

RESEARCH ARTICLE

Maternal Mortality Review by Three-Delay Model: A Three-Year Retrospective Study in Ilocos Norte

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Received: 07 October 2025 Accepted: 24 October 2025 Published: 30 October 2025

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Abstract

Maternal health continues to be a global concern because of the rise of maternal mortality. Locally, in Ilocos Region, significant reduction in Maternal Mortality Rate (MMR) was achieved from 2016 to 2019, however, there was a rise of MMR, which peaked in 2021 where it recorded an MMR of 77.17.⁶ The “three delay model” is a framework used to evaluate the reasons for maternal death in terms of identifying hindrances in maternal care that can be studied to improve maternal health.

The study aimed to determine the causes of maternal death in Ilocos Norte using the three-delay model. It included all maternal deaths that occurred in Ilocos Norte from 2020 to 2022 that met the definition of the World Health Organization for maternal death. A total of 36 maternal deaths were recorded from various healthcare facilities in Ilocos Norte from 2020 to 2022. 24 patients were residents of Ilocos Norte while 12 were from nearby provinces. The types of delays were identified, and the most common cause of death was recorded. Severe preeclampsia (n=8, 22.22%) is the most common cause of maternal death. Type I delay (delay in seeking care) is the most common comprising 50% (n=18) of the cases, followed by Type II delay (delay in reaching a first-level health facility) which is 44.44% (n=16), and the last is Type III delay (delay in receiving adequate care in the facility).

In conclusion, this study reinforces those delays in recognizing complications, reaching healthcare facilities, and receiving adequate care significantly impact maternal outcomes. The findings highlight the urgent need for increased awareness, improved transportation infrastructure, and better financial support to ensure timely access to maternal healthcare services. Strengthening antenatal care and providing prompt medical attention are crucial steps in safeguarding maternal health and preventing deaths.

Keywords: Maternal Death, Maternal Mortality Rate, Maternal Mortality Review Three-Delay Model.

1. Introduction

Safeguarding maternal health is dependent on the creation of a healthy world. The promotion of safe motherhood equates to the promotion of the well-being of women. Maternal health continues to be a global concern because of the rise in maternal mortality, especially in third-world countries.

The reduction of global maternal mortality is one of the Sustainable Development Goals (SDG).¹

Maternal Mortality Ratio (MMR), which is the ratio of the number of maternal deaths per 100,000 live births, is the standard indicator of measuring maternal deaths. SDG aims to decrease MMR to less than 70 per 100,000 births by 2030.^{2,3}

The World Health Organization reports that every minute, a woman dies as a result of pregnancy and childbirth-related complications. Moreover, it also disclosed that pregnancy and childbirth-related

Citation: Lovely A. Bolo, Gisele G. Acantilado. Maternal Mortality Review by Three-Delay Model: A Three-Year Retrospective Study in Ilocos Norte. Open Access Journal of Gynecology and Obstetrics 2025;7(2): 34-41.

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complications lead to more than 300,000 maternal deaths worldwide, as per estimates.¹ Global MMR in 2017 was estimated at 342 maternal deaths per 100 000 live births, which had declined by 38% since 2000. Ninety-nine percent of these deaths occur in low- and middle-income countries (LMICs), of which Sub-Saharan Africa and South Asia contribute 90 per cent.⁴

The Philippines, being one of the lower-middle income countries, recorded an MMR of 84 in 2016, 81 in 2018 and 78 in 2020.⁵ The record is declining yet it is still far from the SDG target.

Locally, in the Ilocos Region, a significant reduction in MMR was achieved from 2016 to 2019. However, these were not sustained and higher numbers of maternal deaths were reported in the succeeding years. It rose in 2020 and tremendously shot up in 2021 when it recorded an MMR of 77.17.⁶

Such disheartening data led the researcher to look into the maternal mortality rate of Ilocos Norte and assess maternal mortality using the three delay model so that the root of problems in maternal deaths can be identified and improvements can be done in the future, hence this study.

The “three delay model” proposed by Thaddeus and Maine (1990) was used to analyze the delays associated with MMR. These are 1) delay in deciding to seek care, 2) delay in reaching a healthcare facility 3) delay in receiving care at the healthcare facility. This framework has been demonstrated as a valuable and broadly acknowledged system for critically analyzing hindrances in obstetrics care and their contribution to maternal mortality.⁷

2. Objectives

A. General Objective

This study aimed to recognize the most common causes and delays in maternal death in Ilocos Norte from 2020 to 2022.

B. Specific Objectives

2.1 It specifically aimed to answer the following questions

1. The profile, antenatal care, parity, referral characteristics, duration of hospital stay, and interventions of maternal deaths that occurred in Ilocos Norte.
2. The most common cause of maternal death in Ilocos Norte.
3. Type/s of delay contributing to maternal death in Ilocos Norte

3. Methodology

This study utilized a descriptive research design following a retrospective chart review. It employed a total enumeration of maternal deaths that occurred in Ilocos Norte from 2020 until 2022, which satisfied the inclusion criteria.

3.1 Inclusion Criteria

All maternal deaths that occurred in Ilocos Norte during the year 2020-2022 that meets the World Health Organization criteria defined as female deaths from any cause related to or aggravated by pregnancy or its management during pregnancy and childbirth or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy.

3.2 Exclusion Criteria

Maternal death due to accidental or incidental causes.

3.3 Data Collection Process

The details of all the maternal deaths from January 2020 to December 2022 were collected from the individual case sheets, Facility-Based Maternal Death Review Form and MDR Case Summary that were gathered from MMMHMC, Rural health units, Provincial Health Office.

3.4 Data Analysis

All maternal mortality cases were collected and analyzed by grouping them into three criteria of the three delay models.

Each case was assigned a single underlying cause of death. For each maternal death, data sheets were created using all pertinent information obtained from the patient charts. This study reviewed and analysed data based on age, parity, education, residence, antenatal care, referral characteristics, duration of hospital stay, interventions, causes of death, and delays contributing to death.¹³ All the data were presented as frequencies and percentages.

4. Results

A total of 36 maternal deaths were recorded from various health facilities, which include Rural Health Units, district hospitals, private hospitals and the Mariano Marcos Memorial Hospital and Medical Center, from 2020 to 2022. In order to achieve the set objectives of the study, the following data were presented.

4.1 Demographic Characteristics

The demographic profile of maternal death cases that occurred in Ilocos Norte during the years 2020 to 2022 was presented in Table 1. The majority of maternal deaths fall in the age group 30 years and above, comprising more than half (58.34%) of the total deaths recorded. Twenty-nine cases (80.56%)

of maternal death were from the rural area, while the remaining were from the urban area. It is important to note that out of the 36 maternal death patients, 12 of them were from nearby provinces such as Ilocos Sur, Abra, and Cagayan. In addition, most cases were at least high school graduates. As for the socioeconomic status, 61.11% (22 cases) belong to the lower-income class.

Table 1. Demographic Characteristics

	Cases (36)	Percentage
Age at death (Years)		
<20	2	5.56
20-24	4	11.11
25-29	9	25.00
30-34	10	27.78
>35	11	30.56
Place of residence		
Rural	29	80.56
Urban	7	19.44
Education		
Illiterate	0	0.00
Elementary	4	11.11
High school	17	47.22
College	15	41.67
Socioeconomic status		
Lower Class	22	61.11
Middle Class	14	38.89
Upper Class	0	0.00

4.2 Antenatal Care (Anc) and Parity

Figure 1a shows that the majority of the patients had antenatal care at a Rural health unit (RHU), 27.8% sought care from a Private medical doctor (PMD), and 19.4% went to a tertiary hospital for antenatal

care. Despite available healthcare providers, 13.9% of patients had no antenatal check-up.

Figure 1b shows the parity of the cases of maternal death. 80.56% were multipara, and only 19.44% were primipara.

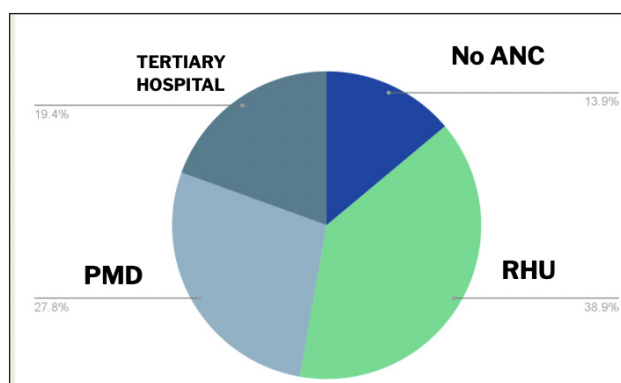


Figure 1a. Antenatal Care

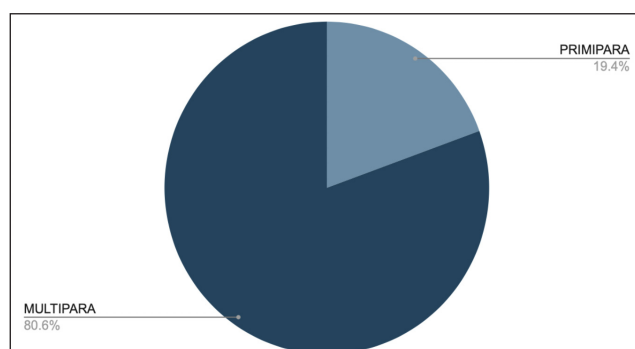


Figure 1b. Parity

4.3 Referral Characteristics

Table 2 provides insights into the pregnant women's referral patterns and access to the hospital at the time of death. It was noted that the majority (41.67%) of the cases arrived at the hospital as walk-ins prior to death. Others were referred from various clinics, 33.33% from the provincial hospital, 5.56% each from the district and private hospitals, and 13.89% from the rural health units.

A significant portion of the cases traveled long distances and spent extended time reaching the final

Table 2. Referral Characteristics

	Cases (36)	Percentage
Referred from		
RHU	5	13.89
District hospital	2	5.56
Provincial Hospital	12	33.33
Private hospital	2	5.56
Walk in	15	41.67
Distance travelled to reach final hospital (Km)		
< 5	4	11.11
5 - 25	7	19.44
25 - 50	12	33.33
> 50	13	36.11
Time travelled to reach final hospital (hour)		
< 30 minutes	10	27.78
1 - 3	15	41.67
3 - 6	11	30.56

hospital, clearly showing the challenges the patients face in accessing the hospital. The majority of the cases came from at least 25 kilometers away from the hospital, comprising 69.44% of the total cases of maternal death. With these, it can be inferred that for a patient to reach the hospital, it will take about 1 to 6 hours of travel. Majority of the cases came from at least 25 kilometers away from the hospital, comprising 69.44% of the total cases of maternal death. With these, it can be inferred that for a patient to reach the hospital, it will take about 1 to 6 hours of travel.

4.4 Duration of Hospital Stay and Intervention

The data in table 3 provides an overview of hospital stay duration and medical interventions for all the maternal death cases. For the duration of hospital stay, most cases (66.67%) stayed between 1 and 7 days, followed by 27.78% who stayed for less than a day.

Regarding medical interventions, Intensive care unit

(ICU) admission was the most common, accounting for 72.22% of cases. Caesarean sections were performed in 38.89% of patients, while blood transfusions were required in 8.33%. Postpartum hysterectomy was conducted in 5.56% of cases, and laparotomy was the least common. These statistics provide insight into the medical needs and hospitalization patterns of the maternal death cases.

Table 3. Duration of Hospital Stay (Days) and Intervention

	Cases (n)	Percentage
Duration of Hospital stay (days)		
< 1	10	27.78
1 - 7	24	66.67
8 - 14	2	5.56
15 - 42		0.00
Intervention		
Caesarean Section	14	38.89
Laparotomy	1	2.78
Postpartum Hysterectomy	2	5.56
ICU admission	26	72.22
Blood transfusion	3	8.33

4.5 Causes of Maternal Death

The data in table 4 categorizes maternal deaths into direct and indirect causes. Among direct maternal deaths, the most common cause was hypertensive disorders in pregnancy, particularly severe preeclampsia, accounting for 22.22% of cases. Postpartum hemorrhage contributed to 16.67% of deaths.

Indirect maternal deaths were predominantly caused by COVID-19 infection, representing the highest

proportion at 27.78%. Cardiac disorders, including myocardial infarction (MI) and rheumatic heart disease (RHD), contributed to 13.89% of deaths. Respiratory disorders accounted for 8.33%, while neurological disorders and pregnancy with abortive outcomes each contributed to 2.78% of cases. These data highlight the significant impact of both obstetric and non-obstetric complications on maternal mortality, with a notable burden from COVID-19 and hypertensive disorders in pregnancy.

Table 4. *Maternal Cause of Death*

Type	Group name/ numbers	Cause of death	Cases (36)	Percentage
Maternal death: Direct	1. Pregnancy with abortive outcome	Abortion	1	2.78
	2. Hypertensive disorder in pregnancy, childbirth and puerperium	Severe preeclampsia	8	22.22
	3. Obstetric hemorrhage	Postpartum hemorrhage	6	16.67
	4. Pregnancy related infection	Puerperal sepsis		0.00
	5. Other obstetric complication	Amniotic fluid embolism	2	5.56
	6. Unanticipated complication of management	Aspiration pneumonitis		0.00
Maternal death: Indirect	7. Non obstetric complication	Anemia		0.00
		Cardiac disorders (MI/RHD)	5	13.89
		Liver disorders		0.00
		Respiratory disorders	3	8.33
		Neurological Disorders	1	2.78
		Covid Infection	10	27.78

4.6 Types of Delays

The data in table 5 categorizes delays in maternal healthcare into three types. Among Type 1 delays (delay in seeking care), the most common reason was unawareness of danger signs. Delay in decision-making was another significant factor, contributing 41.67%. Other reasons, such as beliefs and customs (2.78%) and the non-availability of healthcare professionals (2.78%), played a minor role. At the

same time, illiteracy, ignorance, and lack of birth preparedness did not contribute to delays in this dataset.

For Type 2 delays (delay in reaching a first-level health facility), the most frequent issue was not reaching the appropriate facility in time, affecting 44.44% (16) of cases. Difficulty in getting transport was another key barrier, contributing to 30.56% (11), while delay in mobilizing funds accounted for only 2.78%.

Table 5. *Types of Delays*

Type of Delay	Reason for the delay	Cases (36)	Percentage (%) ^a
Type 1 Delay - Delay in Seeking Care	Unawareness of danger signs	18	50
	Illiteracy & Ignorance	-	0
	Delay in decision making	15	41.67
	No birth preparedness	-	0
	Beliefs and customs	1	2.78
	Non-availability of health care professional	1	2.78
	Any other	-	0
Type 2 Delay - Delay in reaching first level health facility	Delay in getting transport	11	30.56
	Delay in mobilizing funds	1	
	Not reaching appropriate facility in time	16	44.44
Type 3 Delay - Delay in receiving adequate care in facility	Delay in initiating treatment	2	5.56
	Substandard care in hospital	2	
	Lack of blood, equipment & drugs	1	2.78
	Any other	-	0
Any delay ^a			
NA: information that cannot be extracted in our records will be narrated as not available in records			

Type 3 delays (delay in receiving adequate care in the facility) were less frequent but still present. Delays in initiating treatment and substandard hospital care contributed to 5.56% (2) of cases, while a lack of blood, equipment, and drugs accounted for 2.78%.

However, it has to be noted that there were maternal death cases who have at least two different types of delays applicable to them. For instance, one case posed type 2 and 3 delays, wherein the patient did not reach the facility in time, and when she arrived, there was a delay in initiating treatment. Also, for this specific patient, during her hospitalization, she required a blood transfusion but was not served due to a lack of blood supply.

Overall, the data highlights that delays in seeking care and reaching an appropriate facility were the most significant barriers to timely maternal healthcare, with lack of awareness and transportation challenges being the predominant factors.

5. Discussion

The Three Delays Model is very crucial for understanding why maternal deaths occur and how to prevent them. It highlights the barriers women face when accessing timely and appropriate maternal health care.⁶

Based on the results presented, it can be inferred that the demographic profiles of the pregnant patients may influence the types of delays. It was observed that the most common reason for the Type 1 Delay is a lack of awareness. Many women and families may not recognize the danger signs of pregnancy complications. Suppose there are delays in seeking care for a pregnant woman. In that case, they may not realize they have underlying conditions, such as high blood pressure and elevated blood sugar levels, that require urgent medical attention. It may be assumed that these complications are usual in pregnancy, and when recognized, it may already be life-threatening.¹⁴

In a study conducted by Ghumare, the leading cause of maternal death in a rural town in India is eclampsia, which is also observed in this study.²¹ It is also important to note that the data collected for this study is from 2020-2022, which is the time of the COVID-19 pandemic that puts pregnant women at a higher risk, hence a considerable number of maternal deaths were recorded due to COVID-19 infection. During this season, movement is restricted, especially for pregnant women. This can also be a contributory factor to why pregnant women were not able to seek

care. Combining the delay due to lack of awareness and COVID pandemic restrictions imposed a greater risk for pregnant women. In another study by Sk, Type 1 delay was the most significant contributor to maternal deaths.²³

On the other hand, the second type of delay refers to problems in physically reaching an appropriate health care facility after the decision to seek care has been established. This was also the second major contributor mentioned in the study of Sk. They reported that the maternal deaths recorded were coming from rural areas that have transportation problems, as well as poor roads, and additionally, financial constraints in getting private vehicles.²² These findings can also be correlated to the data in this study, where 69.44% of the patients of maternal death were at least 25 kilometers away from the final hospital. It takes at least one hour and utmost 6 hours before reaching the facility. 11 maternal deaths were found to be from outside Ilocos Norte, where it took them from 3 to 6 hours travel time before reaching the referral facility, and only one patient from outside Ilocos Norte who is 1-3 hours away from the referral facility. If a patient has a delay in seeking care, and with the distance from the hospital and the time to reach it, there will be a very high chance that the pregnant patient will expire. Also, most patients belong to the low-income and middle-income classes, which may be challenging when seeking care from a healthcare provider or reaching a healthcare facility to avail of antenatal care. These are all factors that contribute to maternal death.

Severepreeclampsia, possible postpartum hemorrhage, and other causes of death, as presented in this study, are mostly preventable if there is prompt detection. Ensuring prompt and timely seeking care is particularly helpful in alleviating pregnancy complications, hence lowering the incidence of maternal death.²²

6. Conclusion

In conclusion, the Three Delays Model provides a valuable framework for understanding the barriers contributing to maternal deaths. This study reinforces that delays in recognizing complications, reaching healthcare facilities, and receiving adequate care significantly impact maternal outcomes. The findings highlight the urgent need for increased awareness, improved transportation infrastructure, and better financial support to ensure timely access to maternal healthcare services. By addressing these challenges, particularly among low- and middle-income populations, maternal mortality rates can be reduced.

Strengthening antenatal care and ensuring prompt medical attention are crucial steps in safeguarding maternal health and preventing avoidable deaths.

6.1 Limitations and Recommendations

This study covers recorded data in various healthcare facilities from 2020 to 2022, and only obtained 36 maternal death cases. Expanding the sample size by including the year 2023 onwards, when restrictions were removed, in the post-COVID-19 pandemic era, is recommended for a more comprehensive assessment of maternal deaths. In this way, a better understanding of the causes of maternal deaths will be presented. The researcher also suggests combining qualitative and quantitative approaches for future studies related to the Three Delay Model to gain a deeper understanding of maternal health challenges. This can be done by conducting in-depth interviews of the patients' families and relatives and the healthcare providers to gather their personal experiences and insights. This study can also be improved by evaluating the healthcare readiness in maternal care of rural health units, which are the primary access points for these pregnant women in their local areas. It is also noteworthy to relay the results of such studies to various towns in Ilocos Norte and the Provincial Health Office to give feedback on the status of maternal deaths in different healthcare facilities.

In addition, healthcare providers and policymakers can identify barriers in maternal healthcare by addressing the three delays. It is recommended that they develop a maternal healthcare program where pregnant women, especially those from rural areas that are very far from healthcare facilities, are guided on the interventions to improve maternal survival. These programs may include community education, better transportation, and hospital capacity-building. Local governments may offer free or low-cost maternal healthcare programs, provide means to reach healthcare facilities, or bring competent medical doctors to perform antenatal care regularly to pregnant women from distant places. Sustainable investments in maternal health will not only save lives but also improve overall public health and economic growth.

6.2 Acknowledgement

I would like to express my deepest gratitude to my research supervisor, Dr. Gisele Acantilado for her invaluable guidance, continuous support, and encouragement throughout the course of my research. Also to our department's research committee for sharing their expertise, insightful feedback, and unwavering patience.

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