclampsia) 2013 is poor, mortality is high and it needs scaling up of the enabling environment and supply quality at national level (12, 14, 15). In Arba Minch district public health facilities, delivery care service is deprived due to shortage of rooms and human resource, basic medical equipment, drugs and supplies (16).

Poor quality of maternal health care is counted as among the main bottleneck to achieve the desired MDG. Quite the reverse, good quality care is crucial to save life of women who face severe pregnancy complications and working through the process will create a new agenda for change, which focuses on improving the quality of the health system (17). As a result of poor quality maternal health care services, maternal mortality remains as a world health problem. In Ethiopia regardless of the great effort done by government to improve obstetric service with the aim of reducing maternal mortality, mortality ratio remains high even at the end of MDG. According to the Ethiopian demographic and health survey (EDHS) 2016 report the estimate maternal mortality ratio is 412 deaths per 100,000 live births (14).

Consequently, it is important to focus on quality of services that provided for women with severe pregnancy complication which can result in maternal death to save their life and decrease maternal mortality. Maternal near miss approach is best for assessment of base line information, situational assessment and health intervention for improvement (10).

Chapter Two

2. Literature Review

2.1. Quality of Maternal Health Care Services

Quality is not easy to measure/define and although there is no universally accepted definition of quality care (18). To say maternal health care is quality care it should be effective, efficient, accessible, acceptable/patient-centered, equitable and safe as defined by WHO. Now days we should focus on promoting quality in health system for at least two reasons. In well-developed health systems, quality remains a serious concern as expected outcomes not predictably achieved and there are wide variations in standards of health-care delivery within and between health-care systems. On the other hand, in developing countries where health system needs to optimize resource use and expand population coverage, the process of improvement and scaling up needs to be based on sound local strategies for quality so that the best possible results are achieved from new investment(19).

Despite these facts, quality of maternal health care service is poor in major parts of developing countries. In Sub-Saharan African countries (Kenya, Namibia, Rwanda, Tanzania, and Uganda) 2016 the overall quality of basic maternal health care function score is low (a mean of 0.42) with poorer quality in primary health care facilities (mean= 0.38) than in secondary health care settings (mean= 0.77) (13). In Kenya 2017 QoMHS is deprived with worsen quality in ANC and deliver care scoring in average 0.52/1 and 0.58/1 respectively. They have 0.68/1 quality level in average for structural inputs for maternal health care service. Only 17% of Kenyan total populations have access to adequate quality maternal health care services (20).

As other study incorporating the three Sub-Saharan African countries (Ethiopia, Tanzania and Uganda) 2015 shows only facility settings serving for few catchment populations have better quality of services. High access to maternal health service is coupled with receiving low quality of the services. None of the hospitals included in the study meet the United Nation's (UN) standard of one comprehensive emergency obstetric care (CEmOC) (21).

In Ethiopia quality of maternal health care had been evaluated formerly by few studies using other methods than MNM approach. Most of the studies reported that the overall quality of maternal health care is poor and needs to take important intervention. Research conducted in Gamo Gofa 2017 concluded that quality of delivery service is poor at public health facilities. According to this study the overall quality of delivery care was 54.06%. Only 5/9 facilities included in the study fulfill more than or equals to 80% (the cut point the researcher used to say good quality) of the minimum standard for equipment and 2/9 public health facilities practice the minimum components of infection prevention practice (16).

Similarly, only 6.25% of the total 32 study facilities have good quality in input, process and output components on delivery services in health facilities, Northern Parts of Ethiopia 2017. From those 32 facilities, 18.75% of them are not rated as providing/having good quality in any of the three quality assessment components (input, process and output). As per the criteria they used 75% or above, to classify the facility as providing standard quality of delivery care or not 21 out of 32 (65.62%) facilities fulfill the criteria (15). There is single study conducted at Sub-Saharan level including Ethiopia 2015 that shows one hospital in Ethiopia (Waliso Hospital) have highest average quality score of 2.3/3(21).

2.2. Maternal near miss

World health organization initiated to develop new approach called maternal near miss which become popular and is better in assessing and improving quality of maternal health services (10). This approach avoids variation in classification of underlying causes of maternal death and creates consistency in case identification. It helps to measure and evaluate health care system quality using some of the indicators (22).

World systematic review 2012 reveals approximately 1% and around 0.25% of the women experienced a near-miss event before, during or after delivery in developing and developed countries respectively. In developed world the ratio of maternal mortality ratio (MMR) to near miss maternal mortality ratio (NMMR) is 1:117-223, whereas it is 1:11.20 in Africa and other developing world which shows low quality of the service. Data from a systematic review of 46

countries in the world demonstrate that the prevalence of near miss case varies from 0.04 to 14.98 %, with higher rates in lower income regions, Africa and Asia. The rate ranges between 2.10 and 4.43% in low-income and middle-income countries and 0.09 and 1.38% in higher-income countries (24). MNMR and mortality index for near miss (MI) in Asia is 21.5 per 1000 and 27.8% respectively which is relatively high compared to other countries (25).

In West Africa the high case fatality rates of several complications of maternal near miss reflects a poor quality of obstetric care. The major direct causes of severe maternal morbidity in this area were hemorrhage (3.05/100 live births), obstructed labour (2.05/100) with 23 cases involving uterine rupture (0.12/100), hypertensive disorders of pregnancy (0.64/00) with 38 cases involve eclampsia (0.19/100) and sepsis (0.09/100) (26).

According to the systematic review of 1995 - 2010, the prevalence ratio of near miss cases range from 1.1%-8.3% in Sub-Sahara Africa with major identified causes of obstructed labor, obstetric hemorrhage, ruptured uterus and sepsis. Other study reveals that, the overall incidence ratio of maternal near miss is 6.17 cases per 100 live births with significant variation between areas in Sub-Saharan Africa 2011 (27). Nigeria has 12% Incidence with the direct causes of severe hemorrhage (41.3%), hypertensive disorders in pregnancy (37.3%), prolonged obstructed labour (23%), septicemia (18.6%) and severe anemia (14.6%) (28). In Mozambique the total MNMR and Near miss fatality rate are 20/1,000LB and 11.2% respectively with Hemorrhage (58.0%), eclampsia(35.5%) and HIV(22.3%) top causes of near miss cases (29).

In Ethiopia 2014 the ratio of maternal deaths to near misses is 1 to 12 and the overall maternal death ratio is 728 per 100 000 live births. According to this study the trend of maternal near miss ratio has decreased almost from 50% to 34% during the five year of study period (30). The overall proportion of MNM in Amhara regional state referral hospitals 2015 is 23.3% (31). Study conducted in Debre Markos referral hospital 2014 (32) reveals that the prevalence of MNM at that hospital is 29.7% among which 30.2% is near miss events. In similar research, the total MNMR is 384.5 per 1000 live births. Furthermore, in Amhara regional state (31) the prevalence of MNM is 23.3 %. In Tigray region severe obstetric hemorrhage, hypertensive disorders, dystocia, sepsis and severe anemia as the major causes of maternal near miss cases (33).

2.3. Near Miss Approach

The near miss approach was developed by World Health Organization in 2009 G.C and recommended to be considered in national plans of all countries to improve maternal health (30) and to be conducted in three steps to assess quality of maternal health care i.e, Baseline assessment, situation analysis and interventions for improving health care. This standardized approach enables the continuous improvement of maternal health service (10). A near miss approach was developed to compensate for “skilled delivery for all pregnant women” which is a more expensive approach, especially in developing countries and generally, it was aimed at reducing delays on service utilization after arrival at health facility (34).

2.4. Maternal Near Miss Indicators

Quality of maternal health care can be evaluated within certain maternal near-miss indicators. The assumption behind this concept is that, it is assumed to be a better indicator than using maternal mortality alone for designing, monitoring, follow up and evaluation of quality of maternal health service. In general, severe acute maternal morbidity assessment can serve as an alternate method to maternal death assessment (35). Maternal near miss indicators include maternal near-miss ratio (MNMR), severe maternal outcome ratio (SMOR) and maternal near-miss mortality ratio (MNMMR) (10).

In general, since the analysis of near miss events is better to reveal the causes of maternal morbidity and the services quality for improved intervention, assessing MNM is more useful to address problems with QoMHS (17). WHO recommend near-miss approach to be implemented in its three steps everywhere for continuous evaluation and improvement of QoMHS. Furthermore, clinical audit and feedback have potential to reduce serious maternal complications including MD (36). Hence assessing QoMHS in annual cycles using this approach would be desirable globally and particularly in developing countries. Nevertheless; there are scarce reports in Ethiopia on prevalence and causes of MNM in limited hospitals. There is no study conducted to assess QoMHS using this approach. Consequently, this study aims to contribute information concerning the QoMHS for the country and as well for study area.

2.5. Factors associated with maternal death

Different studies are able to identify factors associated with maternal death and interventions have been taken in different levels in the world and as well in Ethiopia. However, studies conducted to identify factors associated with maternal death in the cases of maternal near misses are few. Even though there is no too much study, it was indicted that some events are more frequently related with causing death among MNM cases. Hemorrhagic shock, umbers of interventions/procedures provided, sepsis and multiple organ failure were known to be higher in death amongst the women admitted with severe maternal morbidity (Maternal near misses) as per study conducted in Brazil recently (38). In addition to this, Hypertensive disorders of pregnancy such as pre-eclampsia and eclampsia are also common factors to be happening in maternal death cases (39).

Similar to these factors, maternal sepsis is a pre identified factors that associate with maternal mortality. That is why it is considered to focus on pregnancy related systematic infection or sepsis deliberately. It was indicated in “Global Maternal Sepsis Study” maternal sepsis is the underlying cause of 11% of all maternal deaths and a significant contributor to many deaths attributed to other underlying conditions (40).

Delayed health seeking behavior (delayed referral), had a greater risk of maternal death in near-miss morbidity (AOR, 4.76; 95% CI, 0.89–13.6). In opposite to this, blood transfusion is a protective factors in disease progression and as well maternal death (AOR, 3.79; 95% CI, 0.65–8.67) (41).

Conceptual Framework

In the following conceptual framework, we are going to utilize the inclusion criteria for baseline assessment of quality of care from WHO's to calculate indicators that were help us to measure quality of maternal health care. These measurements include mortality index, mortality rate, first line drug given for near miss case management and time within which laparotomy done for uterine rupture. We are going to use them with their cut off pint to measure the quality (cut off points are defined in operational definition). In addition, the statistical association between maternal death and the variables in the inclusion criteria and those listed as others was assessed.

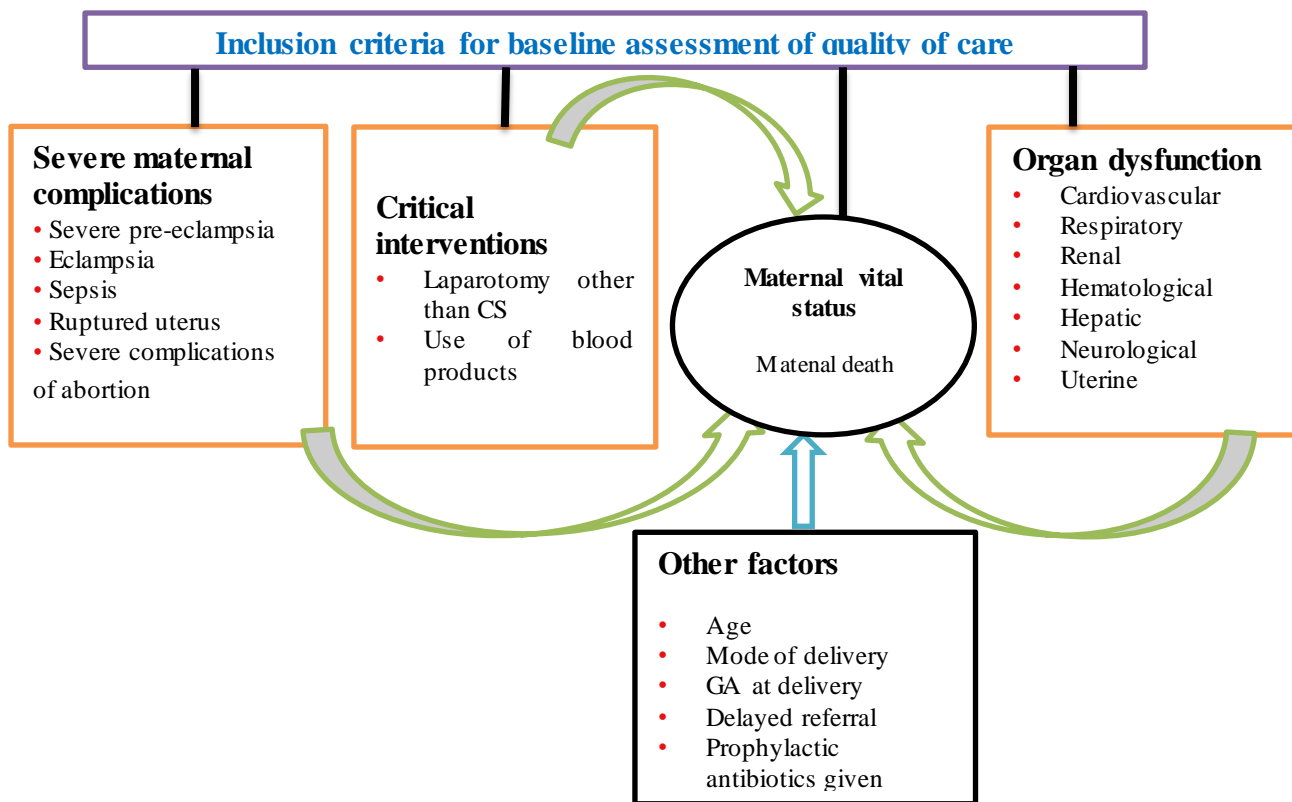


Figure1. Conceptual framework developed after reviewing of literatures to assess quality of maternal health care and factors associated maternal death Jimma, southwest Ethiopia 2018

Significance of the study

The finding of this study will provide the situational information on quality of maternal health care at JUSH for academicians, health professionals and as well for other concerning bodies. Furthermore, the data can be utilized as baseline information to undertake further study and service improvements. This in turn can help for this referral hospital (and health professionals) to focus their service in the direction of improving maternal health care services to improve the quality of life of women who face pregnancy related complication and as well to reduce maternal mortality.

The study result can be utilized as the first step study that should be implemented in three steps in near miss approach which are recommended by WHO. It can also give clue to recommend the implementation of key interventions to near miss cases at hospital and for facilitated referral system. Additionally, it will help to recommend on the area of focus to overcome the factors associated with maternal death. Moreover, information from this study can contribute advocacy value for promoting policy actions and mobilizing professionals and societies to improve the quality of maternal health care. General improvement of the maternal health care services at this study hospital will make the community (including women) the beneficiaries in one or another way as per this study result can be utilized as one input to improve the services.

Chapter Three

3.1. Objective

General Objective

To assess quality of maternal health care and factors associated with maternal death at Jimma University Medical Center using near-miss approach from January 1/2017 to December 30/2017

Specific Objectives

1. To determine mortality index at Jimma University Medical Center
2. To assess maternal near miss mortality ratio at Jimma University Medical Center
3. To evaluate maternal near miss management process at Jimma University Medical Center
4. To assess factors associated with maternal death at Jimma University Medical Center

Chapter Four

4.1. Methods and Materials

4.2. Study area and period

The study was conducted at Jimma University medical center (JUMC) which is one of the public hospital finds in south west Ethiopia. This Hospital is a tertiary hospital in Jimma Town, 353 km far from Addis Ababa the capital city of Ethiopia. It provides health services for 15-20 million people in its catchment area. JUMC contain four major wards (Obstetrics and gynecology ward, pediatrics ward, surgical ward and medical ward) with outpatient department for each. In Obstetrics and gynecology department, maternal health services such as ante natal care service, delivery service and post natal care are being provided. The total live birth of the 2017 at JUMC was 3907. The study was conducted from March to April 2018.

4.3. Study design: Facility based retrospective cohort study design was conducted.

Population

Source population: All records of reproductive age group women who received maternal health service at JUMC from January to December 2017.

Study population: All records of women who received maternal health service at JUMC from January 1/2017 to December 31/ 2017

Sample size: All records of women those utilize the service in study area within the range of study period and fulfill inclusion criteria.

Sampling method and procedure

Sampling technique: All records within the one year were used and Card number was used as identification number to avoid duplication of data from included maternal record. Maternal near misses were identified based on potentially life-threatening conditions, Critical interventions done and Organ dysfunction the women had in their recorded history.

Data collection procedure and techniques

Data collection tool; Check list was adopted from tool validated in sub Saharan Africa for data extraction.

Data collection procedure; Data were extracted from clients' record card.

Data Quality Control; Data collectors were selected and trained for data collection by principal investigator. They were allowed to exercise utilization of the tool with principal investigator for one day before starting normal data extraction. Principal investigator was supervising data collection process daily.

Data processing and Analysis

Quantitative data was coded and entered in to Epi-data version 3.1. After data cleaning it was exported in to SPSS version 21 for analysis. Descriptive statistics such as frequency was done to compute for descriptions such as percent of near miss cases, final mode of delivery, age of women, estimate of gestational age at delivery, so that we can describe all variables involved in the study. Near miss indexes were calculated to assess quality of obstetric care at study Hospital and to assess the gap between the actual use and optimal use of high-priority effective interventions in severe complications related to pregnancy and childbirth. Logistic regression applied for the assessment of factors associated with maternal death. Multicollinearity test was done for independent variables and the VIF of all were below 2. Hosmer and Lemeshow test ($p=0.174$) was used to check for the goodness of model fits and it showed good being greater than the cut of pint. The overall classification table also showed 99.3% indicating that good prediction of the model fitted.

Inclusion criteria;

Data from all records of women recorded within the study period in maternity and labour ward and records of women identified as maternal near miss cases in Gynecology ward were included.

Exclusion criteria; records with incomplete documentations were excluded.

Limitation; Lost patient record, poor quality of document, unrecorded patient history was the big challenges in this study procedure. Tool validated in SSA was used as there is no tool validated in Ethiopia.

Strength; To the level of our knowledge this study is innovative for Ethiopia as there is no study conducted previously to assess quality of maternal health care using his approach.

Variables

Dependent variable; Maternal death

Independent variables; Severe pre-eclampsia, Eclampsia, Sepsis, Ruptured uterus, Severe complications of abortion, Laparotomy other than CS, Use of blood products, organ dysfunction (Cardiovascular dysfunction, Hematological dysfunction, Hepatic dysfunction, Respiratory dysfunction, Renal dysfunction, Neurological dysfunction, Uterine dysfunction), Age, Mode of delivery, Gestational age at delivery, Referral status, Prophylactic antibiotics given.

Operational definition (9);

Good quality maternal health care: It is said good quality MHC when there is

- **Low mortality index (<20%)**
- **Low mortality rate (< 5%)**
- **>95% first line treatment given for near miss case.**
- **Laparotomy for uterine rupture done within three hours of hospital stay**

Mortality index: Number of maternal deaths divided by the number of women with life-threatening conditions expressed as a percentage.

Maternal near-miss (MNM): A woman who nearly died but survived a complication that occurred during pregnancy, childbirth or within 42 days of termination of pregnancy.

Maternal death (MD): Death of a woman while pregnant or within 42 days of termination of pregnancy or its management, but not from accidental or incidental causes.

Delayed referral system: When women are reaching the facility already with a severe maternal outcome whether self-referred or referred from other health facility

Live birth (LB): birth of an offspring which breathes or shows evidence of life.

Severe maternal outcome: life-threatening condition (i.e. organ dysfunction), including all maternal deaths and maternal near-miss cases.

Women with life-threatening conditions (WLTC): all women who either qualified as maternal near-miss cases or those who died (i.e. women presenting a severe maternal outcome).

Severe maternal outcome ratio (SMOR): number of women with life-threatening conditions per 1000 live births (MNM +MD).

Maternal near-miss ratio (MNMR): number of MNM cases per 1000 live births

Maternal near-miss mortality ratio (MNM: 1 MD): ratio between maternal near miss cases and maternal deaths. Higher ratios indicate better care

Ethical consideration; Ethical clearance was obtained from institutional review board (IRB) of Jimma University institute of health science. Permission was obtained from JUMC obstetrics and gynecology director office. There were no unique identifiers on records of patient in the checklist and all the data collected are handled confidentially.

Dissemination plan; Every chance will be tried to present this study result on workshops and scientific conferences. Compiled document will be submitted to JUMC. Finally possible efforts will be made to publish on reputable scientific journal.

Chapter Five

Results

A total of 3835 records comprising 3789 (98.81%) deliveries, 24 (0.6%) abortions, 9(0.002%) discharged still pregnant, 3(0.001%) died still pregnant and 10(0.3%) ectopic pregnancies were reviewed. The total delivery of 2017 at JUMC was 3907 resulting in 96.98% response rate for delivery records. Among the reviewed delivery documents 3674 (96.96%) were live births and the remaining 115 (3.04%) were stillbirths. We could not able to differentiate vital status of one child. Spontaneous vaginal delivery was the most frequent 75.0% final mode of uterine evacuation followed by caesarean section 22.3%. Around 51.2% of the women that utilized the service came referred from other health facilities. Most of the recorded women age included in to the study was in the category of 25 and 29 (35.4%) years of age. Majority of the delivery was occurred at term 3446(89.90%) (Table 1).

Table1. Distribution of final mode and status of uterine evacuation, vital status of infant at birth, abortion and ectopic pregnancy, maternal age and category of gestational age Jimma, southwest Ethiopia, 2018

Variables	Categories	Frequency	Percent
Final mode of uterine evacuation	SVD	2876	75.0
	CS	856	22.32
	Complete abortion	9	0.23
	C and E	15	0.4
	laparotomy for ectopic	10	0.3
	laparotomy for uterine rupture	56	1.46
	died/discharged pregnant	12	0.31
	Unknown	1	0.0002
Vital status of infant at birth	Alive	3674	97.00
	Died	115	3.00
	*Not applicable	46	1.2
Referral status	No	1873	48.0
	Yes	1962	51.0
Abortion	Yes	24	0.6
Ectopic pregnancy	Yes	10	0.3
Category of maternal age	15-19	293	7.64
	20-24	1218	31.78
	25-29	1359	35.46
	30-34	619	16.15
	35-39	310	8.09
	40-45	34	0.89
Category of GA	Ectopic/abortion	32	0.84
	Preterm	290	7.58
	Term	3446	89.90
	Post-term	56	1.46

*Not applicable= Ectopic, abortion, discharged/died still pregnant

The prevalence of maternal near miss and proportion of maternal death at this hospital was 400(10.43%) and 28 (0.73%) respectively. According to this study result, the prevalence of severe maternal outcome (MNM + MD) was 428(11.2%). Among the identified cases, greater part of both severe maternal outcome 77.1% and maternal deaths 85.71% happened among women come referred from other institutions. Largest percentage (94.18%) of the maternal near miss cases happened before arrival which is computed excluding MNM identification criteria that cannot be included in to this study data happened elsewhere before arrival to study hospital and some of the critical intervention those used as screening criteria. Maternal death, critical interventions such as transfusion of ≥ 2 units of red blood cells, laparotomy other than caesarean section, organ dysfunction such as cardio-pulmonary resuscitation and hysterectomy following infection were excluded (figure 2).

Maternal near miss ratio was 108.87 where as severe maternal outcome ratio was 116.49 per 1000 live birth. The overall maternal near miss mortality ratio and mortality index of the study area were 107:7 (15.29) and 6.54% respectively. Maternal near miss mortality ratio being greater and lower mortality index at this facility shows better care for maternal near miss as per mortality index was 6.54%.

To the general and as well among Severe complications / potentially life-threatening conditions sever pre-eclampsia is the leading cause of maternal near miss holding 150 (25.29%). On the other hand, pulmonary edema was the least causes of MNM (0.19%) cases. We had no women presented with or developed after arrival to this institution the screening criteria such as Cardio-pulmonary resuscitation, gasping, acute cyanosis, severe hypoxemia, sever bradypnea, oliguria non responsive to fluids or diuretics, fail to form clot, transfusion for hematologic disorder, jaundice with pre-eclampsia, stroke, paralysis, and Death after 42 days. Transfusion of ≥ 2 unit of blood counts more frequently among (13.41%) the critical interventions done. When we see to Organ dysfunction / life-threatening conditions cardiovascular dysfunctions were more (8.08%) known to cause MNM while coagulation/hematologic dysfunction and hepatic dysfunction count fewer (0.38%) (Table 2).

Table 2. Distribution of maternal near miss screening criterion result Jima, southwest Ethiopia, 2018

Screening criterion	*Screening status	frequency	Total percent
Eclampsia	1	31	6.7%
	2	3	
Sepsis or severe systematic infection	1	64	12.84%
	2	3	
Uterine rupture	1	49	10.73%
	2	7	
Transfusion of ≥ 2 unit blood	1	67	13.41%
	2	3	
Laparotomy other than CS	1	33	6.32%
Shock	1	35	7.7%
	2	1	
Cardiac arrest	1	2	0.38%
Severe tachypnea	1	3	0.57%
Intubation & ventilation not for anesthesia	1	6	1.15%
Creatinine >300 $300 \mu\text{mol/l}$	1	5	0.96%
Thrombocytopenia	1	2	0.38%
Severe acute hye bilirubinemia	1	2	0.38%
Loss of consciousness for >12 hrs.	1	4	0.96%
	2	1	
Uncontrollable fit/ Status epileptics	1	2	0.38%
Hysterectomy following infection	1	5	0.96%
Pulmonary edema	1	1	0.19%
Sever abortion complication	1	24	4.60%
Sever malaria	1	4	0.77%
Severe pre-eclampsia	1	124	25.29%
	2	8	
Ketoacids in the urine	1	4	0.77%
Maternal death	1	28	5.36%

*Screening status; 0= condition not happen 1=condition present at arrival or developed within 12hrs of arrival
2= condition developed after 12 hrs of hospital arrival

Medical disease took largest part in having mortality index obstetric hemorrhage 2.57% followed by pregnancy related infection having 1.40% mortality index. There were no deaths from ectopic pregnancy, surgical disease, mental disease, unanticipated complication of management, coincidental causes and unknown causes (Table 2).

Table 3. Distribution of causes of maternal near miss and maternal death in category Jima, southwest Ethiopia, 2018

Variables	Maternal near miss (%)	Maternal death (%)	Mortality index
Abortion	24(1.20)	1(3.57)	0.23%
Obstetric heamorrhage	68(3.50)	11(39.29)	2.57%
Hypertensive disorders	150(7.17)	2(7.14)	0.47%
pregnancy related infection	55(2.90)	7(25.00)	1.64%
*other obstetric diseases	76(3.90)	1(3.57)	0.23%
medical diseases	35(1.80)	6(21.43)	1.40%
*Coincidental causes	1(0.10)	0(0.00)	0.00%

*other=

56 uterine rupture

9 wound dehiscence repaired

8 Hysterectomy for uterine atony

3 bladder repaired

*Unanticipated complications of management =

4 sepsis due to endometritis after CS delivery

*Coincidental cause

1 fracture and epilepsy

Regarding the treatments given to MNM cases managements, for a total of 150 women with sever pre-eclampsia/Eclampsia magnesium sulfate and/or other anti-convalescent were given. Three women received both types of drugs. This indicates that all eligible women received first line drug for pregnancy related hypertensive disorders and it shows good quality maternal health service on this part. Only 49/55 (89.1%) of women those who developed pregnancy related infection received parenteral antibiotics and this in turn suggests poor practice of severe systematic infection/sepsis treatment. Prophylactic antibiotics provided for 808/861(93.8%) of women who gave birth by caesarean section. This is also indicates poor practice in this health institution since it was done <95%. Among the 56 women presented with ruptured uterus, laparotomy was done for 45 (80.36%) of them within three hours of hospital arrival. The remaining women having uterine rupture got the service (i.e. laparotomy done) after three hours of hospital arrival. However it should be >95% as recommended by near miss working group and those it points to poor service provision again (Table 4).

Table 4. Sever pre-eclampsia/Eclampsia, sepsis/systematic infection, uterine rupture and Cesarean Section and treatment given for them Jima, southwest Ethiopia, 2018

Treatment given	response	Severe maternal complications			
		A. Sever pre-eclampsia/Eclampsia			
		No		Yes	
		Frequency	%	Frequency	%
Magnesium sulfate	No	3680	99.9%	34	22.7%
	Yes	5	0.1%	116	77.3%
Other anticonvulsant	No	3681	99.9%	113	75.3%
	Yes	4	0.1%	37	24.7%
B. Pregnancy related infection					
Parenteral antibiotics		No		Yes	
		Frequency	%	Frequency	%
	No	3695	97.8%	6	10.9%
	Yes	85	2.2%	49	89.1%
C. Caesarean section					
Prophylactic antibiotics		No		Yes	
		Frequency	%	Frequency	%
	No	0	-	53	6.2%
	Yes	0	-	808	93.8%
D. Uterine rupture					
Laparotomy done within three hrs. of arrival		No		Yes	
		Frequency	%	Frequency	%
	No		-	11	19.64%
	Yes		-	45	80.36

Other anticonvulsant = hydralazine

* Cases happened before arrival =cases that can be happen before arrival and present at arrival or developed within 12hrs of hospital arrival in this study.

Among the screening criteria of severe maternal outcomes such as Eclampsia, Sepsis or severe systemic infection, Uterine rupture, Shock, Cardiac arrest, Severe tachypnea, Creatinine $>300 \mu\text{mol/l}$, Thrombocytopenia, Severe acute hyperbilirubinemia, Loss of consciousness for >12 hrs, Uncontrollable fits/ Status epilepticus, Pulmonary edema, Severe abortion complication, Severe malaria, Severe pre-eclampsia and Ketoacids in the urine are cases that can happen before arrival and counted in our study data. Accordingly, majority of the cases 356 (94.18%) cases happened before arrival (Figure 2.).

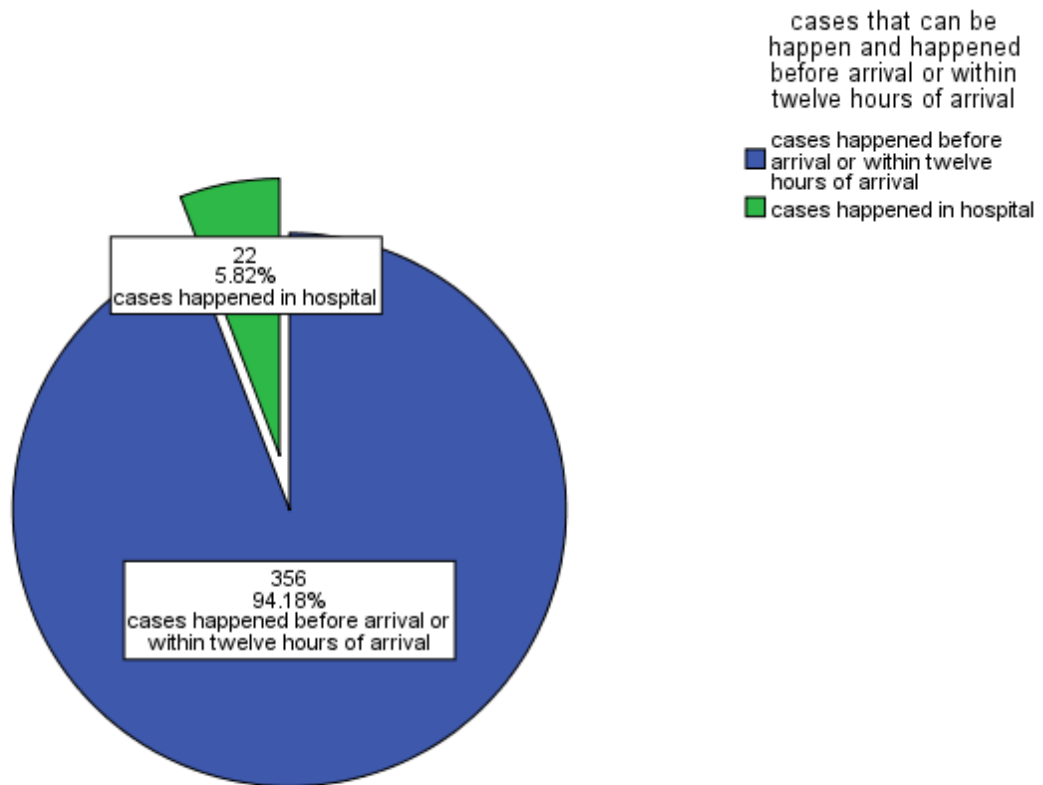


Figure 2. Distribution of severe maternal outcomes happened before and after twelve hours of hospital arrival Jima, southwest Ethiopia 2018

Factors influencing maternal death

Crude analysis of socio-demographic variable (age of women), maternal near miss cases management variables and maternal near miss selection criteria related variables was computed through bivariate logistics regression. It was applied to identify variables associated with maternal death and candidate for multiple logistic regression using identification criteria of P-value less than 0.25. Accordingly the following nineteen variables were selected meeting the criteria P-value lower.

The first seven variables were age of women, referral status of the women, final mode of delivery or uterine evacuation, best estimate of gestational age at uterine evacuation, occurrence of delivery/abortion before arrival, Prophylactic antibiotic for different reasons, Parenteral or therapeutic antibiotics were selected in first model fitted separately for each as significantly associated with maternal death with P value (<0.25) (Table 6).

Table 5. Logistic regression table for selection of candidate variables to see association between women's age, maternal near miss cases management variables, obstetric characteristics and maternal death, JUMC, south west Ethiopia 2018

Variables	Death				
	Response	Yes	No	P-value	COR (95%)
Age of women	Agecat			0.020	
	15-19	2(7.10%)	291(7.60%)	0.397	0.479(.087-2.630)
	20-24	4(14.3%)	1214(31.90%)	0.922	1.079(0.235-4.952)
	25-29	10(35.70%)	1348(35.40%)	0.840	1.185(0.229-6.143)
	30-34	5(17.90%)	614(16.10%)	0.301	2.385(0.459-12.391)
	35-39	5(17.90%)	305(8.00%)	0.030	9.094(1.239-66.770)
Referral status	40-45	2(7.10%)	32(0.80%)		1
	Yes	24(85.70%)	1937(50.90%)	0.001	5.789(2.005-16.717)
Final mode of delivery/uterine evacuation	No	4(14.30%)	1869(49.10%)		1
	Delmode			0.040	
	SVD	21(75.00%)	2855(75.00%)		1
	CS	4(14.30%)	851(22.40%)	0.413	0.639(0.219-1.867)
estimate of GA	Others	3(10.7%)	99(2.6%)	0.024	4.120(1.209-14.041)
	After viability	25(89.30%)	3764(98.90%)	0.142	4.562(0.600-34.667)
Delivery/abortion before	Before viability	1(3.60%)	33(0.90%)		1
	Yes	15(53.60%)	85(2.20%)	0.001	0.176(0.009-0.043)
Prophylactic	No	13(46.40%)	3721(97.80%)		1
	Yes	2(7.10%)	964(25.30%)	0.043	0.227(0.054-0.957)
Parenteral antibiotics	No	26(92.90%)	2842(74.70%)		1
	Yes	9(32.10%)	124(3.30%)	0.001	14.065(6.238-31.714)
	No	19(67.90%)	3682(96.70%)		1

In addition to the above seven variables, among all MNM screening criterion variables Elcampsi, Sepsis/severe systematic infection, Transfusion of ≥ 2 unites of red blood cells, Laparotomy other than cesarean section, shock, Cardiac arrest, severe tachypnea, intubation and ventilation not related to anesthesia, Creatinine ≥ 300 $\mu\text{mol/l}$ or ≥ 3.5 mg/Dl in the urine, Loss of consciousness lasting more than twelve hours, Uncontrollable fit/ Status epileptics, Severe abortion complications and severe pre-eclampsia were significantly associated with maternal death in their first fitted model and selected at $P < 0.25$ (Table 6).

Table 6. Bivariate logistic regression of association between maternal near miss screening criteria and maternal death, JUMC, south west Ethiopia 2018

Screening criterion	Response	Death		P-value	COR (CI 95%)
		Yes (%)	No (%)		
Elcampsia	Yes	2(7.10)	32(0.80)	0.003	9.072(2.066-39.842)
	No	26(92.90)	3774(99.20)		
Sepsis	Yes	21(75.00)	59(1.60)	0.047(0.019-0.115)	1
	No	7(25.00)	3747(98.40)		
Transfusion of \geq 2U of RBC	Yes	4(0.14.30)	66(1.70)	0.001	9.444(3.188-27.982)
	No	24(85.7%)	3740(98.30)		
Laparotomy other than CS	Yes	1(3.60)	32(0.80)	0.154	4.368(0.576-33.127)
	No	27(96.40)	3774(99.20)		
Shock	Yes	5(17.09)	32(0.80)	0.001	25.639(9.173-71.658)
	No	23(83.10)	3774(99.20)		
Cardiac arrest	Yes	1(3.60)	1(0.01)	0.000	140.926(8.591-2311.8)
	No	27(96.40)	3805(99.09)		
severe tachypnea	Yes	1(3.60)	2(0.10)	0.001	70.444(6.201-800.265)
	No	27(96.40)	3804(99.90)		
Intubation not for anesthesia	Yes	2(7.10)	4(0.10)	0.000	73.115(12.825-416.83)
	No	26(92.90)	3802(99.90)		
Creatinine \geq 300 μ mol/l	Yes	1(3.60)	4(0.10)	0.002	35.204(3.809-325.353)
	No	27(96.40)	3802(99.90)		
Acute thrombocytopenia	Yes	0(0.00)	2(0.10)	1.000	0.007
	No	28(100.00)	3806(99.90)		
severe acute hyperbilirubinemia	Yes	0(0.00)	2(0.10)	1.000	0.000
	No	28(100.00)	3804(99.90)		
Loss of consciousness for >12 hrs	Yes	2(7.10)	3(0.10)	0.001	97.513(15.64-608-062)
	No	26(92.90)	3806		
Uncontrollable fit/ Status epilepticus	Yes	1(3.60)	1(0.10)	0.001	140.97(8.591-2311.78)
	No	27(96.40)	3805(99.90)		
Hysterectomy following infection	Yes	0(0.00)	4(0.10)	0.999	0.000
	No	28(100.00)	3802(99.90)		
Pulmonary edema	Yes	0(0.00)	1(0.10)	1.000	0.000
	No	28(100.00)	3805(100.01)		
Severe abortion complications	Yes	1(3.60)	23(0.60)	0.082	6.092(0.794-46.737)
	No	27(96.40)	3783(99.40)		
Severe malaria	Yes	0(0.00)	4(0.10)	0.999	0.000
	No	28(100.00)	3802(99.90)		
Severe pre-eclampsia	Yes	3(10.70)	129(3.40)	0.046	3.420 (1.020-11.475)
	No	25(89.30)	3677(96.60)		

Screening criterion cases such as ruptured uterus, cardio-pulmonary resuscitation, gasping, acute cyanosis, severe hypoxemia, bradypnea, non-responsive oliguria to fluid or antidiuretics, failure to form clots, acute thrombocytopenia, jaundice in the presence of pre-eclampsia, stroke and total paralysis were excluded from bivariate logistic regression model. This is done for the reason that they become constant as per there were no maternal near miss or severe maternal outcome cases happened by these conditions (all of them had no yes response).

In the second fitted model (together for all), Age of women, referral status of the women, final mode of delivery or uterine evacuation, best estimate of gestational age at uterine evacuation, parenteral or therapeutic antibiotics, eclampsia, transfusion of ≥ 2 unites of red blood cells, laparotomy other than cesarean section, cardiac arrest, intubation and ventilation not related to anesthesia and severe abortion complications were removed from the model by backward variable selection method. In contrast to this, prophylactic antibiotics for different reasons, delivery or abortion before arrival, sepsis or severe systematic infection, shock, severe tachypnea, loss of consciousness lasting for more than twelve hours, uncontrollable fit or status epilepsy and severe pre-eclampsia was selected by backward elimination method at P-value $<5\%$ for multivariate logistic regression analysis.

Incorporating candidate variables, multivariate analysis was performed to identify independent predictors of maternal death. Four factors were independently associated with maternal death. They are; prophylactic antibiotic for different reasons, sepsis or severe systematic infections, shock and severe pre-eclampsia.

From the multivariate regression model, odds of maternal death among women who took prophylactic antibiotics is 0.10 times less likely than women who did not take (AOR = 0.098 at CI 0.018-0.529). Women who did not develop sepsis were 0.23 times less likely to die (AOR = 0.234 at CI 0.062-0.879) compared to those who developed the case. The odds of death among women with shock was 9.90 times higher among women with shock compared to those without shock (AOR= 9.902, CI = 2.29-42.815). The odds of death among women presented with or developed severe pre-eclampsia was 7.30 times more likely than their counterparts (AOR=7.298 with CI of 1.485-35.865) (Table 7).

Table 7. Multivariate logistic regression showing factors independently associated with maternal death among maternal near miss cases at JUMC, Southwest Ethiopia, 2018

Variables		Death		COR (CI 95%)	AOR (CI 95%)	P
		Yes	No			
Prophylactic for before CS delivery	Yes	2(7.1%)	964(25.3%)	0.227(0.054-0.957)	0.098(0.018-0.529)	0.007
	No	26(92.9%)	2842(74.7%)	1	1	
Sepsis	Yes	7(25.0%)	59(1.6%)	1	1	
	No	21(75.0%)	3747(98.4%)	0.047(0.019-0.115)	0.234(0.062-0.879)	0.032
Shock	Yes	5(17.09%)	32(0.8%)	25.639(9.173-71.658)	9.902(2.29-42.815)	0.002
	No	23(83.1%)	3774(99.2)	1	1	
Severe pre-eclampsia	Yes	3(10.7%)	129(3.4%)	3.42 (1.020-11.475)	7.298(1.485-35.865)	0.014
	No	25(89.3%)	3677(96.6%)	1	1	

Discussion

The study showed that the total maternal near-miss was 10.43% which is supportable by the study in Nigeria 12% (28) and is distant lower than the result of study in Debre Markos (29.7%) and Amhara referral hospital 23.3% (29, 31). The differences can be due to variation in study periods, differences in socio-demographic characteristics of the study populations and differences in case definitions in maternal near miss selection methods. The overall mortality index of the study was (6.54%) almost comparable within that of the study in Pakistan (8.4%) and Nigeria 8.8 (23, 42). However, it is far lower than the mortality index in India 29.07% and this can be due to difference in health police of the countries, study area and period (43). Mortality rate (0.73%) in this data is lower compared to that occurred in other African countries as systematic analysis of MNM in Africa identified (27). This difference can be from dissimilarity in case management process in this institution and over time improvement of the care provided for maternity case. Systematic analysis on the other hand is of many countries which can create variation when compared with single country because of difference in economic status of different countries, difference in health police and study area.

Maternal near miss ratio in this study was 116.49 per 1000 live births and this is little lower when compared with previous study result conducted in Mekelee which was 101 per 100 live birth (44). This discrepancy can be due to difference in status of study area, this study conducted in referral hospital which provides services for more than 15 million people in the catchment area and the other is for fewer populations. Maternal near miss mortality ratio was 107:7 showing greater women saved and better level of MNM cases management is being provided at JUMC as WHO put it (9).

Since we could not find sufficient study that focus on maternal near miss management process for all services include in this study, it become difficult to discuss few of the results regarding the service provided. However, it is probable to suggest possible comments depending on available WHO cut of point on intervention.

According to this guideline, any treatment for severe maternal outcome should be first line at least to 95% level of treatment provided (9). In line with this 100% first line drug is given for

women with Sever pre-eclampsia/Eclampsia which shows good quality maternal health service on this part. This result is significantly higher than that the Eclampsia was treated with magnesium sulphate in only 87% of maternal near miss cases in northern Tanzania (44).

About 89.1% parenteral antibiotics were received by women having pregnancy related infection and this suggests poor service practice of infection/sepsis treatment. Prophylactic antibiotics provided before CS accounts for 93.8% of women who gave birth by caesarean section. This is also poor practice in this health institution. Laparotomy done within three hours of hospital arrival is by far below the WHO standard (80.36%) indicating poor service provision.

Majority of both severe maternal outcome (maternal near miss) 77.1% and maternal deaths 85.71% happened among women who come referred from other sites. This is in consistence with study done in referral hospital in Debre markos. Similarly, greater number (94.15%) of the MNM cases happened before arrival to this hospital. Previously it is indicated in Debre Markos that maternal near miss happened 90% before arrival to the referral hospital (29). This indicates higher number of maternal near miss occurred before arrival to hospital similarly in both study. According to the WHO guideline this result indicates there is delay in referral process and action needs to be taken on pre-hospital conditions of the situations (9, 29). Higher live birth (97% and lower still birth (3%) in this study compared with previous study can be due to difference in study period, area and study design applied (29).

Hypertensive disorders were the cause (35.05%) of MNM among screening criteria followed by obstetric hemorrhage in this study and it is in parallel with others study findings (21, 32, 35). Similar to previous study in developing country medical cause (shock and cardiac arrest) is the most common organ dysfunction in current study (35).

Regarding factors associated with maternal death, severe pre-eclampsia was significantly associated (AOR=7.3, CI= 1.49-35.865) independently. In supportive to this result study in UK identified that hypertensive disorders of pregnancy was positively associated with maternal death (AOR 2.44, 95% CI 1.31-4.52) (39). On the other way, prophylactic antibiotics was provided less in death cases (AOR = 0.098, CI 0.018-0.529). In a similar fashion, prophylactic antibiotics was also more frequently given in the near misses than in maternal deaths (AOR 0.3; 95% CI 0.06–1.56) in Indonesia a retrospective cohort study (45).

Conclusion and Recommendation

Conclusion

Along with this study hypertensive disorder is highly prevalent in maternal near miss cases and identified as major cause. This seems the enlivenment of pregnancy related problems with the current increasing chronic disease in developing countries. This directs the increasing burden of chronic diseases globally and their interaction with pregnancy and its outcome requires careful research and intervention in the future.

Mortality index at JUMC is far below the WHO cut of point. From this we can conclude that maternal health care services that were given for women with maternal near miss cases were having good quality services. The much lower maternal mortality rate in this hospital strengthens this conclusion. Moreover, the first line drug given for pregnancy related hypertensive disorders (severe pre-eclampsia and eclampsia) yet again shows good practice and quality services on maternal near miss case management process at JUMC.

In contrast to this, there were case management processes at JUMC which shows poor quality services. A prophylactic antibiotic was not given for large part of cesarean section done. Similarly, an antibiotic in the case of treating infection related to pregnancy is not parenteral. Laparotomy done after three hours of hospital arrival for women with uterine rupture is also huge. This needs more attentions to be given on treatment process and appropriate action need to be taken timely to save life of maternal near misses and reduce sequels of the near miss events.

Prophylactic antibiotics before cesarean section delivery, severe pre-eclampsia, sepsis and shock were among maternal near miss screening criterion that significantly associated with maternal death at JUMC.

Recommendation

To the level of **Jimma University Medical Center**, criteria based audit of near miss mothers should become an integral part of the facility's practices to improve quality of obstetric care. In addition to this, JUMC should improve registration system in the Obstetrics and gynecology ward to facilitate clinical audit. It will be good if the log book they are being using include registration of cases and treatment given for the cases. On the other hand, it will also be good if the JUMC staffs practice the WHO near miss guideline utilization in to their daily work. Great scaling up of case management process at this hospital is recommended on the area that had been identified as poor quality services.

Health professionals of JUMC should give due attention to the women who developed severe pre-eclampsia, sepsis and shock as these are significantly associated with maternal death among maternal death at this hospital.

For ministry of health;

As per the conclusion from this study many women come to the hospital after they developed severe complication. To reduce this service utilization delay, education should be strengthened on ANC or at home through media and or by health extension workers for pregnant women to aware them to seek care on time in the presence of pregnancy related complications. This helps to reduce occurrence of maternal near miss cases and as well its sequel complications. Furthermore, Referral system needs to be strengthened more from lower health institutions.

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Annex I

Data collection tool

Questionnaire No _____ Date _____

Individual ID (Patients' card number)

Socio-demographic questions

1. **SD1** Age of mother in completed year _____

Facility related questions

2. **FR1** Is she referred from other site? 0) yes _____ 1) no _____

SCREENING QUESTIONS

For the questions 1 to 4, please specify as 0 to 3

0 =The condition was not present during the hospital stay

1 =The condition was present at arrival or within 12 hours of hospital arrival

2 =The condition developed after 12 hours of hospital arrival

3 =Information not available / unknown or not applicable

1. Severe complications / potentially life-threatening conditions

_____ **A1** Eclampsia

_____ **A2** Sepsis or severe systemic infection

_____ **A3** Ruptured uterus

2. Critical interventions

_____ **B1** Transfusion of ≥ 2 units of red blood cells

_____ **B2** Laparotomy other than caesarean section

3. Organ dysfunction / life-threatening conditions

A. Cardiovascular dysfunction

_____ **C1** Cardio-pulmonary resuscitation

_____ **C2** Shock

_____ **C3** Cardiac arrest

B. Respiratory dysfunction

_____ **D1** Gaspings

_____ **D2** Acute cyanosis

_____ **D3** severe hypoxemia (Oxygen saturation < 90% for > 60 min)

_____ **D4** severe tachypnea ((respiratory rate>40 bpm),

_____ **D5** bradypnea (respiratory rate<6 bpm),

_____ **D6** intubation and ventilation not related to anesthesia

C. Renal dysfunction

_____ **E1** Oliguria non responsive to fluids or diuretics

_____ **E2** Creatinine $\geq 300 \mu\text{mol/l}$ or $\geq 3.5 \text{ mg/Dl}$

D. Coagulation/hematologic dysfunction

_____ **F1** Failure to form clots

_____ **F2** Transfusion of ≥ 2 units of red blood cells

_____ **F3** Acute thrombocytopenia (<50,000 platelets/ml)

E. Hepatic dysfunction

_____ **G1** Jaundice in the presence of pre-eclampsia

_____ **G2** severe acute hyperbilirubinemia (bilirubin>100umol/L or >6.0mg/dL)

F. Neurologic dysfunction

_____ **H1** Stroke

_____ **H2** Loss of consciousness lasting more than 12 hr

_____ **H3** Uncontrollable fit/ Status epileptics

_____ **H4** Total paralysis

G. Uterine dysfunction / Hysterectomy

_____ **I1** Hysterectomy following infection

Maternal deaths

_____ **J0** Death during pregnancy or within 42 days of termination of pregnancy

_____ **J1** Death after 42 days of termination of pregnancy

OTHER CLINICAL CRITERIA;

_____ **K1** Pulmonary edema

_____ **K2** Severe abortion complications

_____ **K3** Severe malaria

_____ **K4** Severe pre-eclampsia

OTHER LABORATORY BASED CRITERIA

_____ **L1** ketoacids in urine

MATERNAL AND PERINATAL INFORMATION (write in the box overlapping the letters)

4. **Z1** Date of hospital admission

5. **Z2** Date of delivery or uterine evacuation

6. **Z3** Date of hospital discharge or death

7. _____ **M1** Final mode of delivery / end of pregnancy. Please specify

1= Vaginal Delivery

6= Laparotomy for ectopic pregnancy

2= Caesarean section

7= Laparotomy for ruptured uterus

3= Complete abortion

8= Women discharged or died still pregnant

4= Curettage / vacuum aspiration

9= Unknown / other (specify) _____

5= Medical methods for uterine evacuation

8. Best estimate of gestational age in completed weeks (obstetric/neonatal) at:

_____ **N1** Delivery or abortion (not applicable if Q7="8")

_____ **N2** Maternal death or hospital discharge (applicable if Q7="8")

9. Regarding the vital status of the infant please specify: 0=Alive 1=Dead

_____ **O1** At birth

_____ **O2** At hospital discharge or on the 7th day of life if still in the hospital

PROCESS INDICATORS

10. About **conditions at arrival** in the facility and the referral process, specify: (0=No 1=Yes)

_____ 0 Delivery or abortion occurred before arrival at any health facility

_____ **P1** Delivery within 3 hours of arrival in the health facility

_____ **P2** Laparotomy within 3 hours of hospital arrival or in other hospital

_____ **P3** Woman referred from other health facility

_____ **P4** Woman referred to any higher complexity hospital

11. About the use of interventions, please specify whether the woman received any of the following : (0=No 1=Yes)

Anticonvulsant

_____ **Q0** Magnesium sulfate

_____ **Q1** Other anticonvulsant

Antibiotics

_____R0 Prophylactic antibiotic during caesarean section

_____R1 Parenteral, therapeutic antibiotics

Fetal lung maturation

_____S0 Corticosteroids (betamethasone or dexamethasone)

UNDERLYING CAUSES OF DEATH / NEAR MISS

12. Please specify: (0=No 1=Yes)

_____T0 Pregnancy with abortive outcome (abortion/ectopic pregnancy)

_____T1 Obstetric hemorrhage

_____T2 Hypertensive disorders

_____T3 Pregnancy-related infection

_____T4 other obstetric disease or complication

_____T5 Medical/surgical/mental disease or complication

_____T6 Unanticipated complications of management

_____T7 coincidental conditions

_____T8 Unknown/ (Specify)

DECLARATION

I, the undersigned, declare that this thesis is my original work, has not been presented for a degree in this or any other university and that all sources of materials used for the thesis have been fully acknowledged.

Name: Bekelu Teka Work

Signature: _____

Name of the institution: _____

Date of submission: _____

This thesis has been submitted for examination with my approval as University advisor

Name and Signature of the first advisor

Name and Signature of the second advisor

