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## Overview of Maternal Mortality Causes from 2006 until 2023 in Cirebon City

Alifa Maulida\*, Ricardi Witjaksono Alibasjah, Menik Herdwiyantri

Universitas Swadaya Gunung Jati, Indonesia

Email:maulidaalifa0@gmail.com\*

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### KEYWORDS

Maternal Mortality Rate; Causes Of Death; Cirebon

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### ABSTRACT

Maternal Mortality Rate (MMR) is a critical health indicator reflecting the risks associated with pregnancy, childbirth, and postpartum periods. Between 2006 and 2023, Cirebon City experienced fluctuations in maternal deaths due to both direct and indirect causes. This study aims to analyze the trends in maternal mortality in Cirebon City, focusing on direct causes such as hemorrhage, eclampsia, and hypertension, as well as indirect causes like cardiovascular diseases and COVID-19. The study used a retrospective descriptive design, analyzing secondary data from maternal death audits and records from the Cirebon City Health Office over a 17-year period. Results revealed 64 maternal deaths, with direct causes contributing 40 deaths (63%) and indirect causes 24 deaths (37%). The most frequent direct causes were bleeding and eclampsia, while COVID-19 and cardiovascular diseases dominated indirect causes. The study highlights the need for continuous improvement in maternal health services, including early detection and intervention, and suggests further research on addressing the impact of pandemics on maternal health outcomes. This study provides essential data to inform health policies aimed at reducing maternal mortality in Cirebon City.

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**Corresponding Author:** Alifa Maulida

**Email:** maulidaalifa0@gmail.com

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### INTRODUCTION

Maternal Mortality Rate (MMR) is one of the indicators used to assess the success of maternal health efforts. Maternal death is defined by the World Health Organization (WHO) as "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes" (World Health Organization [WHO], 2022). The maternal mortality rate is the number of maternal deaths per 100,000 live births. MMR reflects the quality of a country's health because it encapsulates the results of various aspects, both clinical (such as the quality and quantity of medical and health workers, availability of health service facilities, health insurance, and referral information systems) as well as non-clinical health aspects (such as culture, education, and access to health services) (Nurhidajat et al., 2020). According to research by Singh et al. (2021), improving access to skilled health personnel and efficient referral systems can

significantly reduce maternal deaths. Additionally, cultural factors and education about maternal health play a key role in lowering MMR, especially in rural areas (Kumari & Patel, 2022). The availability of healthcare services and health insurance coverage has been shown to positively impact maternal health outcomes (Akhter et al., 2023). Furthermore, studies by Wei et al. (2020) highlight the importance of government policies and infrastructure in improving maternal health outcomes and reducing MMR. Interventions targeting the improvement of non-clinical factors, such as education and community awareness, are critical in addressing maternal mortality (Hassan et al., 2022).

In Indonesia, based on the results of the long form of the Population Census from 2010 to 2020, there has been a decrease in MMR. In 2010, there were 346 deaths per 100,000 live births, decreasing to 305 deaths per 100,000 births in 2015, and further to 189 deaths per 100,000 live births in 2020 (Health Profile et al., 2017). Although there is a tendency for a decrease in maternal mortality, MMR has not reached the Global Millennium Development Goals (MDGs) target, which is 102/100,000 live births (Respati et al., 2020).

The maternal mortality rate in Cirebon City is expressed as a number because the number of live births does not reach 100,000. According to the health profile of Cirebon City for the period 2013-2015, there were 11 maternal deaths: 5 from pregnancy hypertension, 3 from cardiovascular disorders, 2 from bleeding, and 1 from inversion uteri. From 2019-2021, there were 20 maternal deaths: 8 due to COVID-19, 5 due to pregnancy hypertension, 4 due to other causes, and 3 due to bleeding.

The decline in deaths from direct causes such as bleeding, hypertension in pregnancy, and infection illustrates that physical examinations during antenatal care for early detection of risk factors are quite good (Knight et al., 2017; Poon et al., 2018). However, there is still a need to improve skills in early detection through RSBM (*Rumah Sakit Berbasis Masyarakat* or Community-Based Hospitals), which is a government program that has been running in Cirebon City since 2006. This program seeks to improve community health through promotive, preventive, curative, and rehabilitative activities, and by improving the quality of antenatal care services. In addition to addressing direct causes of death, it is also necessary to address indirect causes of maternal death, such as mothers with heart disorders, lung disorders, and other conditions, to prevent delays in handling. This requires preparation to face prevention, screening, and management that goes beyond the field of obstetrics.

This study will explore the maternal mortality rates based on direct and indirect causes from 2006 until 2023 in Cirebon City. Several studies have examined the direct and indirect causes of maternal deaths globally and in Indonesia. However, there is a lack of research focusing specifically on the causes of maternal mortality in Cirebon City, which presents a significant gap. Previous studies by Respati et al. (2020) and Nurhidajat et al. (2020) have highlighted trends in MMR at the national level, but regional disparities remain underexplored. Furthermore, while the global burden of indirect causes like cardiovascular disease and infections, including the recent COVID-19 pandemic, is recognized, the impact of these causes on local maternal health in Cirebon City has not been comprehensively addressed.

The rising maternal mortality, especially due to indirect causes such as COVID-19, underscores the urgency of improving health systems at the local level. There is an immediate

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need to analyze the trends in maternal mortality in Cirebon City to identify the most prevalent causes, both direct and indirect, and to address healthcare system weaknesses that contribute to maternal deaths.

This study brings novelty by offering an in-depth analysis of maternal mortality in Cirebon City over an extended period (2006-2023), focusing on both direct and indirect causes. It also highlights the role of recent health challenges, such as the COVID-19 pandemic, in shaping maternal mortality rates. By exploring the local context and assessing the efficacy of current interventions like the Community-Based Hospital (RSBM) program, this study provides unique insights into regional health systems and their impact on maternal health.

The benefits of this research extend to public health policy, healthcare providers, and local authorities in Cirebon City. By offering data-driven insights, it can guide future interventions aimed at reducing maternal mortality, ultimately contributing to the improvement of maternal health in the region and helping achieve national and international health targets. The main objective of this research is to provide an overview of maternal mortality trends in Cirebon City from 2006 to 2023, with a focus on both direct and indirect causes. This study aims to identify the most common causes of maternal deaths in the region, assess the effectiveness of existing maternal health programs in reducing mortality, and offer policy recommendations for improving maternal health services. Specifically, it will address high-risk pregnancies and indirect causes, such as cardiovascular diseases and infections, to inform strategies that can enhance maternal health outcomes in Cirebon City.

## **METHOD**

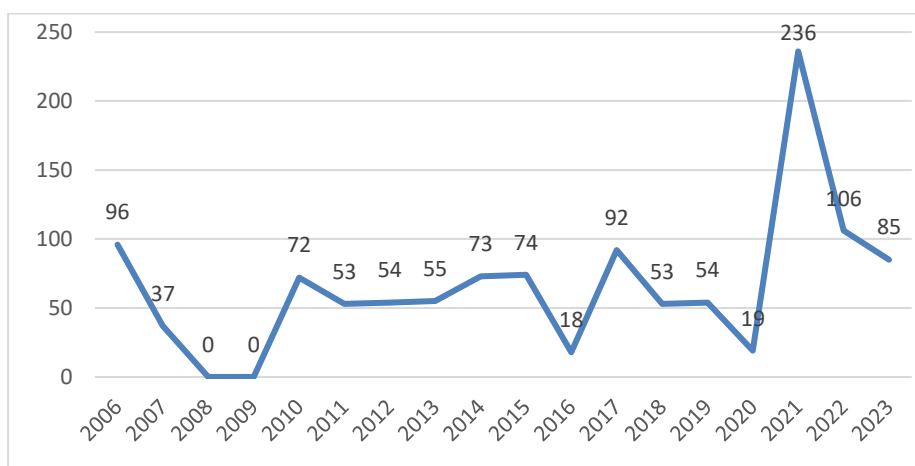
The research applied a retrospective descriptive study design using total sampling, where data were obtained from secondary sources and maternal audit records of all maternal deaths occurring during pregnancy, childbirth, and the postpartum period in Cirebon City between 2006 and 2023, resulting in 64 eligible cases. Inclusion criteria encompassed all maternal deaths within the specified period, while cases with incomplete data and deaths caused by accidents were excluded. The study measured variables related to maternal death causes, categorized into direct causes (*bleeding, pregnancy-induced hypertension, infection, prolonged labor, embolism*) and indirect causes (*anemia, cardiovascular disease, diabetes mellitus, and COVID-19*). Univariate analysis was conducted to examine the frequency distribution and percentage of maternal deaths due to both direct and indirect causes. Ethical approval for the study was granted by the Health Research Ethics Committee of the UGJ Faculty of Medicine under approval number 95/EC/FKUGJ/VI/2024.

## **RESULT AND DISCUSSION**

The study was conducted at the Cirebon City Health Office in the period from June to July 2024. There were 64 maternal deaths based on direct causes 40 (63%) deaths and indirect causes 24 (38%) deaths.

### Overview Of Maternal Mortality Rate

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**Figure 1.** Graph of maternal mortality rates per 100.000 live births in Cirebon City due to direct and indirect causes during 2006-2023

Source: Researcher

There were several years where the maternal mortality rate increased, namely in 2021 as many as 12/5070 (236/100,000 KH), 2022 as many as 5/4707 (106/100,000 KH), 2006 as many as 5/5206 (96/100,000 KH). There were several years where the number of maternal deaths decreased, namely in 2009 as many as 0/5432 (0/100,000 KH), in 2016 as many as 1/5555 (18/100,000 KH), and in 2008 as many as 1/5600 (18/100,000 KH). In general, it is difficult to see a consistent downward trend in MMR from year to year based on the available data.

Maternal death due to direct causes

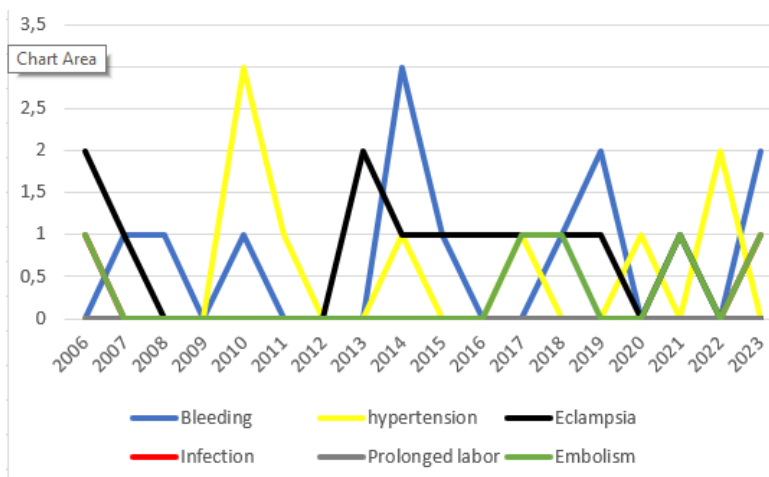
**Table 1.** Direct causes of death in Cirebon City from 2006-2023

Source: Researcher

Direct causes	n (%)			Total	Percentage
	2006-2011	2012-2017	2018-2023		
Hemorrhage	3 (7%)	4 (10%)	5 (12%)	12	30%
Hypertension	4 (10%)	2 (5%)	3 (7%)	9	23%
Eclampsia	3 (7%)	6 (15%)	3 (7%)	12	30%
Infection	1 (2%)	0 (0%)	1 (2%)	2	5%
Prolonged labor	0 (0%)	0 (0%)	0 (0%)	0	0%
Embolism	1 (2%)	1 (2%)	3 (7%)	5	12%
	TOTAL			40	100%

From the table above, it can be seen that bleeding and eclampsia are the top direct causes in Cirebon City during the observation period with the percentage of deaths each (30%) of the total deaths. The increase in deaths due to eclampsia and hemorrhage is caused by delays in medical treatment, lack of regular prenatal check-ups, limited healthcare facilities, low maternal health education, and rapidly developing complications. Followed by hypertension as much as (23%) of the total deaths. Infection and embolism are also recorded as direct causes

of death, although with a lower percentage. Meanwhile, there were no cases of death due to prolonged labor during the observed period.



**Figure 2.** Graph of Maternal Mortality Due to Direct Causes 2006-2023 in Cirebon City  
 Source: Researcher

Maternal death due to indirect causes

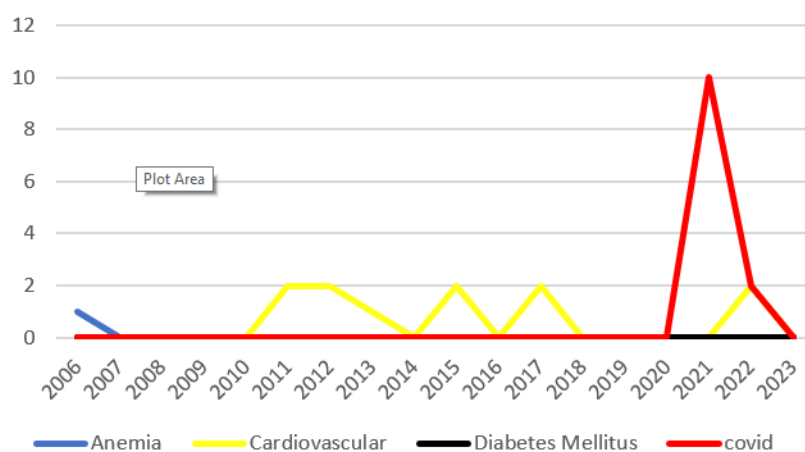
**Table 2.** Indirect causes of death in Cirebon City from 2006-2023

Source: Researcher

Indirect causes	n (%)			Total	Percentage
	2006-2011	2012-2017	2018-2023		
Anemia	1 (4%)	0 (0%)	0 (0%)	1	4%
Cardiovascular	2 (8%)	7 (29%)	2 (8%)	11	46%
Diabetes Mellitus	0 (0%)	0 (0%)	0 (0%)	0	0%
Covid	0 (0%)	0 (0%)	12 (50%)	12	50%
	TOTAL			24	100%

Table 2 presents data on indirect causes of death in a population during three time periods, namely 2006-2011, 2012-2017, and 2018-2023. Based on the table, cardiovascular disease and COVID-19 were the most dominant indirect causes of death during the period. Cardiovascular was found to be 11 (46%), COVID was 12 (50%). Cardiovascular disease was consistently the leading cause of death until 2017 but was then replaced by COVID-19 in the 2018-2023 period. Maternal deaths due to COVID-19 increased because of reduced immunity, respiratory complications, delayed access to care, comorbidities, and limited medical facilities.

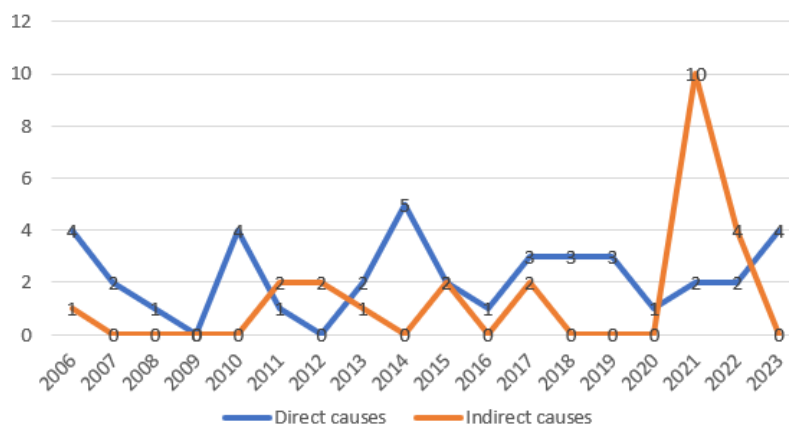
There was 1 death in anemia and diabetes mellitus was recorded as very small and did not contribute significantly to total deaths.



**Figure 3.** Graph of Maternal Mortality Due to Indirect Causes 2006-2023 in Cirebon City  
 Source: Researcher

Cases of death due to cardiovascular disease showed an increase in 2011, 2015, 2017, and 2022, which were obtained by 2 cases of death. Cases of death due to COVID-19 only emerged in 2020 and experienced a high spike in 2021 by 10 cases of death. After that, the death rate began to decline.

Trends in the Number of Maternal Deaths Due to Direct and Indirect Causes



**Figure 4.** Number of Maternal Deaths Due to Direct and Indirect Causes  
 Source: Researcher

Figure 4 indicates a significant increase in both direct and indirect causes of death from year to year. The number of direct causes increased to 5 deaths in 2015, decreased to 1 death in 2016, remained steady at 3 deaths from 2017 to 2019, and then increased again to 4 deaths in 2023. On the other hand, indirect causes of death saw a sharp increase in 2021, with 10 deaths, surpassing the number of direct deaths in the same year.

**Discussion**

Maternal death due to direct causes

The study results revealed that there were fluctuations in several causes of maternal mortality, such as hypertension and bleeding, in 2010 and 2014, while in other years there was a decrease. This suggests that there are various factors influencing the dynamic maternal mortality rate. Direct causes of maternal deaths that frequently occur are bleeding and eclampsia, accounting for 12 deaths, followed by hypertension with 9 deaths. These three causes consistently appear as leading causes of maternal death almost every year. Several factors can increase the risk of mothers developing hypertension during pregnancy, including the pregnant woman's age, knowledge, history of hypertension, family history of hypertension, parity, pregnancy with multiples, obesity before pregnancy, and autoimmune diseases. (Health Profile of West Java et al. 2020)

Maternal deaths due to bleeding are the most dominant during the period 2006-2023. Data from the World Health Organization (2012) indicates that postpartum hemorrhage accounts for about 35% of maternal deaths. The majority of maternal deaths caused by bleeding are due to three types of delays: recognizing pregnancy danger signs, referring mothers to medical centers, and seeking help from health services. These delays contribute significantly to maternal mortality rates during the period from 2006 to 2023. (Ita H et al. 2022). It's important to note that maternal deaths due to embolism have remained stable, with 1 death case reported in 2007, 2017, 2018, 2021, and 2023. Given this continued occurrence, it's crucial to intensify efforts in early detection during antenatal examinations to minimize potential obstetric complications.

In 2006, there was one death due to infection. Following that, from 2007 to 2022, there was a drastic decline in cases, almost reaching zero. This decline indicates that there have been effective control efforts. However, in 2023, there was another death due to infection, which suggests factors such as the emergence of new pathogens and decreased immunity due to a lack of vaccination could lead to an increase in infection cases.

Maternal death due to indirect causes

The number of deaths from indirect causes increased significantly in 2021 due to the COVID-19 pandemic. The pandemic had a major impact on routine health services, including maternal health services. Many pregnant women were afraid to seek medical care due to the risk of COVID-19 infection. (Alifian et al. 2022) COVID-19 also affected the capacity of referral health facilities, leading to changes in the MMR reduction program, such as a decrease in postpartum visits. (Gabiella et al. 2021)

Before the COVID-19 pandemic, the number of maternal deaths from indirect causes was mostly due to cardiovascular disease. In the beginning, there was a significant decline, almost down to zero. However, there were several deaths in 2011, 2012, 2015, 2017, and 2022. Even though there have been decreases in some years, there is still a possibility of an increase in the following year. Worldwide, heart disease is a major cause of maternal death, contributing to over 10% of all maternal deaths globally. (Rebecca et al. 2020)

The Cirebon City Government launched the Community Based Hospital (RSBM) program in 2006, which is still ongoing. RSBM activities in Cirebon City include providing services from obstetricians, cardiologists, and pediatricians who screen high-risk pregnant women, neonates, infants, and toddlers at the basic level. Additionally, the program includes

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discussions on maternal and child mortality cases across different sectors and programs, as well as monitoring and evaluating RSBM. As a result of the program's efforts to reduce maternal mortality rates (MMR) in Cirebon City, significant progress has been made, with no maternal deaths reported in 2009.

The study revealed that deaths from both direct and indirect causes varied significantly from year to year, without showing a consistent downward trend for either category. Fluctuations in the number of maternal deaths may be attributed to factors such as unequal availability and quality of maternal health services, socio-economic conditions, environmental influences, changes in disease patterns, and the impact of pandemics like COVID-19.

The Cirebon City Government is undertaking various efforts to reduce maternal mortality, such as maintaining the Community-Based Hospital (RSBM) program, improving maternal health services, and expanding the coverage of the National Health Insurance (JKN). Other measures include developing PONEK emergency services, conducting mass ultrasound screenings, organizing prenatal classes, implementing the Kampung Siaga Program, optimizing the role of midwives, and carrying out the P4K program to prevent pregnancy and childbirth complications.

#### Limitations

In this study, it only looked at the number of maternal mortality due to direct and indirect causes, but did not look at each death in more detail.

## CONCLUSION

The results and discussion of the research conducted led the researcher to draw several conclusions regarding the causes of maternal mortality rates from 2006 to 2023 in Cirebon City. Throughout the observed period, maternal deaths due to direct causes, namely *bleeding*, *eclampsia*, and *hypertension*, tended to be the most frequent causes of maternal death. This highlights the importance of continuing efforts to prevent and treat *postpartum hemorrhage*, as well as the need for better management of *hypertension* and *eclampsia* during pregnancy. The findings suggest that enhancing early detection and timely medical intervention, as well as expanding access to healthcare services, could significantly reduce these direct causes of maternal mortality. Maternal deaths due to indirect causes were dominated by *cardiovascular* issues, with 11 cases of maternal death, and *COVID-19*, with 12 cases of maternal death. The *COVID-19* pandemic played a significant role in increasing maternal mortality due to indirect causes, demonstrating the need for improved healthcare responses during public health emergencies. Addressing *cardiovascular diseases* in pregnant women remains a crucial focus, as these conditions have a lasting impact on maternal health, especially when compounded by other risk factors such as pregnancy.

To improve maternal health outcomes, it is essential to implement a comprehensive approach that combines specific medical interventions with broader public health strategies. These measures should include continued research into the causes of maternal mortality, strengthening healthcare systems, improving prenatal care, and addressing the socioeconomic factors that contribute to maternal health risks. In addition, strengthening the capacity of healthcare providers to detect and manage both direct and indirect causes of maternal death is

vital. A multi-disciplinary approach involving obstetricians, cardiologists, and other specialists can help address the complex nature of maternal mortality. Finally, further attention should be given to improving the socioeconomic status of women, as higher education, better employment opportunities, and greater access to healthcare can have a positive impact on maternal health outcomes. Public health campaigns should continue to raise awareness of maternal health issues and ensure that healthcare resources are equitably distributed across communities, particularly in underserved areas.

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