PREVALENCE AND FACTORS ASSOCIATED WITH MATERNAL NEAR-MISS IN MAGWAY REGIONAL HOSPITAL, MAGWAY, MYANMAR

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ความชุกและปัจจัยที่เกี่ยวข้องกับมารดาเกือบเสียชีวิตในโรงพยาบาลศูนย์มะเกวย์ เขตมะเกวย์ ประเทศเมียนมา

น.ส.เอย์เมียว เต็ด

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสาธารณสุขศาสตรมหาบัณฑิต
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เอย์เมียว เต็ด : ความชุกและปัจจัยที่เกี่ยวข้องกับมารดาเกือบเสียชีวิตในโรงพยาบาลศูนย์มะเกวย์ เขตมะเกวย์ ประเทศเมียนมา. (PREVALENCE AND FACTORS ASSOCIATED WITH MATERNAL NEAR-MISS IN MAGWAY REGIONAL HOSPITAL, MAGWAY, MYANMAR) อ.ที่ปรึกษาหลัก : วันดี ศิริโชคชัชวาล

บทนำ: การตายของสตรีที่เป็นมารดาเป็นปัญหาด้านสาธารณสุขที่สำคัญในทุกๆวันมีผู้หญิงเสียชีวิตจากภาวะแทรกซ้อนในการตั้งครรภ์เนื่องจากปัญหาที่เกี่ยวข้องกับตั้งครรภ์และการคลอดบุตร การเจ็บป่วยและอัตราการเสียชีวิตที่เกี่ยวข้องกับการตั้งครรภ์ในประเทศเมียนมาร์เพิ่มขึ้นอย่างมากจากร้อยละ 17.6 ในปี พ.ศ.2555 เป็นร้อยละ 20.2 ในปี พ.ศ. 2561 ในประเทศเมียนมาร์มีการศึกษาวิจัยที่จำกัดเกี่ยวกับมารดาเกือบชีวิต ดังนั้นการศึกษาครั้งนี้จึงมีวัตถุประสงค์เพื่อประเมินความชุกและศึกษาปัจจัยที่เกี่ยวข้องกับมารดาเกือบชีวิตในโรงพยาบาลศูนย์มะเกวย์ เขตมะเกวย์ ประเทศเมียนมาร์

วิธีการดำเนินงานวิจัย:การศึกษาแบบภาคตัดขวางโดยใช้การวิเคราะห์ข้อมูลทุติยภูมิของสถานพยาบาลเพื่อประเมินความชุกของมารดาเกือบชีวิต และศึกษาปัจจัยที่เกี่ยวข้องกับมารดาเกือบชีวิตในโรงพยาบาลศูนย์มะเกวย์ ในปี พ.ศ. 2562 โดยใช้ WHO maternal near-miss approach เป็นเครื่องมือในการเก็บข้อมูลและตรวจสอบกรณีมารดาเกือบชีวิตจากประวัติทางการแพทย์ของแผนกสูติศาสตร์และนรีเวชวิทยาตั้งแต่เดือนมกราคม พ.ศ. 2562 ถึงธันวาคม พ.ศ. 2562 ความถี่ ร้อยละ นำเสนอค่าเฉลี่ยและส่วนเบี่ยงเบนมาตรฐานสำหรับการวิเคราะห์เชิงพรรณนา และใช้สถิติวิเคราะห์การถดถอยโลจิสติคทวิเพื่อหาความสัมพันธ์ระหว่างตัวแปรอิสระต่อมารดาเกือบเสียชีวิต โดยมีนัยสำคัญทางสถิติที่ค่า p <0.05

ผลการศึกษา: ในการศึกษาครั้งนี้รวมสตรีมีครรภ์ทั้งหมด 3,291 คนที่มีอายุระหว่าง 15 ถึง 50 ปี ซึ่งเข้ารับการรักษาในโรงพยาบาลศูนย์มะเกวย์ จากจำนวนทั้งหมด พบว่ามี 11 รายที่เป็นมารดาเกือบชีวิต และ 7 รายที่เป็นการตายของสตรีที่เป็นมารดา โดยพบอัตรามารดาเกือบชีวิตคือ 3.9 ต่อ 1,000 ของการเกิด อัตราการตายของมารดาเท่ากับ 246 ต่อ 100,000 ของการเกิด และดัชนีการตายของมารดาเท่ากับ 0.39 และพบว่าปัจจัยที่เกี่ยวข้องกับมารดาเกือบชีวิต คือ สตรีมีครรภ์ที่มีครรภ์เป็นพิษรุนแรง ครรภ์เป็นพิษ และมดลูกแตก

สรุปผลการศึกษา:ผลการศึกษาพบว่าอัตรามารดาเกือบชีวิตในการศึกษานี้ค่อนข้างต่ำ ในขณะที่อัตราการตายของมารดาที่พบ 246 ต่อ 100,000 ของการเกิดมีอัตราสูงกว่าค่าเฉลี่ยทั่วโลกที่ 211 ต่อ 100,000 ของการเกิด ในปี พ.ศ. 2560 นอกจากนี้การศึกษายังพบว่าคุณภาพการดูแลในโรงพยาบาลควรได้รับการปรับปรุง และพบว่ามีจำนวนมารดาเสียชีวิตสูงสุดในกรณีที่มีภาวะติดเชื้อจากการทำแท้ง

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KEYWORD: maternal near miss maternal mortality pregnancy complications organ
                  dysfunctions Myanmar
           Aye Myo Thet : PREVALENCE AND FACTORS ASSOCIATED WITH
           MATERNAL   NEAR-MISS   IN   MAGWAY   REGIONAL   HOSPITAL,
           MAGWAY, MYANMAR. Advisor: Wandee Sirichokchatchawan, Ph.D.

Background: Maternal mortality is an important public health concern. Women die every day from pregnancy complications, delivery-related issues, and childbirth. Pregnancy related morbidity and mortality in Myanmar were dramatically increased from 17.6% in 2012 to 20.2% in 2018. In Myanmar, there are limited studies on maternal near miss. Therefore, this study aimed to estimate the prevalence and determine the factors associated with maternal near miss in Magway Regional Hospital, Myanmar.

Method: This cross-sectional study employed a health facility-based secondary data analysis to estimate the prevalence of maternal near miss cases, and examine factors associated with maternal near miss in Magway Regional Hospital in 2019. WHO maternal near-miss approach was adopted to examine the maternal near-miss. Records were obtained from Obstetrics and Gynecology ward from January 2019 to December 2019. Frequency, percentage, mean and standard deviation were presented for descriptive analysis. Chi-square and Binary logistic regression were used to describe the relationship between the selected independent variables and maternal near miss with statistically significant at p-value <0.05.

Results: A total of 3,291pregnant women between the ages of 15 to 50, who admitted into the Magway Regional hospital, and were included in this study. Among all, 11 cases of maternal near miss with 7 cases of maternal death. The maternal near miss ratio was 3.9 per 1,000 live births. Maternal mortality ratio was 246 per 100,000 live births, and maternal mortality index was 0.39. The pregnant women who had severe preeclampsia, eclampsia, and ruptured uterus found to have higher odds of getting maternal near miss

Conclusion: The results revealed that the maternal near miss ratio in this study was low, whereas maternal mortality ratio was 246 per 100,000 deliveries which was higher than worldwide average of maternal mortality ratio (211 per 100,000 deliveries in 2017). Moreover, the study highlighted that the quality of care during the reviewed period needed to improve, showed the highest number of deaths following abortion related sepsis cases.

Field of Study:	Public Health	Student's Signature	
Academic Year:	2020	Advisor's Signature	

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LIST OF ACRONYMS

ANC   Antenatal Care

APH   Antepartum Hemorrhage

LB   Live Birth

MDR   Maternal Death Review

MMR   Maternal Mortality Ratio

MNM   Maternal near miss case

MOHS   Ministry of Health and Sports (Myanmar)

MRH   Magway Regional Hospital

OG   Obstetrics and Gynecology

PPH   Postpartum Hemorrhage

PIH   Pregnancy Induced Hypertension

SDG   Sustainable Development Goals

WHO   World Health Organization

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CHAPTER 1

INTRODUCTION

1.1. Background and rationale of the study

Since the Millennium Development Goals in the 1990s, the world has been committed to reduce maternal mortality. In twenty first century, Sustainable Development Goal is a continuation of this commitment among many agenda. For the SDG, it had been simply integrated with 17 Goals and 169 targets through the advances of social, political, economic and health care sector. Amongst the targets, reduction of global maternal mortality ratio to less than 70 deaths per 100,000 live births by the end of 2030 is the first priority process indicator made by countries **(1).** In spite of these efforts, global maternal mortality is nevertheless undeniably high with approximately 810 women die every day from pregnancy complications, delivery-related issues, and childbirth **(2)**. Moreover, compared with the developed countries, reduction of MMR is an even slower progress and a major challenge in developing countries where there are risk of economic development and resources-limited setting **(3)**. In these countries, most of women died from severe maternal outcomes or life-threatening conditions during their pregnant life, delivery or puerperal period. Only smallest numbers of women survived from these dangerous conditions. Distressingly, three quarters of maternal mortality are from the preventable causes such as heavy bleeding (hemorrhage), pre-eclampsia, and infection. In addition, maternal mortality is just the beginning of this serious concern. Since it has been estimated that for every maternal death, 20 to 30 women face pregnancy and childbirth-related morbidity, with most causes are also preventable **(4).**

Although the SDG for maternal mortality has not reached its target, the maternal death has been declined. In the light of this situation, focusing on women with serious maternal complications (both maternal near miss cases and maternal deaths) and evaluating the quality of care proposed by World Health Organization **(5)**, would provide a better suggestion of maternal health care system. A maternal near miss (MNM) 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" **(5)**. Since 2007, technical team of WHO defined this standard definition and identification criteria for MNM cases. The main intention of this MNM criteria approach is to get a better clinical practice and to reduce avoidable serious cases by using the research-based finding **(6).**

There are many studies about maternal near miss cases by using WHO maternal near miss approach. Across the worldwide, the total prevalence number of MNM was 18.67 per 1000 live births. Alarmingly, the second highest number of MNM cases was detected in Asia, at nearly 17 per 1000 live births. It is also noticeable that the proportion of MNM prevalence of Africa was included in the highest group, at 31.88 per 1000 live births, while MNM cases in Europe was the lowest with 3.10 per 1000 live births. According to this result, ASEAN countries have still included in the highest range of maternal cases with serious maternal outcomes **(7).**

One of the ASEAN countries, Myanmar has the total number of 815 maternal deaths (MMR 282 deaths per 100,000 live births) in 2016 **(8).** From the year 2016, maternal deaths dramatically increased with 913 deaths reported by Maternal Death Surveillance and Response (MDSR) **(9)** . The top three major leading causes of maternal mortality ratio were unspecified abortion, which accounted for 23%,

followed by other complications of labor and delivery (18%) and postpartum hemorrhage (PPH) with 7%. Yearly hospital data reports showed that the main leading causes of morbidity were pregnancy related cases, childbirth and puerperium cases, which were dramatically increased over the 6 years period in Myanmar (from 17.6% in 2012 to 20.2% in 2018). Additionally, in 2018 these morbidity cases reached almost 600,000 cases. Additionally, in 2018 these morbidity cases reached almost 600,000 cases. These data signify an issue or concern with the importance of detecting pregnant women with severe complications **(10)**. Nonetheless, developing countries tend to overlook these severe complications behind the increased number of death rates. Moreover, Maternal Death Review also illustrated that more than half of maternal cases died in the post-partum period, and around 15% died during delivery. One quarter (25%) of the maternal death cases were happened during pregnancy life **(8).** The review data highlighted that receiving the qualified maternal health care from antenatal period to postpartum period is an essential factor to decrease the deaths and risk of pregnancy complications. Therefore, while many health care strategies implementing to prevent deaths, there is also needed to consider the advances of continuity and quality of maternal health care.

Regarding with the quality of maternal health care, in Myanmar, the major treatments and services of maternal health care were given in tertiary public hospitals of biggest regions and states like Magway, Mandalay and Yangon. Public hospitals in these regions provide major operation, emergency obstetric care and maternal health care services in treating the serious cases from antenatal to postnatal period **(10).** Magway region, one of the top ten largest areas of Myanmar, located in central part of country where almost 4 million people lived in there **(11).**

According to report of Myanmar census data, in 2016, Magway is included in the highest range where maternal death is at 77 deaths. The deaths rate remained stable in 2017, at 79 deaths, but the number of deaths fell suddenly in 2018, at 64 deaths per 100,000 live births. In the year 2019, the figures of maternal death noticeably declined by around 10% above (56 deaths) (**12**). It was also noticeable that the most considerably decrease was detected in abortion. Around 16% abortion rate was detected in 2012, but it dropped to just fewer than 10% by 2018. These declined results are indicated that the advances of continuity and quality of maternal health care are strongly correlated with death rate. Moreover, this consecutive drop rates reflect the improvement of maternal health care services of Magway region (**10**).

Regarding with maternal health care services in Magway Region, among leading causes of hospitalization in 2018, the proportion of single spontaneous delivery (8.1%) and single delivery by caesarean section (7.6%) were highest. Further, Myanmar Health Statistics 2020 reported that in 2019, delivery in public hospital as percentage of deliveries (59.9%), home delivery by Basic Health Staffs 21% and home delivery by Auxiliary Midwives 6% were seen in Magway (**12**). Match up with previous years at state level, Antenatal coverage by basic health staff in 2016 got 5% higher than 2015, 10% higher than 2012. Postnatal Care Coverage increased year by year within five years: 79.7% in 2012, 80% in 2013, 85% in 2014, 86% in 2015 and 97% in 2016 (**13**).

Magway's health system composed of 102 public hospitals. Among them, Magway Regional Hospital is a 200-bed capacity tertiary hospital and included in major public hospitals in Magway State. It has 10 specialist departments for both inpatient and outpatient care. According to statistics from hospital, average number of

in-patient per day is nearly 400 and out-patient per day is more than 200. In addition, the deliveries were increased year by year. In 2019, there were more than 3,000 deliveries in hospital. Maternal mortality ratio of Magway Regional Hospital fell gradually from 13 deaths per 100,000 live births in 2017 to 10 deaths per 100,000 live births in 2019. Most of the deaths are abortion related cases **(14).** Nevertheless, the near-miss cases are still overlooked and remain unknown. Even though, there are many studies about maternal mortality ratio in Myanmar; there is still lacking on the information of MNM prevalence and its association. Therefore, the main objectives of this study are to estimate the prevalence and the associated factors of maternal near miss in Magway Regional Hospital during the year 2019, Magway, Myanmar.
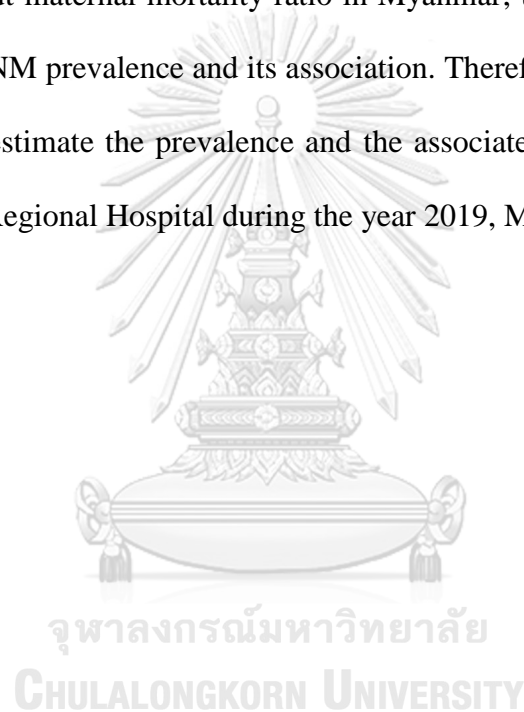
1.2. Research questions

1. What is prevalence of maternal near miss cases in Magway Regional Hospital, Magway, Myanmar in 2019?

2. What is the quality of maternal healthcare services in Magway Regional Hospital, Magway, Myanmar in 2019?

3. Is there any association between maternal characteristics and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019?

4. Is there any association between severe pregnancy complications and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019?

5. Is there any association between obstetric characteristics and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019?

6. Is there any association between underlying causes and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019?

7. Is there any association between contributory/associated condition and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019?

1.3. Research Objectives

General Objective

To estimate the prevalence and determine the factors associated with maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019

Specific objectives

1. To examine quality of maternal healthcare services in Magway Regional Hospital, Magway, Myanmar in 2019

2. To determine the association between maternal characteristics and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019

3. To determine the association between severe pregnancy complications and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019

4. To determine the association between obstetric characteristics and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019

5. To determine the association between underlying causes and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019

6. To determine the association between contributory/associated condition and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019

1.4. Research hypotheses

1. Null hypothesis:

    There is no association between maternal characteristics and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019.

    Alternative hypothesis:

    There is an association between maternal characteristics and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019.

2. Null hypothesis:

    There is no association between severe pregnancy complications and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019.

    Alternative hypothesis:

    There is an association between severe pregnancy complications and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019.

3. Null hypothesis:

    There is no association between obstetric characteristics and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019.

    Alternative hypothesis:

    There is an association between obstetric characteristics and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019.

4. Null hypothesis:

    There is no association between underlying causes and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019.

    Alternative hypothesis:

    There is an association between underlying causes and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019.

5. Null hypothesis:

    There is no association between contributory/associated condition and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019.

    Alternative hypothesis:

    There is an association between contributory/associated condition and maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019.

1.5. Conceptual Framework

Independent Variables	Dependent Variable

Maternal characteristics

- Maternal age
- Marital status
- Educational level
- Occupation

Severe Pregnancy complications

- Severe postpartum hemorrhage
- Severe preeclampsia
- Eclampsia
- Sepsis or severe systemic infection
- Ruptured uterus

Obstetric characteristics

- Gravida
- Parity
- History of Abortion
- Mode of Delivery/End of pregnancy
- History of AN care

Underlying Causes

- Pregnancy with abortive outcome
- Obstetric Hemorrhage
- Hypertensive disorders
- Pregnancy related infection
- Other obstetric disease or complication
- Medical or surgical or mental disease or complication
- Unanticipated conditions
- Coincidental conditions

Contributory /Associated Condition

- Anemia
- HIV infection
- Previous caesarean section
- Prolonged labour

Maternal near miss

1.6. Operational definitions

- Maternal age: The age of woman at the time of getting pregnancy which is divided into three groups ($\leq$ 24 years old, 25 – 34 years old, $\geq$ 35 years old)

- Marital Status: It is categorized as married (legally) and unmarried.

- Educational Level: It refers illiterate, primary school level, middle school level and higher. It measured by number of grades and degree.

    - Illiterate: Pregnant woman who has no grade or who is unable to read or write

    - Primary: Education up to 4th grade

    - Middle school level and higher: 5th grade and above

- Occupation: It corresponds to the pregnant woman's working condition; housewife, manual worker, vendor, professional worker or other.

- Quality of maternal healthcare services: The proportion of pregnant women who received the recommended evidence-based intervention by WHO. The quality of maternal healthcare services was calculated in percentage and identified as "pass" or "an opportunity to improve care".

- Severe pregnancy complications: referred to five complications included severe postpartum hemorrhage, severe preeclampsia, eclampsia, sepsis or severe systemic infection, and ruptured uterus, that are associated with pregnancy.

    o Severe postpartum hemorrhage: Referred to genital bleeding after delivery, with at least one: perceived abnormal bleeding (1000 ml or more) or any bleeding with hypotension or blood transfusion. It was defined as Yes or No.

- Severe preeclampsia: Referred to persistent systolic blood pressure of 160 mmHg or more or a diastolic blood pressure of 110 mmHg. Excludes eclampsia. It was defined as Yes or No.

- Eclampsia; Referred to generalized fits in a patient without previous history of epilepsy. Includes coma in pre-eclampsia. It was defined as Yes or No.

- Sepsis or severe systemic infection: Referred to presence of fever (body temperature >38°C), a confirmed or suspected infection (e.g. septic abortion, pneumonia), and at least one: heart rate >90, respiratory rate >20, leukopenia (white blood cells <4000), leukocytosis (white blood cells >12 000). It was defined as Yes or No.

- Ruptured uterus: Referred to rupture of uterus during labour. It was defined as Yes or No.

- Gravida: It means total number of pregnancies including the current pregnancy, irrespective of the period of gestation, and divided into three groups (G1, G2 and G3, G4 and above)

- Parity: It means total number of completed pregnancies/delivered the baby (live birth and still birth) beyond 20 weeks of gestation, and divided into three groups (P0, P1 and P2, P3 and above).

- History of Abortion / Miscarriage: The women who had experienced in abortion whether complete abortion or not. It was categorized as "None" and "One time and above".

- History of AN Care: It referred to the pregnant woman who had ever received at least one time of antenatal care from health care staffs/professional. It was

categorized into "Received ANC from health care staffs" and "Did not receive ANC from health care staffs"

- Mode of Delivery/End of Pregnancy: It referred to when the pregnant women give birth in normal way (spontaneous) or vacuum extraction or forceps or caesarean section. When women have ectopic pregnancy or miscarriage, delivery way refers laparotomy or uterine evacuation or dilation or evacuation. The pregnant women who attend the hospital to receive treatment for minor cases, then she goes back home with healthy condition refers discharged still pregnant.

- Underlying causes: It means the basic cause of maternal death or near-miss cases; abortion, obstetric hemorrhage, hypertensive disorder, infection or medical diseases.

  o Pregnancy with abortive outcome defined as Yes or No abortive outcome. The criteria of abortive outcome by medical staff from Magway Regional Hospital is retained products of pregnancy tissues found from sepsis induced abortion or ectopic pregnancy.

  o Obstetric Hemorrhage means Yes or No obstetric hemorrhage defined by medical staff from Magway Regional Hospital such as antepartum hemorrhage.

  o Hypertensive disorders recorded as Yes or No underlying hypertension disorder recorded by medical staff from Magway Regional Hospital.

  o Pregnancy related infection means Yes or No infection defined by medical staffs of Magway Regional hospital such as candidiasis and urinary tract infection.

- o Other obstetric disease or complication means Yes or No obstetric complication/disease like placenta previa, cervical ectopian and uterine atony.

- o Medical or surgical or mental disease or complication is Yes or No medical disease recorded by medical staff of Magway Regional Hospital such as diabetes mellitus, hepatitis B, and chest infection, systemic lupus erythematous and mental disease.

- o Unanticipated conditions defined as Yes or No conditions recorded by medical staff such as accident or injury.

- o Coincidental conditions mean when the pregnant women with life-threatening condition become worse due to its underlying disease.

- Contributory or Associated Condition: It is supporting factor that contribute life-threatening condition, such as medical disease or obstetric history.

  - o Anemia defined as Yes or No anemia by medical staffs from Magway Regional Hospital. The criterion of anemia in MRH: for 24 gestational week hemoglobin range is lower than 10.5 g/dl, for 25 – 36 week hemoglobin ranges lower than 10 g/dl.

  - o HIV infection defined as Yes or No HIV infection by medical staffs from Magway Regional Hospital. The criterion of HIV in MRH is when HIV test showed positive. Hospital can't test CD4count due to resource limitation and financial situation.

  - o Previous caesarean section means Yes or No documented by medical staff for the women who had birth history of caesarean (surgical) delivery.

- o Prolonged labour is Yes or No prolonged labour by medical staffs from Magway Regional Hospital. The criterion of prolonged labour in MRH is labor lasting hour more than 8 hours.

- Maternal near miss: Referred to the women who nearly died but survived a complication during pregnancy, childbirth or within 42 days of termination of pregnancy. The Maternal near miss cases were identified as "Yes" and "No" if one or more of the complications, related to the organ dysfunctions was presented. The organ dysfunctions include cardiovascular dysfunction, respiratory dysfunction, renal dysfunction, coagulation/hematologic dysfunction, hepatic dysfunction, neurologic dysfunction, uterine dysfunction/hysterectomy, and multiple organ dysfunctions.

CHAPTER 2

LITERATURE REVIEW

This chapter presented previous literature result that supported for current research. Global maternal mortality ratio reduction is designated as MDGs since a long time period ago. In reducing the maternal deaths, there is needed to consider factors associated with severe pregnancy-related complications lead to death and near-miss cases and quality of maternal health care services. These considering factors were explained as subtopics under below.

2.1. Sustainable Development

In 2000, to address the maternal health, targets were established as part of Millennium Development Goals (MDGs). The fifth goal of eight MDGs is more than half of the maternal mortality ratio must be reduced between 1990 and 2015. After 2015, MDGs results proved that global goals definitely play a role in effecting large-scale improvement and also helped in implementing the targets, then constructed SDGs (**15**).

In 2015, United Nations Member States which includes 195 nations (developed and developing countries) decided to do 2030 Agenda for sustainable development. The core part of this agenda is 17 SDGs with 169 targets based on the MDGs. The intention of this agenda is to become a well-established and better future for all by the year 2030 (**1**).

Among 17 SDGs, Goal No - 3 (ensure healthy lives and promote well-being for all at all ages) is primarily linked with health system. It has 13 targets and 28 indicators to measure achievement of each country. Further, it focused on to access

universal coverage that seeks delivering healthcare service to all population equitably **(16).**

The Goal 3 set up targets to cover a broader range of issues including reduction of the preventable deaths of newborn, infants and under 5 children, communicable and non-communicable diseases. The first priority target (3.1) is that maternal mortality ratio must be decreased fewer than 70 per 100,000 live births by 2030. Pregnancy complications are the basic cause of maternal deaths among women in developing countries. They have a higher risk of life-threatening obstetric emergency conditions. To get this target, the pregnant women require accessing the quality of care until the end of pregnant life. Around 46% of women in low-income countries benefit from skilled care during delivery. This mean that millions of deliveries were not done by doctors, midwifes or trained nurses. Thus, Goal 3 observed another indicator about reduction of maternal deaths (3.1.2 – percentage of births attended by trained health care workers who give care and supervise to pregnant women during delivery and after delivery) **(17).**

2.2. Global Maternal Mortality Ratio

The maternal mortality ratio (MMR) refers to the number of maternal deaths during the specified period of time per 100,000 live births in the same period. The *figure 1* shows the global maternal mortality ratio, which are for the year 2017. In 2017, globally, around 295, 000 women died during pregnancy life and postnatal period. The most deaths are occurred in developing countries, and most of these death cases are preventable. Due to poverty, too far from getting information and inadequate efficient services, most of developing countries are struggling to achieve the goal 3 targets **(18).**
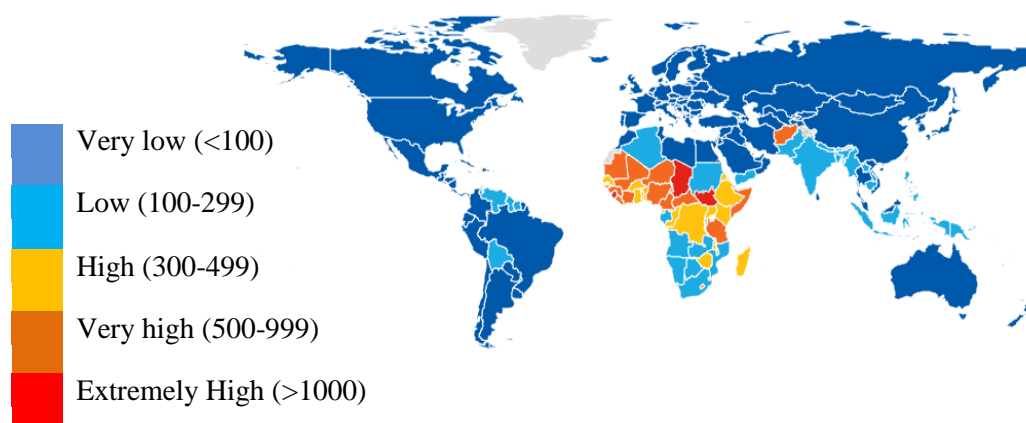
Figure 1: Global Maternal Mortality Ratio (18)

2.3. Maternal Deaths in Myanmar

2.3.1. Myanmar demographic

The Republic of the Union of Myanmar is located in South-East Asia, bounded by Bangladesh, India, China, Laos and Thailand on the landward side. In 2019, Myanmar has total population of more than 54 million, in which 70% of populations are lived in rural areas. 53.2 percent of populations are female while others are male. Among female population, nearly half of the total percent are reproductive age population who gave birth **(19).**

2.3.2. Maternal mortality in Myanmar (2000-2017)
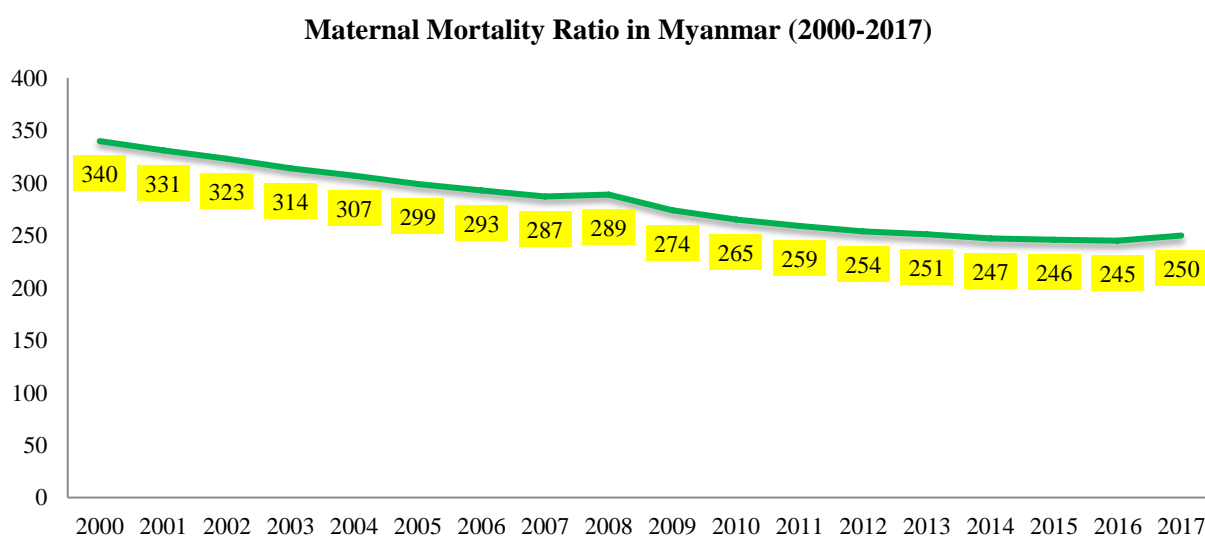
Figure 2: Maternal Mortality Ratio in Myanmar (18)

World Bank reports illustrated that in Myanmar, the trend of maternal mortality rate is remarkably decreased after a decade and half from 2000 to 2017 (*figure 2*). The highest number of maternal deaths was detected in 2000. It means that every day in 2000, approximately 10 women died from pregnancy related complications or life-threatening conditions. But maternal deaths were slowly decreased year by year until 2017 **(20).**

2.3.3. Maternal morbidity in Myanmar

The single spontaneous delivery and single delivery by caesarean section are the leading causes of Morbidity in 2017 and 2018. Unspecified abortion also included in top ten highest list of morbidity **(10).** From 2015 to 2017, it can be seen that out of these complications, the leading morbidity cases were the same with those in previous years with obstetric hemorrhage including antepartum and postpartum being the highest (32%, 30% and 36%); followed by PIH (Pregnancy Induced Hypertension) at 18%, 20% and 19% respectively; other or indirect causes (26%, 28%). In *figure 3*, the most noticeable difference between years is the number of sepsis that has declined, comprising 5 per cent compared to figures reported from previous years as 11 per cent (2015) and 8 per cent (2016) **(8, 21)**.
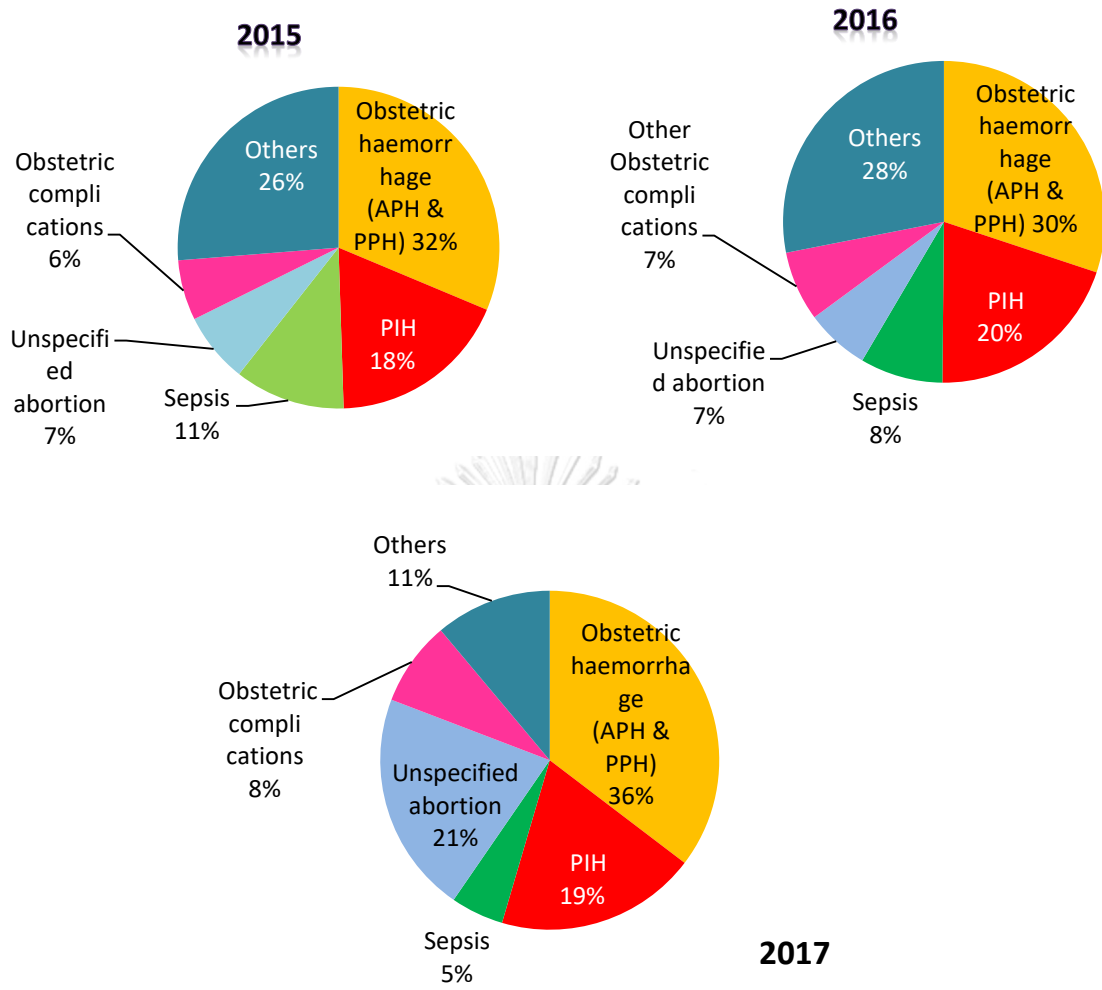
*Figure 3: Yearly percentage of maternal morbidity in Myanmar (**8, 10, 21**)*

2.4. Factors to maternal morbidity and mortality

Table 1: Individual Risk factors associated with maternal deaths and maternal morbidity (4)

Age	Women who aged between the extreme range of reproductive life (less than 20 years and greater than 35 years) have a higher risk of pregnancy complications and death.
Parity	First and more than three to five pregnancies are having higher risk of complications and deaths. Moreover, women with very high- order births pregnancies can neglect on maternity complications if their previous deliveries were uncomplicated. According to some literatures, multiple pregnancies have a great chance to suffer postpartum hemorrhage; women in their first pregnancy have a longer duration of labor.
Unwanted pregnancies and abortion outcomes	Unwanted pregnancy is a major contributor for unsafe abortion. Women who lack of social care and support will not prepare childbirth plan, in the worst, when they suffer domestic violence from their unmarried husband or husband, they are more likely to commit suicide.
Women's education	The educated women know the effectiveness of ANC services and are more likely to take these services.
Past obstetric history	The previous history of stillbirth and emergency cesarean delivery used as a predict factor for pregnancy complications and deaths.

Marital Status	The women who have not married yet are lacking social or mental support from their partners or their families, and then they will try to induce abortion or suffer financial difficulties when seeking care for childbirth.

2.4.1. Factors to maternal morbidity

The above table 1 (Individual Risk factors associated with maternal deaths and maternal morbidity) plus other medical problems have an association with severe maternal morbidity. These problems include anemia, pre-existing diabetes or hypertension and other mental problems **(4).** One systematic review of the prevalence of maternal hemorrhage proved that the pregnant women who suffer massive blood loss during delivery may remain anemia for long term period **(22).** It is also noted that the pregnant women who got too high blood sugar levels during pregnancy have a greater risk of early delivery, preeclampsia, and having big baby which can trouble delivery. Another medical problem which leads to maternal morbidity is UTI (urinary tract infection). It is the bacterial infection in urinary tract. If women infected, they need to see the health care provider to test their urine and treat the infection with antibiotics **(23)**.

Center of Disease Control and Prevention (CDC) already identified that other contributing factors which can cause maternal morbidity are placenta previa and placenta abruption. If vaginal bleeding is heavy or preterm labor pain start without stopping bleeding, the baby will be delivered by emergency cesarean section. Regarding with placenta abruption, sometimes this problem disappeared by home rest,

but when it worse, the pregnant women who need to seek immediate medical attention **(23).**

2.4.2. Factors associated with maternal mortality

Across the worldwide, early 80% of all maternal deaths are due to direct obstetric causes and deaths due to indirect causes counted around 30% of all deaths. The main contributing factors to maternal deaths are hemorrhage and hypertensive disorders in developing countries, particularly in Asia and Africa. For the deaths concerned with obstetric cases, it is crucial to evaluate the cases with acute complications during pregnancy and cases with serious maternal outcomes (both "near-miss" cases and maternal deaths) **(24).**

According to World Health Organization data, the most important causes of maternal death are obstetric hemorrhage, hypertension, abortion, and sepsis. Further, WHO already mentioned indirect causes of maternal deaths were AIDS, Sexually Transmitted disease and other medical problems such malaria, TB. The pregnant women with HIV infection must take prevention of Mother-to-Child Transmission (PMTCT) and treatment of HIV program since first time of antenatal care **(25).**

The health facility-based studies on causes of maternal mortality from Ethiopia illustrated that although abortion related problems are reduced after a decade, obstructed labor/uterine rupture, hemorrhage and hypertensive disorders of pregnancy are still leading in maternal death. Obstructed labor cases were happened when pregnant women who came to health facility very late or they have lacked of getting obstetric services **(26).**

2.5. Maternal near miss

In 2007, typical definition and standardized criteria for maternal near miss were issued by professional working group of WHO. A maternal near miss (MNM) 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." Later on, WHO published maternal near miss approach in order to assess the women with severe complications during their pregnant life and to observe and get a better quality of maternal related health care services **(5).**

2.5.1. WHO CRITERIA FOR Maternal near miss

Table 2: WHO criteria for maternal near miss cases

	Clinical Criteria	Laboratory Criteria	Management Criteria
Cardiovascular dysfunction	- Shock - Cardiac arrest	- pH < 7.1	- Continue use of vasoactive drugs - Cardiopulmonary resuscitation
Respiratory dysfunction	- Acute cyanosis - Gasping - RR > 40 bpm or <6 bpm	- Oxygen saturation (<90% for ≥ 1hr)	- Intubation and mechanical ventilation
Renal dysfunction	- Non-responsive oliguria	- creatinine ≥ 3.5 mg/dl	- Dialysis
Hematologic dysfunction	- Clotting failure	- Acute thrombocytopenia < 50,000 platelets	- Transfusion of red blood cell concentrate ≥ 5 units
Hepatic dysfunction	- Jaundice with pre- eclampsia	- Acute bilirubin > 6 mg/dl	
Neurologic dysfunction	- Loss of consciousness ≥ 12 h - Repeated seizures		
Uterine dysfunction			- Hysterectomy due to infection or bleeding

Maternal near miss cases were identified by using the WHO criteria (Table 2)

that set up clinical, laboratory and management criteria. The clinical criteria

comprised the case with women who experienced shock, cardiac arrest, gasping, acute

cyanosis, clotting failure, oliguria, jaundice with pre- eclampsia, loss of consciousness

≥ 12 h, respiratory rate greater than 40 or less than 6 and repeated seizures. Another

one is laboratory standard. The women who have pH value less than 7.1, oxygen

saturation (<90% for ≥ 1hr), creatinine ≥ 3.5 mg/dl, acute thrombocytopenia < 50,000

platelets, acute bilirubin > 6 mg/dl are meet with laboratory standard for near miss

cases. The final criterion for identifying near miss cases is management criteria.

Among the women who use vasoactive drugs continuously, who received cardiopulmonary resuscitation, intubation and mechanical ventilation, dialysis treatment, excessive blood transfusion ($\geq$ 5 units) and the women who have done hysterectomy due to infection or bleeding are regarded as near miss cases **(27).**

There are several types of studies about maternal near miss cases and quality of care *(Figure 4)*. The Ghana study found that the WHO near-miss approach can be regarded as a reasonable strategy in low-income countries. By reviewing the result from this approach, referral system and clinical practice would be improved, but also severe maternal complications could be reduced **(28)**.
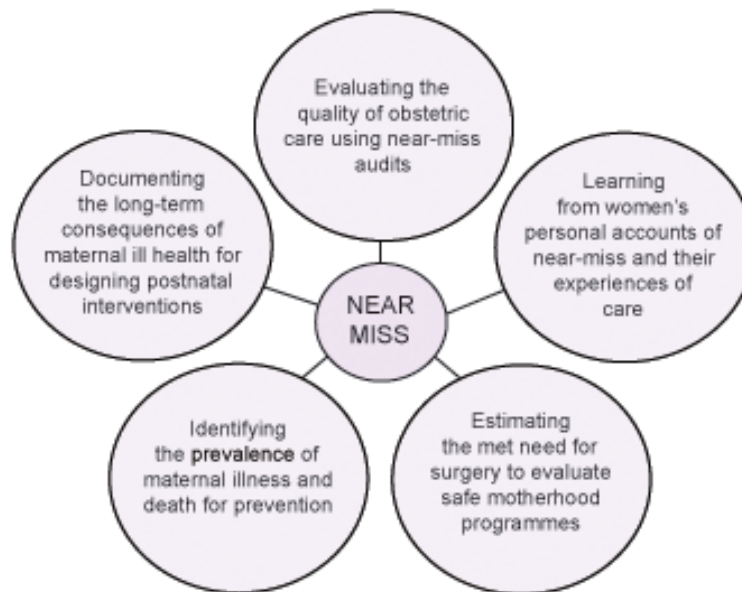

Figure 4: Maternal near miss approaches in health research **(29)**

In 2010, researchers in Baghdad investigated maternal near miss and quality of maternal health in six major public hospitals. This study showed that maternal near miss approach allowed the better pathway for improving the quality of maternal health care services. In addition, if results based health care programs were effectively used, better referral system along with reducing serious cases would be achieved **(30).**

In Nepal, a survey about near-miss cases and maternal mortality also conducted in Medical Hospital. This result indicated that the principal causes of deaths and near-miss cases were almost the same, and then, maternal health care services recording system for severe maternal outcomes was still under development **(31).**

2.6. Severe pregnancy-related complications lead to death and near-miss cases

The major complications are post-partum hemorrhage, sepsis, pre-eclampsia and eclampsia. Nevertheless, Table 3 presents the possible complications those can lead to near-miss cases.

An observational study about near-miss cases was conducted in four major countries within Levant region. This study revealed that antepartum and postpartum hemorrhage cases were the major contributing factors of maternal near miss cases **(32).** The other finding in Australia showed that most of near-miss cases were found in women associated with early pregnancy complication, pregnancy-induced hypertension and hemorrhage related problems **(33).**

Moreover, a study conducted in a specialized health care centers in Europe also proved that women with high blood pressure cases caused maternal deaths and severe maternal outcome. Further, this study highlighted that pregnant women who

received early-diagnosis and proper treatments since early gestation period have not suffered severe complications than those who have not **(34).**

Table 3: Pregnancy-related complications lead to near-miss cases

Complications	DESCRIPTION
Obstetric hemorrhage	Excessive blood loss $\geq$ 500 ml or 1000 ml in antepartum, intra partum or postpartum period. Due to this fact, women have to transfuse packed cells volume up to 5 units.
Eclampsia	It is characterized by high blood pressure and protein in the urine. The condition affects some pregnant women usually during the second trimester of pregnant life. SBP (more than or equal to 140 mmHg) or DBP (more than or equal to 90 mmHg) with protein. Then, women may get shock and uncontrollable fits **(4).**
Severe systemic infection or puerperial sepsis	Sepsis has a case fatality rate of 33% of preventable maternal death. Temperature above 38` C for over 24 hours or recurring during puerperal period (from the end of the first to the end of the tenth day after childbirth or abortion) **(35).**
Ruptured uterus	It found during childbirth resulted in tearing of uterus. From this problem, maternal deaths are rare but fetal outcomes are not good.
HIV/AIDS	A study on association between HIV/AIDS and obstetric complications showed that women with HIV have more than 3 times to develop sepsis. And they have eight times risks to dead when compared with those who have not infected HIV **(36).**
Abortive outcomes	It includes miscarriage, ectopic pregnancy and abortive conditions. More than 200 women experienced severe morbidity due to unsafe induced abortion for every 100,000 deliveries.

	Those women may receive laparotomy or admit to Intensive Care Unit **(37).**
Obstetric fistula	It is a childbirth injury, resulting from prolonged obstructed labor without timely access to emergency Caesarean section. It becomes included in one of the maternal death causes in 2018. Most of young, poor, illiterate women living in hard to reach areas suffer these complications **(38).**

The Myanmar study also found that post-partum hemorrhage, eclampsia, sepsis and abortion were remained leading causes of maternal severe complications and outcomes. The highest number of maternal cases with these severe complications died in post-natal period, next to antenatal and post-natal period **(8).**

These all studies exploring the main causes of the severe complications highlighted that there is needed to consider on receiving quality of maternal health care from antenatal care after delivery.

2.7. Quality of maternal health care services

In 2015, Ethiopian researchers' national survey detected three quarters of serious cases (maternal near miss cases and maternal deaths) can be prevented by at least one antenatal care visit. Thus, in order to reduce the maternal mortality ratio and severe cases, antenatal care services should be considered as first concern **(39).**

Zeeman GG and others conducted a study about obstetric critical care showed that provision of interventions along with equipment, urgent referral to high level health centers and appropriate management strategies reduced the prevalence and risk of life-threatening conditions **(40).**

In Ethiopia, a study conducted on prevalence of maternal near miss and relating factors among major women hospitals stated that the units of maternal near miss cases were peaked at highest level in 2015. Further, it illustrated that major obstetric care and emergency health care services were strongly correlated with occurrence of maternal near miss cases and death rate **(41).**

In Myanmar, Ministry of Health and Sports delivered health care services based on primary-health care approach. The basic framework based on sub-rural health centers and rural health centers where Midwives, Health Assistant and Public Health care Staff are assigned to provide health services. The patients who need special care or emergency treatment are referred to township or specialist level **(42, 43)**. The major or specialist health care services are given in public hospitals of big cities. Among them, the major public hospitals (Yangon, Mandalay and Magway) have performed surgical operation cases and given emergency obstetric care services **(10).**

In Magway, the total number of hospitals in 2014 and in 2018 was 82 and 102 respectively. On average, public hospitals in Magway Region provided outpatient care for almost 600,000 outpatients and over 35,000 deliveries in 2018. Further, there is an upward trend on pregnant women who seeking antenatal care (ANC) from public hospitals, ANC coverage increased from between 70% and 85% in 2012 to 89% in 2019. In addition, more than 90% of deliveries were attended by skilled birth professionals **(12, 44).**

Myanmar Ministry of Health and Sports (Table 4 and Table 5) conducted the following activities to improve the health status of mothers, newborns and children in achieving the Sustainable Development Goals **(43).**

Table 4: Maternal and Child Health Care Services in Myanmar

Maternal and Child Health Care Activities in Myanmar
- Providing proper antenatal care
- Promoting skilled and institutional delivery and post-natal care
- Expansion of post-abortion care and quality birth spacing services
- Ensuring Emergency Obstetric and Newborn Care
- Providing Essential Newborn Care
- Strengthening Adolescent Reproductive Health Care
- Male Involvement in Reproductive Health
- Focusing Cervical Cancer screening, early diagnosis and treatment
- Establishing Community Health Volunteer
- Promoting Referral System and Community Volunteers for mothers and children

Table 5: MATERNAL HEALTHCARE SERVICES IN MYANAMR (42, 45)

LEVEL	DESCRIPTION OF MATERNAL SERVICES
PRIMARY HEALTHCARE	General medical care, antenatal care for pregnant mothers-nutrition promotion for mothers (iron, B1, and Vitamin A supplementation), exclusive breast feeding, immunization, deworming program and safe motherhood measures – at the RHC, Sub-RHC and MCH centers.
SECONDARY CARE	Primary care plus minor surgery care attached to a minor surgery theatre, emergency cardiac care, laboratory, radiology, supervision and consulting with a gynecologist.
TERTIARY CARE	Specialist care for emergency patients by physicians, surgeons and highest levels of obstetric and neonatal care. Give treatment of more complex maternal medical conditions, obstetric complications and fetal conditions.

In conclusion, the above literatures strongly pointed out maternal mortality ratio reduction was slower progress in developing countries, and that severe pregnancy related complications and maternal near miss cases played a major role in slowing the reduction of maternal deaths. According to literatures, prevalence of MNM across worldwide was 18.67 per 1000 live births, and Asia with MNM at almost 17 per 1000 live births. It was noted that many studies used WHO maternal near miss criteria and approach as measurement tool in order to examine severe maternal outcomes and for improving quality of maternal health care in health care facilities. Other previous studies showed that there is a need to assess factors associated with maternal near miss and severe pregnancy complications.

CHAPTER 3

RESEARCH METHODOLOGY

3.1. Research design

This cross-sectional study employed a health facility-based secondary data analysis to estimate the prevalence of maternal near miss cases, and examine factors associated with maternal near miss in Magway Regional Hospital, Magway, Myanmar in 2019.

3.2. Study area

Magway Division is located in central part of country (Myanmar) (*Figure 5*). As of 2015 census data, it had a total population of nearly 4 million. Out of these, 53.69% were females while others were males. In term of population density ranking, Magway region stood at seventh place. The total population of Magway region defines almost 8% of total population of Myanmar. In this area, around 85% lived in rural areas and most of women and men do farming **(11).**
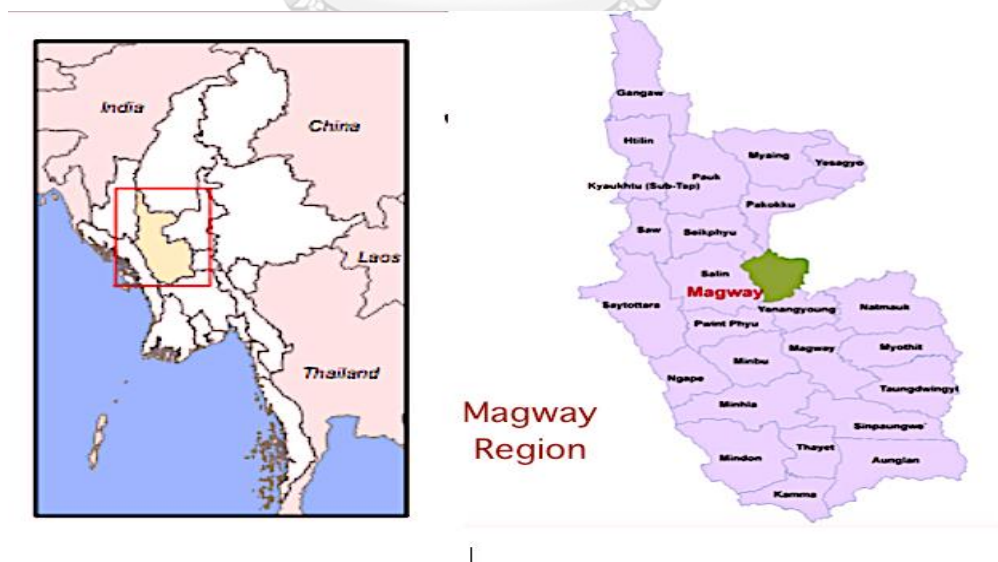

Figure 5: MAP OF MYANMAR

The data was collected from the Obstetrics and gynecology ward of Magway Regional Hospital, which was the major public hospital, located on the main road of Magway City (Corner of Pyi-Taw-Thar Road and Hospital Road, Township, Magway, +063 25511). It performs major operations and provides specialized treatment. There were more than 5,000 AN attendance (outpatients), nearly 3,500 obstetric admissions and almost ten patients in ICU (Intensive Care Unit) admission annually.
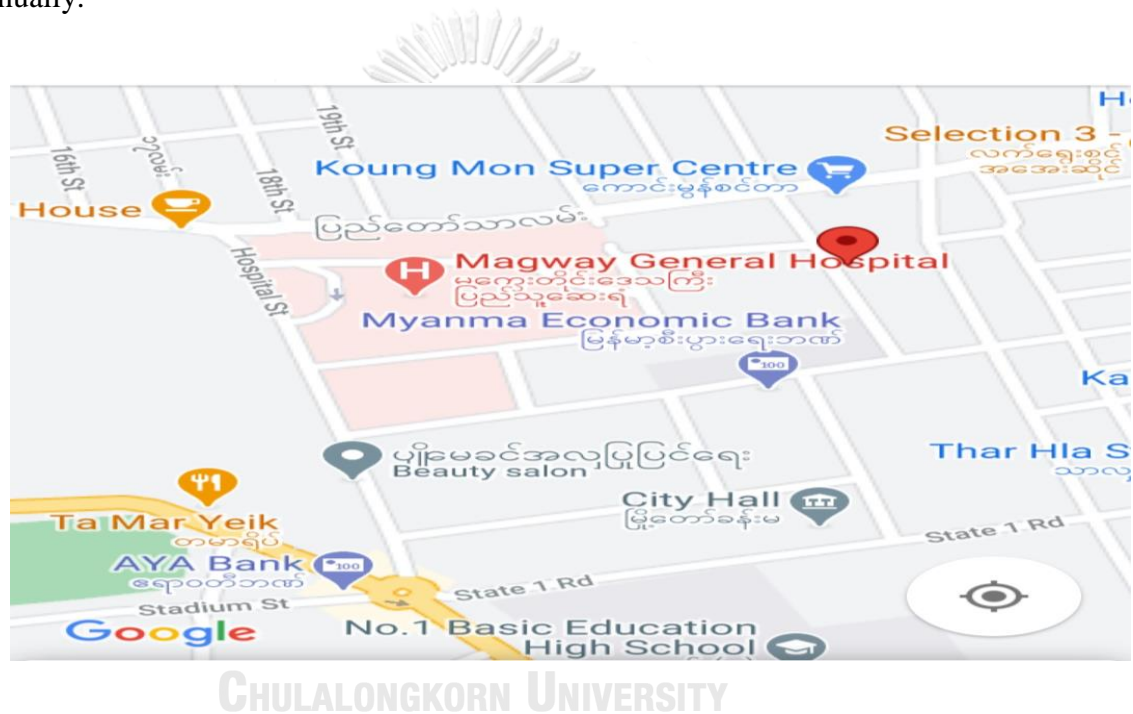

Figure 6: Study location

3.3. Study period

Data was collected from March to June 2021.

3.4. Study population

All pregnant women who were admitted or referred to Magway Regional Hospital within 42 days of termination of their pregnancy in 2019 will be included in the study.

3.4.1. Inclusion criteria

- All medical records of pregnant and admitted or referred to the obstetrics and gynecology ward Magway General Hospital during pregnancy or within 42 days of termination of their pregnancy in 2019.

3.4.2. Exclusion criteria

- All records with incomplete maternal near miss related data were removed from the analysis.

3.5. Sample Size

From the hospital data, there were 3396 pregnant women attended for maternal care and services in 2019. After excluding the misinformation and data error, the final sample size in this study was **3291 pregnant women.**

3.6. Sampling technique

Multistage sampling technique was used. Magway was purposively selected since it was one of the biggest states in Myanmar. In Magway city, there is only one tertiary hospital. As one of the tertiary hospitals with the highest numbers of admission of pregnant women, Magway Regional Hospital was purposively selected as a study area. All pregnant women who were admitted or referred to Magway Regional Hospital during within 42 days of termination of their pregnancy in 2019 and match with the study criteria were included in the study.

3.7. Measurement tool and Data collection

In this study, hospital records were the main source of information. A data collection form was designed in order to collect general characteristics of the study participants such as maternal age, education and occupation which were already reported in in admission and medical record (Appendix 3). Reviewing the hospital record was performed to identify the maternal near miss cases using the WHO

Maternal near miss Tool (Appendix 2) in an individual data collection form. The WHO Maternal near miss Tool followed the use of WHO maternal near miss criteria. In addition, with respective of the maternal outcome, gestational age and neonatal outcome were collected. In the process of reviewing on the hospital record, confusing facts were clarified with the help of hospital staffs. The collected data were entered as a coded form in SPSS software version 22.

3.8. Data analysis

3.8.1. Maternal characteristics

There were four items for socio-demographic characteristics which consist of Age, Marital status, Educational level and Occupation. Age meant the age of pregnant woman at the time of pregnancy. Marital Status was categorized as married (legally) and unmarried. Educational level also categorized as illiterate, primary, middle school level and higher. Lastly, occupation variable categorized as housewife, manual worker, vendor, professional worker or other (Appendix 3).

3.8.2. Maternal near miss case
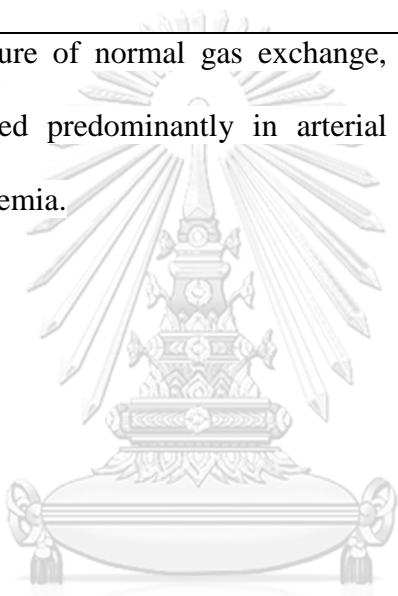
The maternal near miss cases were identified as a near-miss case if the one or more of listed conditions were presented. The WHO near-miss criteria and tool (Appendix 2) used, and the listed conditions were as below:

- Cardiovascular dysfunction

- Respiratory dysfunction

- Renal dysfunction

- Coagulation/hematologic dysfunction

- Hepatic dysfunction

- Neurologic dysfunction

- Uterine dysfunction/hysterectomy

- Multiple organ dysfunction

Table 6: Types of organ dysfunctions (46)

Types of dysfunctions	Definition	WHO Defined sign and symptoms or conditions
Cardiovascular dysfunction	It consist of five features: 1. a generalized reduction in peripheral vascular tone, mediated largely through the local vasodilatory activity of nitric oxide 2. a generalized increase in capillary permeability producing diffuse capillary leak and edema, and contributing to further dysfunction in other organ systems 3. alterations in regional blood flow to specific organ beds 4. Micro vascular plugging and stasis, resulting from occlusion of the microvasculature by abnormally rigid erythrocytes and leukocytes,	• Shock • cardiac arrest • severe hypo perfusion or severe acidosis • receive cardio-pulmonary facility resuscitation • take vasoactive drugs continuously

	and resulting in arterio-venous shunting that contributes to a high mixed venous saturation 5. myocardial depression, affecting the right side of the heart in particular	
Respiratory dysfunction	A failure of normal gas exchange, reflected predominantly in arterial hypoxemia.	• acute cyanosis • gasping • severe tachypnea • severe bradypnea • severe hypoxemia • Intubation and ventilation not related to anesthesia.
Renal dysfunction	Impairment of normal selective excretory function, initially in oliguria despite adequate intravascular volume, but later in a rising creatinine level, and fluid and electrolyte derangements of sufficient magnitude that dialysis is required.	• oliguria non responsive to fluids or diuretics • dialysis for acute renal failure • severe acute azotemia

Coagulation/ hematologic dysfunction	Leukocytosis is an adaptive response to a variety of acute stresses and therefore commonly present, although not truly a manifestation of organ dysfunction. Similarly a mild anemia resulting from both bone marrow suppression and iatrogenic blood-taking is common. Thrombocytopenia, in its most extreme form resulting in disseminated intravascular coagulation (DIC).	• failure to form clots • massive transfusion of blood or red cells (≥ 5 units) • severe acute thrombocytopenia
Hepatic dysfunction	It reflected in hyper bilirubinemia and cholestasis, rather than in biochemical evidence of hepatocellular injury or synthetic dysfunction.	• jaundice in the presence of pre-eclampsia • severe acute hyper bilirubinemia
Neurologic dysfunction	An altered level of consciousness, reflected in a reduction in the Glasgow Coma Score.	• prolonged unconsciousness / coma (lasting >12 hours) • stroke • status epilepticus /

		uncontrollable fits or global paralysis
Uterine dysfunction/ hysterectomy	Hysterectomy is the surgical removal of the uterus. It may also involve removal of the cervix, ovaries, Fallopian tube and other surrounding structures.	• hemorrhage or infection leading to hysterectomy
Multiple organ dysfunction	The development of potentially reversible physiologic derangement involving two or more organ systems not involved in the disorder that resulted in ICU admission, and arising in the wake of a potentially life-threatening physiologic insult.	• Admission to Intensive Care Unit

3.8.3. Quality of maternal healthcare services

The quality of maternal healthcare services was identified as "pass" or "an opportunity to improve care". First, the target participants were identified for each condition (indicator) as show in **Figure 7.** Next, the proportion of that target participants which received the recommended evidence-based intervention for each condition was calculated. For instance, for all reviewed records of pregnant women who had eclampsia, what was the proportion that they received magnesium sulfate? **If**

the proportion is below 95%, it interpreted as an opportunity to improve care. If the proportion is ≥ 95%, it interpreted as a "pass" (5).

3.8.4. Pregnancy complications

Pregnancy complications were identified following WHO near-miss tool (Appendix 2) as a "Yes" and "No" for five complications:

- Severe postpartum hemorrhage

- Severe preeclampsia

- Eclampsia

- Sepsis or severe systemic infection

- Ruptured uterus

3.8.5. Obstetric characteristics

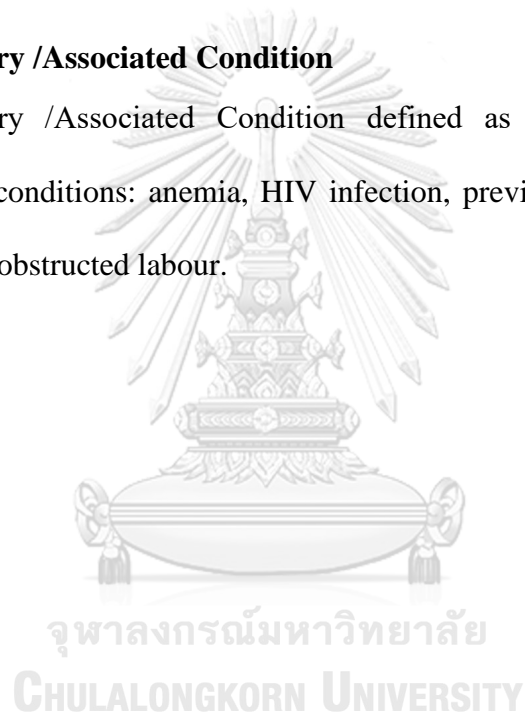The following variables in obstetric characteristics were examined as:

- Gravida defined as total number of pregnancies.

- Parity defined as total number of completed pregnancies/delivered the baby (live birth and still birth) beyond 20 weeks of gestation.

- History of abortion/miscarriage defined as the total number of abortion and miscarriage combined.

- Mode of Delivery/End of Pregnancy defined as the following conditions: "vaginal delivery", "caesarean section", "curettage / vacuum aspiration", "women discharged still pregnant", or "others" (complete abortion, medical methods for uterine evacuation, laparotomy for ectopic pregnancy, laparotomy for ruptured uterus).

- History of AN care defined as "had received at least one antenatal care from healthcare staffs" and "did not received antenatal care from healthcare staffs"

3.8.6. Underlying causes

- Underlying causes defined as "Yes" or "No" for the following causes: the pregnancy with abortive outcome (abortion/ectopic pregnancy), obstetric hemorrhage, hypertensive disorders, pregnancy-related infection, other obstetric disease or complication, medical/surgical/mental disease or complication, unanticipated complications of management and coincidental conditions.

3.8.7. Contributory /Associated Condition

- Contributory /Associated Condition defined as "Yes" or "No" for the following conditions: anemia, HIV infection, previous caesarean section and prolonged/obstructed labour.

Indicators	Number	Percentage
1. Prevention of postpartum haemorrhage		
Target population: women giving birth in health-care facilities		
Oxytocin[a] use		
Use of any uterotonic (including oxytocin)		
2. Treatment of severe postpartum haemorrhage		
Target population: women with severe PPH		
Oxytocin[a] use		
Ergometrine		
Misoprostol		
Other uterotonics		
Any of the above uterotonics		
Tranexamic acid		
Removal of retained products		
Balloon or condom tamponade		
Artery ligation		
Hysterectomy		
Abdominal packing		
Proportion of cases with SMO		
Mortality		
3. Anticonvulsants for eclampsia		
Target population: women with eclampsia		
Magnesium sulfate[a]		
Other anticonvulsant		
Any anticonvulsant		
Proportion of cases with SMO		
Mortality		
4. Prevention of caesarean section related infection		
Target population: women undergoing caesarean section		
Prophylactic antibiotic during caesarean section		
5. Treatment for sepsis		
Target population: women with sepsis		
Parenteral therapeutic antibiotics[a]		
Proportion of cases with SMO		
Mortality		
6. Ruptured uterus		
Target population: women with ruptured uterus		
Laparotomy		
Laparotomy after 3 hours of hospital stay		
Proportion of cases with SMO		
Mortality		
7. Preterm birth		
Target population: women having a preterm delivery after 3 hours of hospital stay		
Corticosteroids for fetal lung maturation[a]		
Early neonatal mortality		

Figure 7: Outcome indicators related to specific conditions for assessing the quality of maternal healthcare services (5)

Descriptive analysis

The collected data was stored in a computer database, maintaining confidentiality. The data entry and analysis were done using SPSS software version 22 licensed by Chulalongkorn University.

The prevalence of maternal near miss was determined as the number of maternal near miss cases per 1,000 live births. For descriptive statistic, frequency and percentage were presented for categorical data. Normality of the data was tested using Kolmogorov Smirnov test for continuous data. Normal distribution continuous data was presented by mean ± standard deviation. Non-normal distribution continuous data was presented by median (interquartile range; IQR).

Analytical analysis

To determine the association between independent variables and maternal near miss (Yes/No), Chi-square test was used, while those that did not meet the assumption of Ch-square were instead employed the Fisher's exact test. The independent variables with p-value < 0.25 were selected for further analysis of multivariate analysis. Binary logistic regression was used to describe the relationship between the selected independent variables and maternal near miss with statistically significant at p-value <0.05.

3.9. Reliability and Validity

Since the study used WHO maternal near miss tool and all data were extracted from the medical records by a single researcher, the reliability and validity of the instrument were not performed.

3.10. Ethical Consideration

This study did not require direct interaction or contact with the participants, and all data were extracted from medical records without any patient identification. Also, there were no participant interviews. Confidential information on the participant's identity was disclosed. Therefore, the researcher exempted participant information sheet and consent form from individual participants. The study was ethically approved from Research Ethics Review Committee for Research involving Human Research Participants, Chulalongkorn University (COA. No. 085/2021) (Appendix 5), and got the approval permission of accessing and using the medical records from Magway Regional Hospital (Appendix 6). The hospital did not require submitting any report/publication resulting from using the medical records to Magway Regional Hospital.

CHAPTER IV

RESULTS

This study was conducted using the secondary data analysis of the medical records that obtained from Obstetrics and Gynecology (OG) ward of Magway Regional Hospital from January 2019 to December 2019. According to hospital data, there were 3,396 pregnancies admitted for pregnancy, childbirth or treatment of pregnancy complications to OG ward this year, but data error and some patients not concerned with OG problems has found in this record. After excluding these errors, a total of 3,291 women were recorded: 2,896 deliveries and 2,840 live births. This chapter explains the findings of the study which are separated into three main parts as follow:

4.1. Descriptive Analysis

- 4.1.1. Maternal characteristics

- 4.1.2. Pregnancy complications

- 4.1.3. Obstetric characteristics

- 4.1.4. Underlying Causes

- 4.1.5. Contributory/Associated condition

- 4.1.6. Organ dysfunction and Prevalence of maternal near miss

- 4.1.7. Quality of maternal healthcare services

4.2. Bivariate Analysis

- 4.2.1. Association of maternal characteristics and maternal near miss

- 4.2.2 Association of pregnancy complications and maternal near miss

- 4.2.3. Association of obstetric characteristics and maternal near miss

- 4.2.4. Association of underlying causes and maternal near miss

- 4.2.5. Association of associated condition and maternal near miss

4.3. Adjusted relationship of explanatory variables with maternal near miss

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4.1. Descriptive Analysis

4.1.1. Maternal characteristics

The socio-demographic characteristics of the pregnant women in this study are shown in Table 7. From the one-year records, there were 3,291pregnant women between the ages of 15 to 50, who admitted into the Magway hospital, and were included in this study. The mean age of pregnant women was 29.52 ± 6.435 years old, with the minimum age of 15 years old and maximum age of 50 years old. Majority of the pregnant women in this study fell in the age between 25 to 34 years old (49.7%). While pregnant women who aged 35 years old and more had the lowest percentage at 24.6%. Nearly all (99.9%) participants were married women, and almost 69.9% of all pregnant women were educated up to primary level, whereas only 3.2% of women were illiterate. In addition, 1,345 of all pregnant women (40.9%) were farmers. Meanwhile, 1,192 (36.2%) of them were housewives.

Table 7: Maternal characteristics of study population (n = 3291)

Maternal characteristics	Frequency (n)	Percentage (%)
Age Group		
• ≤ 24 years	849	25.8
• 25 years – 34 years	1634	49.7
• ≥ 35 years	808	24.6
Mean ± SD	29.52 ± 6.435	
Min-Max	15 – 50 years	
Marital Status		
• Unmarried	2	0.1
• Married	3289	99.9
Education of the pregnant women		
• Illiterate	104	3.2
• Primary School Level	2300	69.9
• Middle School Level and Higher	887	27
Occupation of the pregnant women		
• Farmer	1345	40.9
• Housewife	1192	36.2
• Manual Worker	334	10.1
• Vendor	191	5.8
• Professional Workers (e.g. Teachers, medical workers)	121	3.7
• Other	108	3.3

4.1.2. Severe pregnancy complications

There were a total of **367** pregnant women who suffered severe pregnancy complications in this study. Table 8 shows the study populations who experienced severe pregnancy complications. Out of all observed complications among 367 pregnant women, eclampsia and severe preeclampsia were noticeably the highest figures with 226 (6.9%) and 115 (3.5%) pregnant women experiencing them, respectively. Eleven participants (0.3%) had severe postpartum hemorrhage, whereas ten participants (0.3%) had sepsis and severe systemic infection. Only five pregnant women or 0.2% had experienced ruptured uterus.

Table 8: Severe Pregnancy complications of study population (n = 3291)

Severe Pregnancy complications	Frequency (n)	Percentage (%)
Severe postpartum hemorrhage		
Yes	11	0.3
No	3280	99.7
Severe preeclampsia		
Yes	115	3.5
No	3176	96.5
Eclampsia		
Yes	226	6.9
No	3065	93.1
Sepsis or severe systemic infection		
Yes	10	0.3
No	3281	99.7
Ruptured uterus		
Yes	5	0.2
No	3286	99.8

4.1.3. Obstetric characteristics

Obstetric characteristics are shown in Table 9. Majority of pregnant women were at gravida 1 (47.9%), and 40% of them were at gravida 2 and 3; while about 12% were at gravida 4 and above. Over half of the pregnant women (51.4%) were nulliparous. Also, 355 pregnant women (10.8%) had previously experienced at least one abortion. Most of the pregnant women gave the birth by spontaneous vaginal delivery (39.2%), followed closely by caesarean section delivery (37.6%). Only 10.7% of them required curettage/vacuum aspiration. In addition, 17 pregnant women (0.5%) were experienced other modes of delivery such as medical methods for uterine evacuation, complete abortion, and laparotomy. While 12% of the pregnant women were discharged while still pregnant; unfortunately, seven pregnant women were deceased during hospitalization. Regarding the antenatal care, more than three quarter of pregnant women in this study had received at least one antenatal care by health professionals during their pregnancy as shown in Table 9.

4.1.4. Underlying Causes

Among 3,291 pregnant women, 392 pregnant women (11.9%) had underlying causes as shown in Table 10. The highest frequency for underlying causes was observed with "Medical or surgical or mental disease or complication" at 199 pregnant women, which accounted for six percentage, followed by "Other obstetric disease or complication" with 118 pregnant women (3.6%). Whereas hypertensive disorders and pregnancy with infection cases were relatively low at 1.3% and 0.5%, respectively. Only seven pregnant women had abortive outcomes, while six women had underlying causes related to unanticipated conditions and coincidental conditions.

Table 9: Obstetric characteristics of study population (n = 3291)

Obstetric characteristics	Frequency (n)	Percentage (%)
Gravida		
• G 1	1576	47.9
• G 2 and G 3	1317	40
• G 4 and above	398	12.1
Parity		
• P 0	1691	51.4
• P 1 and P 2	1255	38.2
• P 3 and above	345	10.5
Abortion History		
• None	2936	89.2
• One time and above	355	10.8
Mode of Delivery/ End of Pregnancy (n=3,284) [a]		
• Vaginal Delivery	1287	39.2
• Caesarean Section	1234	37.6
• Curettage / Vacuum Aspiration	353	10.7
• Women discharged still pregnant	393	12
• Other (e.g. Medical Methods for uterine evacuation, complete abortion, laparotomy)	17	0.5
History of AN Care		
• Received antenatal care from health care staffs [b]	2558	77.7
• Did not receive antenatal care from health care staffs	733	22.3

[a] Excluded 7 cases of women died still pregnant; [b] Received at least one ANC from healthcare staffs

Table 10: Underlying causes of study population (n = 3291)

Underlying causes	Frequency (n)	Percentage (%)
Pregnancy with abortive outcome		
Yes	7	0.2
No	3284	99.8
Obstetric hemorrhage		
Yes	2	0.1
No	3289	99.9
Hypertensive disorders		
Yes	44	1.3
No	3247	98.7
Pregnancy related infection		
Yes	16	0.5
No	3275	99.5
Other obstetric disease or complication		
Yes	118	3.6
No	3173	96.4
Medical or surgical or mental disease or complication		
Yes	199	6
No	3092	94
Unanticipated conditions		
Yes	4	0.1
No	3287	99.9
Coincidental conditions		
Yes	2	0.1
No	3289	99.9

4.1.5. Contributory /Associated condition

Table 11 presents the contributory/associated condition of the pregnant women in this study. More than three hundred pregnant women (11.4%) had history of birth with caesarean section, and 3.7% had experienced labor pain for prolonged hours. Furthermore, 29 pregnant women (0.9%) had HIV infection, while anemia was found among 27 pregnant women.

Table 11: Contributory /Associated Condition of study population (n = 3291)

Associated Condition	Frequency (n)	Percentage (%)
Anemia		
Yes	27	0.8
No	3264	99.2
HIV Infection		
Yes	29	0.9
No	3262	99.1
Previous Caesarean Section		
Yes	376	11.4
No	2915	88.6
Prolonged Labour`		
Yes	123	3.7
No	3168	96.3

4.1.6. Organ dysfunction and Prevalence of maternal near miss

Table 12 shows the information related to organ dysfunction of the pregnant women in this study. Among all, 11 pregnant women were experienced a total of 13 organ dysfunctions. Of the dysfunctions, coagulation dysfunction was presented in five pregnant women (45.45%). Unexpectedly, the two pregnant women, who suffered both cardio-vascular and hematologic dysfunctions; also got shocked and transfused packed cell up to 5 units. There was only one pregnant woman was found in each other severe maternal outcomes (cardio-vascular, respiratory, hepatic, and neurologic).

Table 12: Organ dysfunction involved (n = 11)

Organ dysfunctions	Number of cases (n)	Percentage (%)
• Cardio-vascular Dysfunction (Shock)	1	9.09
• Coagulation or Hematologic Dysfunction (Transfusion of red blood cell concentrates ≥5 units)	5	45.45
• Cardio-vascular Dysfunction and Coagulation or Hematologic Dysfunction	2	18.18
• Respiratory Dysfunction (Severe tachypnea)	1	9.09
• Hepatic Dysfunction (Jaundice in the presence of preeclampsia)	1	9.09
• Neurologic Dysfunction (Uncontrollable fits)	1	9.09

Prevalence of maternal near miss

Figure 8 shows the summary of the pregnant women with and without life-threatening conditions. From 3,396 pregnant women, 105 cases were excluded. There were 2,840 live births in Magway Regional Hospital during the period of this study. The study finds that 3,273 pregnant women had no life-threatening conditions, whereas 18 pregnant women experienced severe maternal outcomes such as organ dysfunctions as shown in Table 12. From this result, there are 11 cases of maternal near miss and 7 cases of maternal death. Therefore, the maternal near miss ratio was 3.9 per 1,000 live births. Maternal mortality ratio was 246 per 100,000 live births, and maternal mortality index was 0.39.
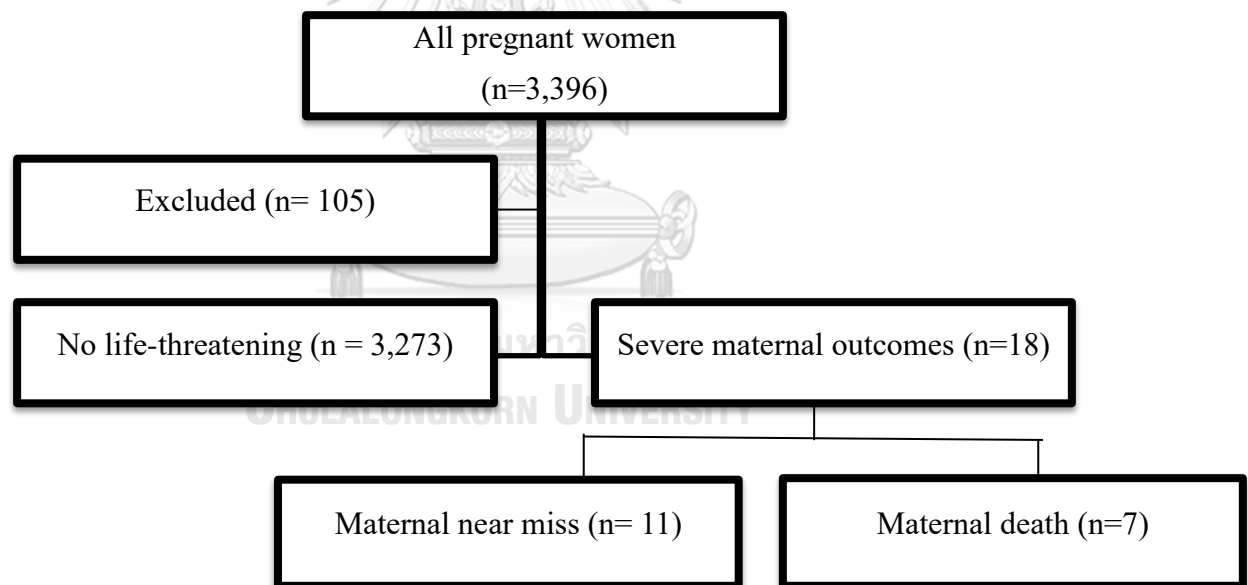
Figure 8: Summary of maternal near miss and maternal death cases

4.1.7. Quality of maternal healthcare services

Maternal healthcare services supported by hospital are illustrated on Table 13. In the study, proportion of target participants which received the recommended evidence-based intervention for severe postpartum hemorrhage, preterm delivery and prevention of caesarean related infection are above 95%. Among study population (3,291), more than 2,000 pregnant women gave birth by spontaneous virginal delivery or using caesarean section during the study period in MRH.

The study hospital used relevant treatment and management (oxytocin 81.82%, ergometrine 9.09%, misoprostol 18.18% and removal of retained products 63.63%) for each postpartum hemorrhage patients: they fully received at least one treatment for treating postpartum hemorrhage which is greater than study criteria (95%). Moreover, almost half of the pregnant women delivered the baby with caesarean section: all those surgical patients (100%) got prophylactic antibiotics. Further, the result illustrated that over one hundred women delivered premature baby. Even though total percent of corticosteroids were used for fetal lung maturation, two neonates were dead in the study period due to eclampsia and history of attempt delivery at home.

In contrast, even over three quarters (89.23%) of participants were received suggested preventive treatment (oxytocin and other uterotonic) in preventing postpartum hemorrhage; its management did not pass according to study identification criteria. Similarly, the upmost prevalence number of life-threatening condition was founded as eclampsia (226 cases) during the study; it led to dead and organ dysfunctions up to four cases. Dealing with its treatment, only 48.67% of them received anticonvulsants from the health facility. Then, another noticeable point is

that ten patients had severe sepsis infection, however, very few numbers (30%) of them received therapeutic antibiotics. Due to this inadequate quality of care, five mothers were died from sepsis. Regarding with rupture uterus, about 20 % of cases underwent laparotomy after 3 hours of hospital stay. As stated in quality identification criteria, these managements for eclampsia, sepsis and rupture uterus cases were not passed; hospital urgently need to improve interventions on these severe pregnancy complications.

Table 13: Quality of maternal healthcare services related characteristics of study population

Indicators	Number (n)	Percentage (%)	Received treatment* n (%)	Pass (Yes/No)
1. Prevention of postpartum hemorrhage				
Target population: women giving birth in health-care facilities	2896		**2584 (89.23)**	No
Oxytocin use	2464	85.08		
Use of any uterotonic	120	4.14		
2. Treatment of severe postpartum hemorrhage				
Target population: women with severe PPH	11		**11 (100)**	Yes
Oxytocin use	9	81.82		
Ergometrine	1	9.09		
Misoprostol	2	18.18		
Tranexamic Acid	1	9.09		
Removal of retained products	7	63.63		
Balloon or condom tamponate	1	9.09		
Hysterectomy	1	9.09		
Proportion of cases with severe maternal outcomes	1			
Mortality	1			
3. Anticonvulsants for eclampsia				
Target population: women with eclampsia	226		**110 (48.67)**	**No**
Magnesium sulfate	110	48.67		
Proportion of cases with severe maternal outcomes	4			
Mortality	1			

   *Number of women and percentage who received at least one treatment for each indicator

Table 13: Quality of maternal healthcare services related characteristics of study population (Continue)

Indicators	Number (n)	Percentage (%)	Received treatment* n (%)	Pass (Yes/No)
4. Prevention of caesarean section related infection				
Target population: women undergoing caesarean section	1236		**1236 (100)**	Yes
Prophylactic antibiotic during caesarean section	1236	100		
5. Treatment for sepsis				
Target population: women with sepsis	10		**3 (30)**	No
Parenteral, therapeutic antibiotics	3	30		
Proportion of cases with severe maternal outcomes	6			
Mortality	5			
6. Ruptured uterus				
Target population: women with ruptured uterus	5		**1 (20)**	No
Laparotomy	1	20		
Proportion of cases with severe maternal outcomes	1			
Mortality	0			
7. Preterm birth				
Target population: women having preterm delivery after 3 hours of hospital stay	125		**125 (100)**	Yes
Corticosteroids for fetal lung maturation	125	100		
Early neonatal mortality	2			

*Number of women and percentage who received at least one treatment for each indicator

4.2. Bivariate Analysis

In this study, Chi square was used in bivariate analysis to analyze the association between the independent and dependent variables.

The dependent variable was maternal near miss case (yes/no). The independent variables were maternal characteristics, severe pregnancy complications, obstetric characteristics of pregnant women, underlying causes, contributory/associated conditions. All of these variables are grouped into categories as mentioned in research methodology section. A p-value < 0.25 was considered statistically significant in this section.

The researcher found 7 cases of maternal death, thus, these seven cases were excluded from total 3,291 pregnant women. Therefore, association was analyzed only for pregnant with no-life threatening condition and maternal near miss in bivariate analysis.

4.2.1. Association of maternal characteristics and maternal near miss

Table 14 shows that there were only 11 maternal near miss cases in this study, with majority of them were in the age group between 25 to 34 years old, were married, had primary school education, and were a farmer or a housewife.

The result of Chi-square test showed that only one variable from socio-demographic characteristics were significantly associated with maternal near miss case, which was educational level (p-value = 0.010). Whereas there were no statistically significant associations observed between age group (p-value = 0.845) and occupation (p-value = 0.338) with maternal near miss. Regarding the marital status, there is only one case of single pregnant woman was found.

Therefore, the variable was removed from the chi-square analysis, and was not presented in Table 14.

Table 14: Association of maternal characteristics with maternal near miss cases (n = 3284)

Maternal characteristics	Maternal Near Miss Case		Chi-square	p-value
	No (n=3,273) n (%)	Yes (n=11) n (%)		
Age Group				
≤ 24 years	846 (25.8)	2 (18.2)	0.337	0.845
25 years – 34 years	1623 (49.6)	6 (54.5)		
≥ 35 years	804 (24.6)	3 (27.3)		
Education Level				
Illiterate	102 (3.1)	2 (18.2)	9.173	**0.010***
Primary School Level	2288 (69.9)	8 (72.7)		
Middle School Level and Higher	883 (27)	1 (9.1)		
Occupation				
Farmer	1339 (40.9)	5 (45.5)	4.876	0.338[a]
Housewife	1184 (36.2)	4 (36.4)		
Manual Worker	333 (10.2)	0 (0.0)		
Vendor	188 (5.7)	2 (18.2)		
Professional Workers (e.g. Teachers, medical workers)	121 (3.7)	0 (0.0)		
Others	108 (3.3)	0 (0.0)		

* p-value < 0.25; [a] using Fisher exact test

4.2.2. Association of severe pregnancy complications and maternal near miss

Regarding with pregnancy complications, Chi square test results show that four major complications; severe pre-eclampsia (p-value = 0.054), eclampsia (p-value = 0.035) and ruptured uterus (p-value = 0.017) were statistically associated with near miss cases in this study (Table 15). But two of complications, severe postpartum hemorrhage (p-value = 1.000) and sepsis (p-value = 1.000) have no association with maternal near miss.

Table 15: Association of severe pregnancy complications with maternal near miss (n = 3284)

Severe pregnancy complications	Maternal Near Miss Case		Chi-square	p-value
	No (n=3,273) n (%)	Yes (n=11) n (%)		
Severe postpartum hemorrhage				
• No	3263 (99.7)	11 (100)	0.034	1.000[a]
• Yes	10 (0.4)	0 (0.0)		
Severe pre-eclampsia				
• No	3160 (96.5)	9 (81.8)	7.039	**0.054*[a]**
• Yes	113 (3.5)	2 (18.2)		
Eclampsia				
• No	3051 (93.2)	8 (72.7)	7.212	**0.035*[a]**
• Yes	222 (6.8)	3 (27.3)		
Sepsis or severe systemic infection				
• No	3268 (99.8)	11 (92.3)	0.017	1.000[a]
• Yes	5 (0.2)	0 (16.7)		
Ruptured Uterus				
• No	3269 (99.9)	10 (90.9)	58.008	**0.017*[a]**
• Yes	4 (0.1)	1 (9.1)		

* p-value < 0.25, [a] using Fisher exact test

4.2.3. Association of obstetric characteristics and maternal near miss

Table 16 describes the association between pregnancy related characteristics of study population and maternal near miss. The results show that mode of delivery/end of pregnancy and history of AN Care were statistically significant associated with maternal near miss.

In this study, mode of delivery and pregnant women who had received AN Care during their pregnancy were significantly associated with maternal near miss cases at p-value = 0.010, p-value = 0.019. Nevertheless, abortive history was not significantly associated with near miss cases with p-value = 0.332. Also, parity and gravida groups were not statistically significant associated with maternal near miss since the p-value were greater than 0.25.

Table 16: Association of obstetric characteristics with maternal near miss (n = 3284)

Obstetric characteristics	Maternal Near Miss Case		Chi-square	p-value
	No (n=3,273) n (%)	Yes (n=11) n (%)		
Gravida				
G 1	1567 (47.9)	5 (45.5)	0.399	0.819
G 2 and G 3	1313 (40.1)	4 (36.4)		
G 4 and above	393 (12)	2 (18.2)		
Parity				
P 0	1683 (51.4)	4 (36.4)	1.275	0.529
P 1 and P 2	1250 (38.2)	5 (45.5)		
P 3 and above	340 (10.4)	2 (18.2)		
Abortion History				
None	2924 (89.3)	9 (81.8)	0.649	0.332[a]
One time and above	349 (10.7)	2 (18.2)		
Mode of Delivery/End of Pregnancy				
Vaginal Delivery	1285 (39.3)	2 (18.2)	13.315	**0.010***
Caesarean Section	1232 (37.6)	2 (18.2)		
Curettage / Vacuum Aspiration	351 (10.7)	2 (18.2)		
Women discharged still pregnant	388 (11.9)	5 (45.5)		
Others [b]	17 (0.5)	0 (0.0)		
History of AN Care				
Yes [c]	2551 (77.9)	5 (45.5)	6.706	**0.019*[a]**
No	722 (22.1)	6 (54.5)		

* p-value < 0.25, [a] using Fisher exact test; [b] uterine evacuation, complete abortion, laparotomy; [c] received ANC at least one from healthcare staffs

4.2.4. Association of underlying causes and maternal near miss

The associations between underlying causes and near miss cases among pregnant women were illustrated in Table 17. From Chi square test, obstetric disease (p-value < 0.001) and medical or surgical disease or complication (p-value = 0.025) were significantly associated with maternal near miss cases. Even though the other underlying causes which include pregnancy with abortive outcomes, obstetric hemorrhage, hypertensive disorders, pregnancy related infection, unanticipated condition and coincidental conditions were not statistically associated with maternal near miss as their p values were greater than 0.25.

Table 17: Association of underlying causes with maternal near miss (n = 3284)

Underlying causes	Maternal Near Miss Case		Chi-square	p-value
	No (n=3,273) n (%)	Yes (n=11) n (%)		
Pregnancy with abortive outcome				
• No	3270 (99.9)	11 (100)	0.010	1.000[a]
• Yes	3 (0.1)	0 (0.0)		
Obstetric Hemorrhage				
• No	3271 (99.9)	11 (100)	0.007	1.000[a]
• Yes	2 (0.1)	0 (0.0)		
Hypertensive disorders				
• No	3229 (98.7)	11 (100)	0.150	1.000[a]
• Yes	44 (1.3)	0 (0.0)		
Pregnancy related infection				
• No	3257 (99.5)	11 (100)	0.054	1.000[a]
• Yes	16 (0.5)	0 (0.0)		
Other obstetric disease or complication				
• No	3163 (96.6)	6 (54.5)	57.485	**<0.001*[a]**
• Yes	110 (3.4)	5 (45.5)		
Medical or surgical or mental disease or complication				
• No	3079 (94.1)	8 (72.7)	8.858	**0.025*[a]**
• Yes	194 (5.9)	3 (27.3)		
Unanticipated conditions				
• No	3269 (99.9)	11 (100)	0.013	1.000[a]
• Yes	4 (0.1)	0 (0.0)		
Coincidental conditions				
• No	3271 (99.9)	11 (100)	0.007	1.000[a]
• Yes	2 (0.1)	0 (0.0)		

* p-value < 0.25,[a] using Fisher exact test

4.2.5. Association of contributory/associated condition and maternal near miss

Table 18 demonstrates the association between the contributory/associated conditions and maternal near miss among pregnant women. The pregnant women who suffered anemia and HIV infection were significantly associated with near miss at p-value = 0.003 and 0.090, respectively. On the other hand, the women who had history of caesarean delivery and women presenting with prolonged/ obstructed labour were not statistically associated with maternal near miss (p-value = 0.626, and p-value = 1.000, respectively).

Table 18: Association of contributory/associated conditions with maternal near miss (n = 3284)

Associated condition	Maternal Near Miss Case		Chi-square	p-value
	No	**Yes**		
	(n=3,273)	**(n=11)**		
	n (%)	**n (%)**		
Anemia				
• No	3249 (99.3)	9 (81.8)	42.495	**0.003**[*][a]
• Yes	24 (0.7)	2 (18.2)		
HIV Infection				
• No	3246 (99.2)	10 (90.9)	8.861	**0.090**[*][a]
• Yes	27 (0.8)	1 (9.1)		
Previous Caesarean Section				
• No	2897 (88.5)	11 (100)	1.427	0.626[a]
• Yes	376 (11.5)	0 (0.0)		
Prolonged labour				
• No	3150 (96.2)	11 (100)	0.429	1.000[a]
• Yes	123 (3.8)	0 (0.0)		

* p-value < 0.25,[a] using Fisher exact test

4.3. Adjusted relationship of explanatory variables with maternal near miss cases

Through bivariate analysis, the associations between the studied independent variables and maternal near miss among the pregnant women in this study were firstly assessed by Chi-square test with p-value < 0.25. The independent variables, namely education level, history of ANC, mode of delivery/end of pregnancy, severe pregnancy complications (severe preeclampsia, eclampsia and ruptured uterus), underlying causes (obstetric disease and medical or surgical or mental disease or complication), anemia and HIV infection were statistically significant associations with maternal near miss cases, and were considered for binary logistic analysis. These variables were entered and analyzed using binary logistic regression in SPSS, reported using adjusted odds ratio (aOR) along with 95% CI and p-value. Statistically significant was considered with p-value < 0.05, which were presented in Table 19.

The results show that maternal and obstetric characteristics were not associated with maternal near miss among the pregnant women attending Magway Regional Hospital as shown in Table 19.

For the pregnancy complication, the pregnant women who had severe preeclampsia, eclampsia, and ruptured uterus found to have higher odds of getting maternal near miss. The pregnant women who had severe preeclampsia have 8.673 times higher odds of getting maternal near miss in comparison with the pregnant women who did not have severe preeclampsia (aOR = 8.673, 95% CI = 1.100 - 68.370). Likewise, the pregnant women experienced eclampsia found to have 21.189 times higher odds of suffering near miss than those with non-eclampsia patients (aOR = 21.189, 95% CI = 3.481 – 128.963). As well as the pregnant women with ruptured

uterus, they have 21.917 times higher odds of experiencing maternal near miss than the women who lack this complication (aOR = 21.917, 95% CI = 1.602 – 299.776).

The underlying causes (other obstetric disease or complication, and medical or surgical or mental disease or complication) were statistically significantly associated with maternal near miss in the study. The pregnant women who had obstetric complications or complication (such as placenta previa, abruptio placenta and retained placenta), and medical or surgical or mental disease or complication were found 29.268 times and 9.064 times odds of having near miss, respectively (aOR = 29.268, 95% CI = 4.617 – 185.526, and aOR = 9.064, 95% CI = 1.496 – 54.937) in comparison with not having these underlying causes.

After examining the variables related to contributory/associated condition, pregnant women with anemia and HIV infection found association with maternal near miss case. The pregnant women with anemia were 31.093 times higher odds of getting maternal near miss than non-anemic people (aOR = 31.903, 95% CI = 4.327 – 223.419). Also, the pregnant women with HIV infection found to have 59.807 higher odds of getting maternal near miss when compared with the pregnant women who did not have HIV infection (aOR = 59.807, 95% CI = 4.836 – 739.577).

Table 19: Adjusted relationship between explanatory variables with maternal near miss (n = 3284)

Variables	p-value	aOR	95% C.I.	
			Lower	Upper
Education Level				
Illiterate	Ref.			
Literate	0.128	0.231	0.035	1.524
Mode of Delivery/ End of Pregnancy				
Vaginal Delivery	Ref.			
Caesarean Section	0.511	0.480	0.054	4.273
Curettage/Vacuum Aspiration	0.366	2.820	0.298	26.667
Complete abortion/Women discharged still pregnant	0.605	1.738	0.215	14.076
History of AN Care				
Did not receive antenatal care from health care staffs	Ref.			
Received antenatal care from health care staffs	0.106	0.323	0.082	1.270

* = Statistically significant at p-value < 0.05

Table 19: Adjusted relationship between explanatory variables with maternal near miss cases (n = 3284) (Continue)

Variables	p-value	aOR	95% C.I.	
			Lower	Upper
Severe preeclampsia				
No	Ref.			
Yes	**0.040***	8.673	1.100	68.370
Eclampsia				
No	Ref.			
Yes	**0.001***	21.189	3.481	128.963
Ruptured uterus				
No	Ref.			
Yes	**0.021***	21.917	1.602	299.776
Other obstetric disease or complication				
No	Ref.			
Yes	**<0.001***	29.268	4.617	185.526
Medical or surgical or mental disease or complication				
No	Ref.			
Yes	**0.016***	9.064	1.496	54.937
Anemia				
No	Ref.			
Yes	**0.001***	31.903	4.327	223.419
HIV Infection				
No	Ref.			
Yes	**0.001***	59.807	4.836	739.577

* = Statistically significant at p-value < 0.05

CHAPTER V

DISCUSSION

There were very limited studies regarding maternal near miss in Myanmar. Therefore, this study aimed to find the prevalence, the associated factors, and quality of care regarding maternal near miss, in Magway Regional Hospital, Magway, Myanmar. The ratio of maternal near miss at Magway Regional Hospital was 3.9/1000 live births, while maternal mortality ratio was 246/100,000 live births and maternal mortality index was 0.39. Seven factors were associated with maternal near miss in this study namely severe preeclampsia (aOR = 8.673, 95% CI = 1.100 - 68.370), eclampsia (aOR = 21.189, 95% CI = 3.481 – 128.963), ruptured uterus (aOR = 21.917, 95% CI = 1.602 – 299.776), other obstetric disease or complication (aOR = 29.268, 95% CI = 4.617 – 185.526), medical or surgical or mental disease or complication and aOR = 9.064, 95% CI = 1.496 – 54.937), anemia (aOR = 31.903, 95% CI = 4.327 – 223.419) and HIV infection (aOR = 59.807, 95% CI = 4.836 – 739.577). Interestingly, maternal and obstetric characteristic of the pregnant women were not associated with maternal near miss from the findings. The interventions and management of studied hospital on severe pregnancy complications were needed to improve. Besides, the evidence-based maternal health interventions should be designed for management of obstetric complications.

Prevalence of maternal near miss and maternal mortality

The ratio of maternal near miss at Magway Regional Hospital was 3.9/1000 live births. It was higher than WHO recommendation that is generally expected to be around 7 severe maternal outcomes/1000 deliveries **(5)**. But, the result was lower than Asian countries (17 per 1000 live births) and worldwide trend (18.67 per 1000 live

births) in generally **(7)**. Moreover, this finding was considerably lower than those documented in previous study conducted in developing country like Nepal: 36 near-miss obstetrical cases were reported **(31)**. This might be difference in the years of study, the study population as well as various definitions in identifying in cases of pregnancy complication and organ dysfunctions. Further, the present study was retrospective data collection in one general hospital (tertiary care) which would give lower number of maternal near miss case.

The maternal mortality ratio in this study was 246 per 100,000 live births and maternal mortality index was 0.39. This ratio was nearly the same with Union MMR of 250 per 100,000 live births in 2017 **(18)**, and it was noted that Magway maternal mortality ratio might highest in tertiary hospitals. The other comparable result of MMR 254/100,000 live births was reported in the study of maternal near miss and maternal deaths in Mozambique **(47)**. These results are similar to present study. But MMR for the present finding was much lower than the recent study conducted in the Nepal where 324 maternal mortality ratio per 100,000 live births occurred **(31)**. This wide variation in range was seen due to the difference in the study population and deliveries rate.

Socio-demographic characteristics and maternal near miss

It was noted that socio-demographic characteristics such as age, marital status, educational level, and occupation in the study hospital were not statistically associated with maternal near miss case. Most of the women (73%) who got severe pregnancy complications were of low education, the other were presented with high level of education. Those women who had lower level of education do farm working in rural setting area; they didn't give proper care to their pregnancy life, they didn't

know how to take care of their babies. But women with high level of education also experienced severe maternal outcomes in this study since they also lived at rural area where far from tertiary hospital and health care center. Even though studies **(48, 49)** proved that the education is critical element in prevention of maternal death, the present study points out other barriers in term of living area and three delays: 1) deciding to seek care; 2) reaching the healthcare facility; and 3) receiving care.

Obstetric characteristics and maternal near miss

When we looked at among the patients with obstetric characteristics, primigravida had a high contribution to maternal near miss: 5/11 (45.5%) is similar to the findings in World Bank study **(4)**. Concerning with receiving antenatal care, Myanmar Ministry of Health and Sports, Hospital Report (2014 – 2016) illustrated that antenatal coverage and post natal coverage in Magway were increased year by year **(13)**. This study results support and augment these findings by showing that 77% of study population received antenatal care services from health care providers which include physicians, obstetricians, doctor and nurse/midwife. Regardless of this fact, nearly 400 pregnant women still got pregnancy complications and more than 100 gave preterm birth in this study. The noticeable factor from these results is that there is need to promote the prevention strategies and enforce capacity building training of health care workers to improve their performance. Mandalay Central Women Hospital's quasi-experimental study supported that point; by promoting the training to health care providers at health centers and creating the awareness on pregnancy complications, the referral cases and early detection of cases were improved **(50)**.

In addition, the studied hospital chose caesarean section as an effective way to manage high risk pregnancy such women with severe eclampsia, obstructed labour

and antepartum hemorrhage. The same study proved that caesarean delivery is the protective factor against disease progression from pregnancy complications to severe maternal outcomes. It might be interpreted the caesarean section as a solution for cases of maternal morbidity **(51)**. Nonetheless, this study is controversial to other studies on how caesarean contributes to near miss case **(47, 52)**, because there is high risk pregnant women in this study who urgently require emergency caesarean section as pregnancy resolution.

Pregnancy complications and severe maternal outcomes (maternal near miss + maternal death)

In this study, more than three hundreds pregnant women (nearly 10%) of study population developed severe complications namely, severe post-partum hemorrhage, severe preeclampsia, eclampsia, sepsis and ruptured uterus.

It was also found that postpartum hemorrhage was included in main causative factors to severe maternal outcome in MRH as compared to nationwide study which mentioned that pregnancy with abortive outcomes and obstetric hemorrhages due to postpartum hemorrhage were the major causes of maternal death **(21).** The reason is that almost postpartum hemorrhage patients in this study were lived in rural areas; they tended to deliver the babies at home with traditional birth attendants or by self. Due to this fact they have high risk for getting severe complication or approaching to death. Moreover, blood transfused patients due to postpartum hemorrhage were so many in the study. A previous cross-sectional study in major public hospitals in Egypt, Lebanon, Palestine and Syria also reported coagulation dysfunction was most prevalent, the cardiologic was presented as second in all hospital **(32).** It might be the studied hospitals are major referral hospitals where blood cell packs and blood

transfusion are maintained. Most of women were transfused up to 4 units at the MRH. Even though WHO criteria assumed as 5 units blood transfusion is reflection of the severity and indicator of the severe pregnancy complications, other factors like blood donation at a suitable time and shortage of blood products in hospital are needed to consider.

As shown in this study, severe pre eclampsia and ruptured uterus were also major determinants of maternal near miss. The findings of this study explored 3.5% of prevalence of severe pre eclampsia among the pregnant visiting MRH Hospital, which was fewer than Union average (19%) of hypertensive disorders in pregnancy, childbirth and the puerperium **(21).** The overall prevalence of severe pre ecalmpsia in this study was also lower than 7% of Egyptian and Syrian hospitals **(32).** The reason is that Egyptian study was conducted in three public hospitals, but all these findings strongly proved the same point which is the profile of severe pre eclampsia is critical element of maternal near miss.

It is noteworthy that there is limited study for ruptured uterus in Myanmar, only few studies which conducted on abortion can be found. The present study described rupture uterus lead to maternal near miss as cardio and hematologic dysfunctions. Contrary to other studies, there was no mortality as a result of rupture uterus in this study **(53).** This may be explained by rapid referral system and active management of case. In addition, the studied hospital gives prophylactic treatment of blood transfusion to this rupture patient.

The study also evidenced that sepsis as the main killer of pregnant women. Five maternal deaths were recorded as sepsis patients out of seven cases, in which only one patient presented with shock. All those sepsis patients lose their life, but also

their kids due to induced abortion. This study had similar findings to the WHO
Maternal Near-Miss Approach and the Maternal Severity Index Model (MSI) study in
that a lower reported cases of postpartum hemorrhage and higher proportions of sepsis
that contributed to maternal outcomes **(27).** This is because abortion is illegal in
Myanmar; safe and legal abortion care was not widespread used until now. That fact
also points out the requirement to ensure the fundamental rules and regulation related
with self-induced abortion and untrained medical attendants.
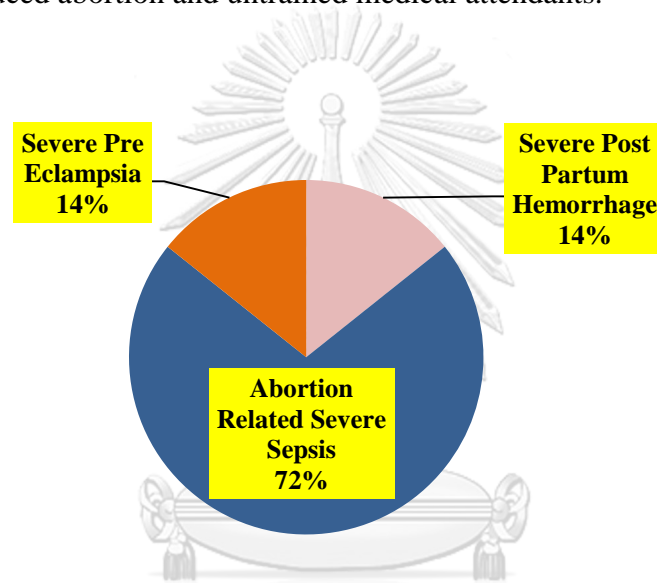
Figure 9: Causes of maternal death

Underlying causes and maternal near miss

Compared with a UK study, which showed more than 200 women experience
a severe maternal morbidity correlated with induced abortion for every 100,000 live
births in countries where abortion is unsafe, the present study have the same results.
This UK figure also revealed that the unsafe abortive group is highly exposed to
severe maternal morbidity as mortality. MRH study result strongly proved that
induced abortive patients were suffered sign and symptoms of severe infection, then,
they even lost their lives **(54).** This is because reproductive care and family planning

services to reduce unwanted pregnancies and access to comprehensive reproductive health services, including safe and legal abortion care were underused in Myanmar.

Obstetric complications such retained placenta, abruptio placenta and uterine atony were most common problems in this study. As compared with international study, a study of maternal near miss in Lebanon, Al Galaa and Egypt has also documented the main causative factors to maternal near miss were irregular presentation (including placenta previa, accrete /percreta and abruptio). These findings are pointed out the importance of exploring the negative impacts of placenta condition and uterine presentation on maternal health **(32).**

The most common medical diseases contributing to organ dysfunctions were pre-existing diabetes mellitus, pulmonary embolism and Hepatitis B. Of the eleven maternal near miss, DM had a high prevalence: 2/11 (18.2%) is higher than the findings in China study (8.2%), which associated with occurrence of 7.1% Hepatitis B found among near miss cases; this figure is nearly the same with the background estimate of 5.5% affecting the pregnant women in China **(55).** Possible reasons for these findings include pregnant women in this study didn't follow the healthy eating plan and didn't receive blood testing and Hep-B vaccination before getting pregnant.

In the present study, the pregnancy complications and underlying medical diseases were observed for any association with maternal near miss. Nevertheless, the study finds some conflicting results between severe pregnancy complications and underlying causes – that the underlying hypertensive disorder was very low, but the severe preeclampsia and eclampsia cases were very high. In general, the underlying causes should be higher than the severe pregnancy complication. This might be from the incomplete or inaccurate of medical records, and from the fact that pregnant

women might receive only one ANC during any trimester. Due to these reasons, the pregnant women in this study might not be diagnosed or recognized for the underlying causes before admitting to the hospital leading to the inconsistent results.

Associated condition and maternal near miss

As we look to the problem as a whole, sometimes we might miss the effect of associated condition behind the problem. Similarly, the major factors behind the maternal near miss were indirect causes.

Overall, anemia (0.8%) was the most frequent condition among maternal near miss cases in MRH.   This result was lower than hospitals in Egypt, Lebanon, Palestine and Syria in which anemia was key associated factor to maternal near miss case with prevalence of 15.5% **(32)**. Compared with World Bank Report, in 2019, worldwide anemia prevalence among pregnant women is 36.5%, prevalence of anemia in Myanmar is 48%, other ASEAN countries: Thailand is 32%, Indonesia 44% and Vietnam is 28%, thus the current study finding for anemia prevalence is too low **(56).** It might be missing hemoglobin values across countries and over time and then, this study has conducted in one public hospital in which majority of pregnant women were received AN Care services that include supplementation of folic acid in order to prevent birth abnormalities and iron deficiency anemia. In this study, AIDS disease also detected as key problem. Many women are not aware that they have an associated medical condition which became worse during pregnancy. From the present study findings, there is important thing need to be concerned about HIV infection as it led the first contributory cause among obstetric complications. One study, namely, South African confidential enquiries report, (Saving Mothers reports 2005–2007) also showed that HIV-infected pregnant women have six-time risk of

getting puerperal sepsis and three times chances of death from the sepsis after delivery **(57).** According to hospital record, AIDS patients in MRH who suffer pregnancy complications did not find a way for early treatment and PMCT (Prevention of mother-to-child transmission) services from any health care centers.

Quality of care

The target population with the use of special intervention is assessed. In studied hospital, magnesium sulfate as anticonvulsant, oxytocin for prevention of postpartum hemorrhage and therapeutic antibiotics were underused. Even though sepsis and eclampsia were the most registered cause of MNM, the management for eclampsia and sepsis due to abortion were only 48% and 30% recorded. Controversially, Ethiopia study had administration of parenteral antibiotics for 96.2% and parenteral anticonvulsant for 95% while blood transfusion was the least provided management **(41).** The quality of care might be weak because diagnosis, idea about standardizing treatment and controlling drug usage depended on only physicians' experience. Sadly, another reason is pregnant women in MGH do farming and house work; they can't afford the cost of treatment and medicines even though they know their situation are worsened.

Limitation

The study has some limitations. Because, it was conducted at one public hospital, the results might not be representative of entire nation. As it was secondary data analysis, it has retrospective study's nature; history related with pregnancy complications, delivery time and the correct dosage used by health facilities might be conflicted. In addition, the study relied on the accuracy of the medical records; the researcher encountered incomplete or inaccurate documentation, and ANC visit was counted as received ANC (Yes) for at least one ANC visit in any trimester. Due to these facts, the staffs and researcher were not aware whether the participants had underlying hypertensive disorder before reaching MRH or not. Therefore, these limitations could interfere with the results of the study. On account of these facts, maternal near miss ratio and maternal mortality might be underestimated or overestimated in this study.

CHAPTER VI

CONCLUSION AND RECOMMENDATION

6.1. Conclusion

In conclusion, this study investigated the maternal near miss cases, and examined the factors associated with maternal near miss among pregnant women who admitted to Magway Regional Hospital during the year 2019. The results revealed that the maternal near miss ratio was low (3.9 per 1,000 live births), whereas maternal mortality ratio was 246 per 100,000 deliveries which was higher than worldwide average of maternal mortality ratio (211 per 100,000 deliveries in 2017). Moreover, the study highlighted that the quality of care during the reviewed period needed to improve, showed the highest number of deaths following abortion related sepsis cases.

It found many associations between severe pregnancy complications, underlying causes and maternal near-miss. Further, pregnant women with associated condition such anemia and AIDS were found as factors associated with severe maternal outcomes. These results will be useful for Ministry of Health and Sports, Department of Obstetrics and Gynecology in order to address the challenges and barriers in maternal health care strengthening. The underlying diseases of pregnant women, management of pregnancy complication and post abortion care plays a major role in reduction of maternal death and life-threatening pregnancy complications.

6.2. Recommendations

This study found that there were some incomplete/inaccurate medical records; therefore, not only the improvement of the quality of care of reproductive health care services/system but also the medical record audit system should be strengthened. Complete and accurate medical record is one of good tools that will help the hospital to find out the root causes of near miss and maternal death, which give the hospital an opportunity for improvement.

6.2.1. Recommendation for policy makers and health workers

Based on the results of the study, the following interventions should be improved for reduction of maternal death and near miss cases.

(i)   Policy makers should implement rule and regulations on clinic and hospitals for abortion case in order to get prompt treatment and safe abortion care. If possible, the fees should be guaranteed by government.

(ii)   Health department should encourage capacity building and training program for health workers. Moreover, awareness rising should reinforce more on reproductive care and services at academic institutions and rural areas.

(iii)   Local Government should focus on accessing reproductive health care services and family planning, prevention and treatment of underlying disease (e.g. pregnant women should receive Hepatitis B vaccine, PMCT services and AN Care from health care centers since 1st AN Care visit.)

6.2.2. Recommendations for further researchers

(i) Further studies should be explored on blood donation services and referral system

(ii) Moreover, qualitative study by using focus group discussion and in-depth interview should be conducted on abortion related cases and AIDS patients whether received or not PMCT services.

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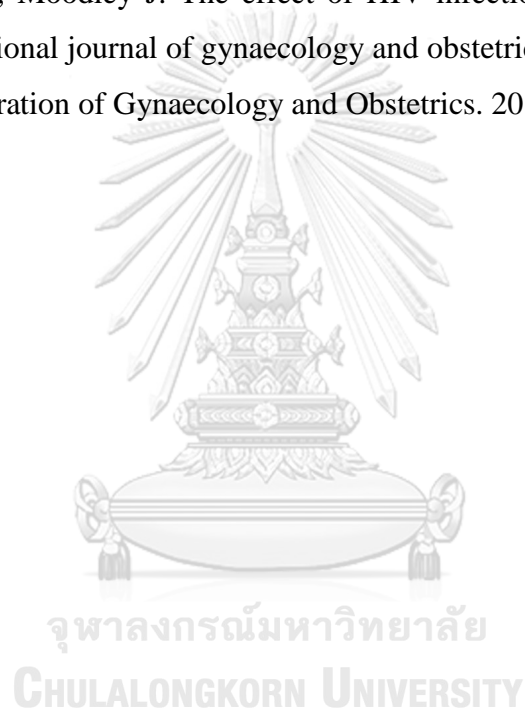
APPENDICES

APPENDIX 1: Medical record for admission and discharge of a patient

Magway General Hospital, Myanmar

MAGWAY REGIONAL HOSPITAL
ADMISSION & DISCHARGE   Annex(   )

NAME		SEX	AGE	ADMISSION NUMBER

PERMANENT ADDRESS

MARITAL STATUS	ETHNIC GROUP	RELIGION
OCCUPATION	DATE PREV. ADM	

NAME NEAREST RELATIVE OR FRIEND	RELATIONSHIP	REFERRED TO HOSPITAL BY	POLICE CASE YES ☐ NO ☐

ADDRESS (Present)

MEDICAL OFFICER INCHARGE

SERVICE	WARD

FATHER'S NAME

ADMISSION DATE	TIME

MOTHER'S NAME

DISCHARGE DATE	TIME

ADMITTED FOR

....
ADMITTING OFFICER'S NAME AND SIGNATURE

DRUG SENSITIVITY/ALLERGY

REMARKS

DISCHARGE DIAGNOSIS (Principal Morbid Condition)

OTHER DIAGNOSIS/ COMPLICATIONS & ASSOCIATED CONDITIONS

CAUSE OF INJURY   ROAD TRAFFIC ACCIDENT ☐   ASSAULT ☐   FALL ☐   MACHINERY ☐   OTHERS ☐

CLINICIAN SUMMARY (SIGNIFICANT HISTORY/ FINDINGS/ INVESTIGATIONS/TREATMENT)

SURGICAL OPERATION PROCEDURE (if Applicable)

TYPE OF DISCHARGE: APPROVAL ☐   SIGNED & GONE ☐   ABSCONDED ☐   TRANSFER TO ☐

DISCHARGE STATUS :   RECOVERED ☐   IMPROVED ☐   NOT IMPROVED ☐   DIED ☐

CAUSE OF DEATH : (If Applicable)
I. IMMEDIATE CAUSE   (a) _____
                                      DUE TO OR AS A CONSEQUENCE OF
ANTECEDENT CAUSES   (b) _____
Morbid conditions, if any, giving rise to the above cause,   DUE TO OR AS A CONSEQUENCE OF
Starting the underlying condition last (c) _____

II. Other significant conditions contributing to
The death, but not related to the disease or
condition causing it

AUTOPSY PERFORMED	
YES	NO

DOCTOR'S SIGNATURE ON ------------------   DATE ------------------
COMPLETION OF RECORD

M.R.1

HISTORY

INFORMATION SHOULD RECORD ON ALL POSITIVE AND ALSO RELEVANT NEGATIVE FINDINGS REGARD IN PRESENT COMPLAINT, PRESENT ILLNESS, PAST FAMILY AND SOCIAL HISTORIES: INVENTORY BY SYSTEMS: DOCTOR

NAME OF PATIENT	AGE	WARD	HOSPITAL NUMBER
HISTORY AND PHYSICAL EXAMINATION			
MR.2			

PROGRESS NOTES AND TREATMENT RECORD
ALL ENTRIES TO BE DATED AND SIGNED

PROGRESS NOTES	DOCTOR'S ORDERS AND TREATMENT GIVEN

NAME OF PATIENT	AGE	WARD	HOSPITAL NUMBER

PROGRESS AND TREATMENT
MR.3

USE REVERSE - DO NOT WASTE SPACE

APPENDIX 2: WHO Maternal near miss tool used in this study

(Measurement Tool)

| World Health Organization | **Maternal Near-Miss Tool** | Individual data collection form WHO MNMA 1.1 |

IDENTIFICATION

Facility code (1-20): ☐☐   Individual identification code: ☐☐☐☐

SCREENING QUESTIONS

In the questions 1 to 4, please specify:
- 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**
   - ☐ A0 Severe postpartum haemorrhage
   - ☐ A1 Severe preeclampsia
   - ☐ A2 Eclampsia
   - ☐ A3 Sepsis or severe systemic infection
   - ☐ A4 Ruptured uterus

2. **Critical interventions or intensive care unit admission**
   - ☐ B0 Use of blood products (includes any blood transfusion)
   - ☐ B1 Interventional radiology (uterine artery embolization)
   - ☐ B2 Laparotomy
   - ☐ B3 Admission to Intensive Care Unit

3. **Organ dysfunction / life-threatening conditions**
   - ☐ C0 **Cardiovascular dysfunction**
     [shock, use of continuous vasoactive drugs, cardiac arrest, cardio-pulmonary resuscitation, severe hypoperfusion (lactate >5 mmol/L or >45mg/dL) or severe acidosis (pH<7.1)]
   - ☐ C1 **Respiratory dysfunction**
     [acute cyanosis, gasping, severe tachypnea (respiratory rate>40 bpm), severe bradypnea (respiratory rate<6 bpm), severe hypoxemia (PAO2/FiO2<200 O2 saturation <90% for ≥60min) or intubation and ventilation not related to anaesthesia]
   - ☐ C2 **Renal dysfunction**
     [oliguria non responsive to fluids or diuretics, dialysis for acute renal failure or severe acute azotemia (creatinine ≥300umol/ml or ≥3.5mg/dL)]
   - ☐ C3 **Coagulation/hematologic dysfunction**
     [failure to form clots, massive transfusion of blood or red cells (≥ 5 units) or severe acute thrombocytopenia (<50,000 platelets/ml)]
   - ☐ C4 **Hepatic dysfunction**
     [jaundice in the presence of pre-eclampsia, severe acute hyperbilirubinemia (bilirubin>100umol/L or >6.0mg/dL)]
   - ☐ C5 **Neurologic dysfunction**
     [prolonged unconsciousness / coma (lasting >12 hours), stroke, status epilepticus / uncontrollable fits, total paralysis]
   - ☐ C6 **Uterine dysfunction / Hysterectomy**
     [haemorrhage or infection leading to hysterectomy]

4. **Maternal deaths**
   - ☐ D0 Death during pregnancy or within 42 days of termination of pregnancy
   - ☐ D1 Death after 42 days of termination of pregnancy

Please note:
i. If you answered "1" or "2" to any of the questions 1 to 4, go to question 5
ii. If you answered "0" to all of the questions 1 to 4, the woman is not eligible for this assessment. Do not answer the questions 5 to 14
iii. In case of doubt on questions 1 to 4, consult the attending physician
iv. In the questions 5 to 14, if information is not available, unknown or not applicable, fill with "9"(s)

MATERNAL AND PERINATAL INFORMATION

5. Date of hospital admission   d d m m y y y y ☐ E0
6. Date of delivery or uterine evacuation   d d m m y y y y ☐ E1
7. Date of hospital discharge or death   d d m m y y y y ☐

8. Final mode of delivery / end of pregnancy. Please specify: ☐ E3
   - 1= Vaginal Delivery
   - 2= Caesarean section
   - 3= Complete abortion
   - 4= Curettage / vacuum aspiration
   - 5= Medical methods for uterine evacuation
   - 6= Laparotomy for ectopic pregnancy
   - 7= Laparotomy for ruptured uterus
   - 8= Women discharged or died still pregnant
   - 9= Unknown / other

9. Best estimate of gestational age in completed weeks (obstetric/neonatal) at:
   Delivery or abortion (not applicable if Q8="8") ☐ E4
   Maternal death or hospital discharge (applicable if Q8="8") ☐ E5

10. Regarding the vital status of the infant, please specify: 0=Alive 1=Dead
    At birth ☐ E6
    At hospital discharge or on the 7th day of life if still in the hospital ☐ E7

PROCESS INDICATORS

11. About conditions at arrival in the facility and the referral process, specify:
    (0=No 1=Yes)
    - ☐ F0 Delivery or abortion occurred before arrival at any health facility
    - ☐ F1 Delivery within 3 hours of arrival in the health facility
    - ☐ F2 Laparotomy within 3 hours of hospital arrival or in other hospital
    - ☐ F3 Woman referred from other health facility
    - ☐ F4 Woman referred to any higher complexity hospital

12. About the use of interventions, please specify whether the woman received any of the following: (0=No 1=Yes)
    Prevention of postpartum haemorrhage
    - ☐ G0 Oxytocin   ☐ G1 Other uterotonic
    Treatment of postpartum haemorrhage
    - ☐ H0 Oxytocin   ☐ H5 Removal of retained products
    - ☐ H1 Ergometrine   ☐ H6 Balloon or condom tamponade
    - ☐ H2 Misoprostol   ☐ H7 Artery ligation (uterine/hypogastric)
    - ☐ H3 Other uterotonics ☐ H8 Hysterectomy
    - ☐ H4 Tranexamic acid   ☐ H9 Abdominal packing
    Anticonvulsant
    - ☐ I0 Magnesium sulfate ☐ I1 Other anticonvulsant
    Antibiotics
    - ☐ J0 Prophylactic antibiotic during caesarean section
    - ☐ J1 Parenteral, therapeutic antibiotics
    Fetal lung maturation
    - ☐ K0 Corticosteroids (betamethasone or dexamethasone)

UNDERLYING CAUSES OF DEATH / NEAR MISS

13. Please specify: (0=No 1=Yes)
    - ☐ L0 Pregnancy with abortive outcome (abortion/ectopic pregnancy)
    - ☐ L1 Obstetric haemorrhage
    - ☐ L2 Hypertensive disorders
    - ☐ L3 Pregnancy-related infection
    - ☐ L4 Other obstetric disease or complication
    - ☐ L5 Medical/surgical/mental disease or complication
    - ☐ L6 Unanticipated complications of management
    - ☐ L7 Coincidental conditions
    - ☐ L8 Unknown

CONTRIBUTORY / ASSOCIATED CONDITIONS

14. Please specify: (0=No 1=Yes)
    - ☐ M0 Anaemia
    - ☐ M1 HIV infection
    - ☐ M2 Previous caesarean section
    - ☐ M3 Prolonged/obstructed labour
    - ☐ M4 Other condition specified in the local manual of operations
    - ☐ M5 Other condition specified in the local manual of operations
    - ☐ M6 Other condition specified in the local manual of operations
    - ☐

Date ☐☐☐☐☐☐☐☐

APPENDIX 3: WHO Outcome indicators related to specific conditions for assessing quality of maternal health care services (Measurement Tool)

Indicators	Number	Percentage
1. Prevention of postpartum haemorrhage		
Target population: women giving birth in health-care facilities		
Oxytocin[a] use		
Use of any uterotonic (including oxytocin)		
2. Treatment of severe postpartum haemorrhage		
Target population: women with severe PPH		
Oxytocin[a] use		
Ergometrine		
Misoprostol		
Other uterotonics		
Any of the above uterotonics		
Tranexamic acid		
Removal of retained products		
Balloon or condom tamponade		
Artery ligation		
Hysterectomy		
Abdominal packing		
Proportion of cases with SMO		
Mortality		
3. Anticonvulsants for eclampsia		
Target population: women with eclampsia		
Magnesium sulfate[a]		
Other anticonvulsant		
Any anticonvulsant		
Proportion of cases with SMO		
Mortality		
4. Prevention of caesarean section related infection		
Target population: women undergoing caesarean section		
Prophylactic antibiotic during caesarean section		
5. Treatment for sepsis		
Target population: women with sepsis		
Parenteral therapeutic antibiotics[a]		
Proportion of cases with SMO		
Mortality		
6. Ruptured uterus		
Target population: women with ruptured uterus		
Laparotomy		
Laparotomy after 3 hours of hospital stay		
Proportion of cases with SMO		
Mortality		
7. Preterm birth		
Target population: women having a preterm delivery after 3 hours of hospital stay		
Corticosteroids for fetal lung maturation[a]		
Early neonatal mortality		

APPENDIX 4: Data Collection Form

Maternal characteristics			
Admission Number		**Age**	
Marital Status	1. Married 2. Unmarried	**Education**	1. Illiterate 2. Primary 3. Middle school level and higher
Occupation	1. Housewife 2. Manual worker 3. Vendor 4. Professional 5. Other		
Obstetric History			
Gravida			
Parity			
History of Abortion / Miscarriage			
History of AN care	1. Yes 2. No		

APPENDIX 5: The near-miss criteria glossary

Acute severe azotemia	creatinine $\geq$ 300 µmol/l or $\geq$ 3.5 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 mg/dl), prolonged prothrombin time (>6s, PT 1.5 times normal), or elevated D-dimer (>1000 mg/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 mm × 75 mm); (58) Hold the tube in your closed fist to keep it warm (+37°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 $\geq$ 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 ml/h for 4 hours or <400 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 μmol/l or >6.0 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 hypo perfusion	Lactate >5 mmol/l or 45 mg/dl.

APPENDIX 6: Ethic Approval from Research Ethics Review Committee for Research involving Human Research Participants, Chulalongkorn University (COA. No. 085/2021)

AF 01-12

The Research Ethics Review Committee for Research Involving Human Research Participants, Group I, Chulalongkorn University

Jamjuree 1 Building, 2th Floor, Phyathai Rd., Patumwan district, Bangkok 10330, Thailand, Tel: 0-2218-3202, 0-2218-3049 E-mail: eccu@chula.ac.th

COA No. 085/2021

Certificate of Approval
Exemption for Ethics Review

Study Title No. 085.1/64 : PREVALENCE AND FACTORS ASSOCIATED WITH MATERNAL NEAR-MISS IN MAGWAY REGIONAL HOSPITAL, MAGWAY MYANMAR

Principal Investigator : AYE MYO THET

Place of Proposed Study/Institution : College of Public Health Sciences,

Chulalongkorn University

This Research proposal is exempted for ethics review in compliance with the Office for Human Research Protections (OHRP Exempt Categories) 45 CFR part 46.101(b).

Certified under condition: To conduct this research project, the researcher (s) must strictly adhere to research proposal approved by the committee. If there is any amendment, it must be sent to the committee for review before carrying on the project.

Signature: ....
(Associate Professor Prida Tasanapradit., M.D.)
Chairman

Signature: ....
(Assistant Prof. Raveenan Mingpakanee, Ph.D.)
Secretary

Date of Exemption : 19 April 2021

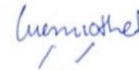# APPENDIX 7: Approval Letter from Magway Regional Hospital

To

Medical Superintendent

Magway General Hospital

Magway City

Date: 16/10/2020

Subject: **Letter of request to collect the necessary information for a research paper**

1.   Regarding the above issue, I am Aye Myo Thet, Master's degree student of Chulalongkorn Univeristy, Bangkok, Thailand. I have been attending Master of Public Health course since August. For this master degree course, I have to do a research. The tile of my research paper is **"Prevalence and factors associated with maternal near miss in Magway Regional Hospital, Magway, Myanmar",** which is the Medical Records Review Category.

2.   Therefore, I respectfully request permission to collect the secondary data at Magway Regional Hospital that is required for my master degree study.

With regard

Aye Myo Thet
(Student No. 6374038053)
Master of Public Health Student
Chulalongkorn University, Thailand

Registration Number	3682
Date	16/10/2020
Medical Superintendent	
Medical Officer	

Approved By

Dr. Win Win Htay

M.B., B.S

Dip.Med.Sc

Hospital Admin

Magway General Hospital

Comment

- Deputy Medical Superintendent and Medical Officers at Magway General Hospital
  - o To coordinate with Miss Aye Myo Thet's data collection plan

APPENDIX 8: Budget and Study time Frame

The budget required for the research is estimated below;

Description	Cost
1. Approval Request Documents for data collection	5,00 THB
2. Transportation	6,000 THB
3. Printing and copy cost	5,000 THB
4. Hospital Chart Review funding cost	5,000 THB
5. COVID – test and medical certificate	5,000 THB
Total	**21,500 THB**

จุฬาลงกรณ์มหาวิทยาลัย

CHULALONGKORN UNIVERSITY
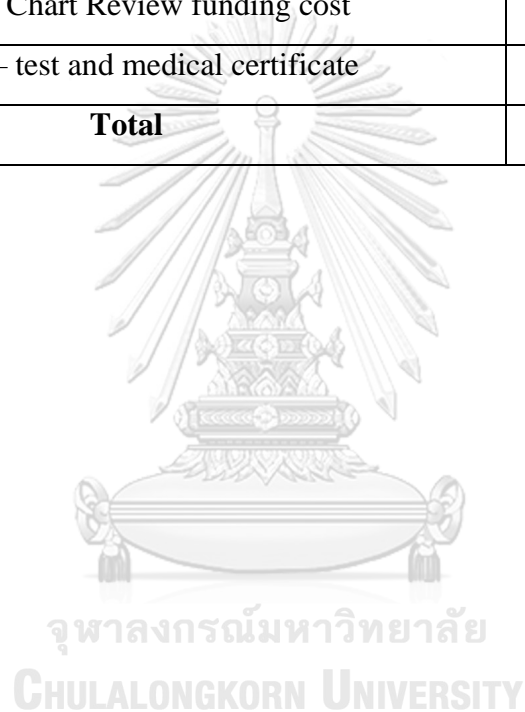
Study Time Frame

Research Activities	Time Frame (month)								
	Oct 2020	Nov 2020	Dec 2020	Jan 2021	Feb 2021	Mar 2021	Apr 2021	May 2021	June 2021
Literature review	■	■	■						
Proposal Writing		■	■	■					
Proposal Exam					■				
Ethical approval						■			
Respond to the comments from research ethic review							■		
Contact the hospital staffs for data collection							■		
Data collection							■	■	
Data entry								■	
Data analysis									■
Thesis writing and thesis defense									■
Total	9 months								

VITA

NAME	Aye Myo Thet
DATE OF BIRTH	6 July 1992
PLACE OF BIRTH	Magway
INSTITUTIONS ATTENDED	University of Community Heatlh, Magway, Myanmar
HOME ADDRESS	No 68, Main Road, Kan Hla Village, Magway township, Myanmar
PUBLICATION	- Knowledge, Attitude, Practice on health seeking behaviors among under 5years children' mothers in Thit-Yar-Gauk Rural Health Centre, Magway township. (December 2012) - "Establishment of Non-permitted Dyes Free Market, Zay-Cho, Mandalay Region". (Myanmar Health Sciences Research Journal). It has been registered with the registration No. M-00196, dated 27-4-2019
AWARD RECEIVED	ASEAN and Non - ASEAN Full Scholarship Award