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Original Research

# Profile of Maternal Mortality Due to Cardiovascular Disease Based on Determinant Factors at Dr. Soetomo Regional General Hospital

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ABSTRACT

**Background:** Although Indonesia's maternal mortality rate (MMR) decreased from 346 per 100,000 live births in 2010 to 189 in 2020, it remains high compared to other Southeast Asian countries. Cardiovascular diseases are among the leading indirect causes of maternal deaths globally, accounting for over 33% of cases. **Aim:** This study aims to analyze maternal mortality due to cardiovascular disease at Dr. Soetomo Regional General Hospital based on determinant factors. **Methods:** This study was a descriptive analytical study utilized secondary data from medical records of 123 patients who experienced maternal deaths due to cardiovascular disease at Dr. Soetomo Hospital between January 2020 and December 2023. Determinants were categorized as near (cardiovascular diagnosis), intermediate (maternal age, gestational age, obstetric status, and delivery mode), and distant (occupation) factors. **Results:** Among 123 cases, the leading cardiovascular complications were hypertension in pregnancy (58.5%), congenital heart disease and pulmonary hypertension (15.4%), and cardiomyopathy and heart failure (14.6%). Intermediate determinants included maternal age >35 years (28.5%), multigravida status (60.2%), multiparity (56.9%), and third-trimester presentation (65%). Most deaths (96.7%) occurred postpartum, with cesarean section being the predominant delivery mode (74.8%). The majority of patients were housewives (53.7%). **Conclusion:** Hypertension in pregnancy remains a primary near determinant of maternal mortality. Intermediate and distant determinants, such as maternal age, obstetric status, and socioeconomic factors, also contribute significantly. Efforts to reduce maternal mortality should include improved antenatal care, early cardiovascular screening, and targeted public health interventions.

## Highlights:

1. This study reinforces hypertension in pregnancy (58.5%) as the leading cause of maternal mortality due to cardiovascular disease, highlighting its significant contribution compared to other conditions like congenital heart disease (15.4%) and cardiomyopathy (14.6%).
2. A striking 96.7% of maternal deaths occurred postpartum, with cesarean section (74.8%) being the predominant delivery mode, suggesting a need for enhanced postpartum monitoring and cardiovascular care in high-risk pregnancies.

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## Introduction

Maternal mortality remains a critical global health issue, with cardiovascular diseases emerging as a significant indirect cause. The physiological changes during pregnancy, such as increased cardiac output and plasma volume, place additional stress on the cardiovascular system, especially in women with pre-existing conditions.[1,2] Hypertension in pregnancy, affecting 7–10% of pregnancies, is a major contributor to maternal and fetal morbidity and mortality.[1]

Maternal death is defined as the death of a woman during pregnancy, childbirth, or within 42 days after delivery. In some low- and middle-income countries, maternal mortality rates are 50 to 100 times higher than in high-income countries[3,4]. Indonesia has made progress in reducing its maternal mortality rate (MMR) from 346 per 100,000 live births in 2010 to 189 in 2020[5]. However, this rate remains high compared to other Southeast Asian nations. Cardiovascular diseases contribute to over 33% of indirect maternal deaths globally[6,7]. This study analyzes maternal mortality due to cardiovascular diseases at Dr. Soetomo Regional General Hospital, focusing on near, intermediate, and distant determinants.

## Methods

This descriptive analytical study utilized total sampling and secondary data from 123 medical records of maternal deaths caused by cardiovascular diseases at Dr. Soetomo Hospital between January 2020 and December 2023.

1. Inclusion criteria: Women who experienced maternal death due to cardiovascular disease recorded by medical records at Dr. Soetomo Regional General Hospital in 2020-2023.
2. Exclusion criteria: Patients with incomplete death data and medical records.

Determinants were classified based on McCarthy and Maine's framework[8] into near (cardiovascular diagnosis), intermediate (age, gestational age, obstetric status, delivery mode), and distant (occupation) factors.

This classification of cardiovascular disease is based on the ESC (European Society of Cardiology) Guidelines on The Management of Cardiovascular Disease During Pregnancy[9], which divides cardiovascular disease into 8 groups, namely hypertension in pregnancy, venous thromboembolism, congenital heart disease and pulmonary hypertension, aortic disease, heart valve

disease, coronary artery disease, cardiomyopathy and heart failure, and arrhythmia.

## Results

Distribution of cardiovascular complications that are near determinants of maternal death can be seen in Table 1.

Table 1. Distribution of Cardiovascular Diseases Diagnosis

| Diagnosis | Number of Subjects (n) | Percentage (%) |
|---|---|---|
| Congenital Heart Disease and Pulmonary Hypertension | 19 | 15,4 |
| Aortic Disease | 1 | 0,8 |
| Heart Valve Disease | 7 | 5,7 |
| Cardiomyopathy and Heart Failure | 18 | 14,6 |
| Arrhythmia | 6 | 4,9 |
| Hypertension in Pregnancy | 72 | 58,5 |
| **Total** | **123** | **100,0** |

## Near Determinants

Hypertension in pregnancy was the leading cardiovascular complication (58.5%), followed by congenital heart disease and pulmonary hypertension (15.4%), and cardiomyopathy and heart failure (14.6%).

## Intermediate Determinants

Table 2. Distribution of Maternal Age

| Age (years) | Number of Subjects (n) | Percentage (%) |
|---|---|---|
| 16-20 | 6 | 4,9 |
| 21-25 | 32 | 26,0 |
| 26-30 | 26 | 21,1 |
| 31-35 | 24 | 19,5 |
| 36-40 | 27 | 22,0 |
| >40 | 8 | 6,5 |
| **Total** | **123** | **100,0** |

## Maternal Age

Based on Table 2, 28.5% of cases involved women aged >35 years who do have a higher risk of maternal death. Meanwhile, in the age group of 21-35 years who have a lower risk of maternal death tend not to have a significant difference. Data obtained that the age group of 21-25 years was 32 patients (26.0%), then the age group of 26-30 years was 26 patients (21.1%), followed by the age group of 31-35 years was 24 patients (19.5%).

Table 3. Distribution of Gestational Age of Patients at New Onset

| Maternal Age | | Number of Subjects (n) | Percentage (%) |
|---|---|---|---|
| **Trimester** | **Age (weeks)** | | |
| 1 | <13 | 1 | 0,8 |
| 2 | 13-16 | 1 | 0,8 |
| | 21-24 | 6 | 4,9 |
| | 25-28 | 14 | 11,4 |
| 3 | 29-32 | 26 | 21,1 |
| | 33-36 | 35 | 28,5 |
| | 37-40 | 19 | 15,4 |
| Postpartum | | 21 | 17,1 |
| **Total** | | **123** | **100,0** |

Table 4. Distribution of Gestational Age of Patients at Termination

| Maternal Age | | Number of Subjects (n) | Percentage (%) |
|---|---|---|---|
| **Trimester** | **Age (weeks)** | | |
| 1 | <13 | 1 | 0,8 |
| 2 | 13-16 | 1 | 0,8 |
| | 21-24 | 4 | 3,3 |
| | 25-28 | 11 | 8,9 |
| 3 | 29-32 | 27 | 22,0 |
| | 33-36 | 36 | 29,3 |
| | 37-40 | 22 | 17,9 |
| | >40 | 1 | 0,8 |
| Not Born | | 4 | 3,3 |
| No Data | | 16 | 13,0 |
| **Total** | | **123** | **100,0** |

## Gestational Age

Based on Table 3 and Table 4, 65% of patients came to the hospital or experienced new onset of cardiovascular disease in the third trimester and 70% delivered in the same trimester. Based on the duration of pregnancy, most patients gave birth to preterm fetuses (gestational age less than 37 weeks), which was 80 patients (65.0%). While the fetuses born at term (gestational age 37-42 weeks) were 23 patients (18.7%). In addition, there were 4 patients (3.3%) who died while pregnant or did not give birth until the end of their lives. Others, there were 16 patients (13.0%) who did not have data on gestational age at delivery because they did not have complete medical record data, such as giving birth in another hospital.

Table 5. Distribution of Patient's Gravida

| Gravida | Number of Subjects (n) | Percentage (%) |
|---|---|---|
| Primigravida | 42 | 34,1 |
| Multigravida | 74 | 60,2 |
| Grandemultigravida | 7 | 5,7 |
| **Total** | **123** | **100,0** |

Table 6. Distribution of Patient's Parity

| Parity | Number of Subjects (n) | Percentage (%) |
|---|---|---|
| Nuliparous | 2 | 1,6 |
| Primiparous | 49 | 39,8 |
| Multiparous | 70 | 56,9 |
| Grandemultiparous | 2 | 1,6 |
| **Total** | **123** | **100,0** |

## Obstetric Status

Based on Table 5 and Table 6, multigravida (60.2%) and multiparous (56.9%) are the dominant groups and are risk factors for maternal death.

Table 7. Distribution of Patient's Delivery Mode

| Delivery Mode | Number of Subjects (n) | Percentage (%) |
|---|---|---|
| Spontaneous Pervaginam | 20 | 16,3 |
| Sectio Caesarea | 92 | 74,8 |
| Hysterotomy | 2 | 1,6 |
| Antepartum Death | 4 | 3,3 |
| No Data | 5 | 4,1 |
| **Total** | **123** | **100,0** |

### Delivery Mode

Cesarean section was the most common method (74.8%), which can be attributed to the fact that the data were collected from a type A hospital, the highest referral center.

### Distant Determinants

| Job | Number of Patients (n) | Percentage (%) |
|---|---|---|
| Housewife | 66 | 53,7 |
| Private Employee | 41 | 33,3 |
| Farmer | 2 | 1,6 |
| Medical Personnel | 2 | 1,6 |
| Teacher | 2 | 1,6 |
| Student | 2 | 1,6 |
| Other | 8 | 6,5 |
| **Total** | **123** | **100,0** |

**Occupation:** The majority of patients were housewives (53.7%), which reflects that being a housewife is the most common occupation for women in Indonesia.

### Discussion

This study highlights several key determinants of maternal health complications, particularly cardiovascular issues during pregnancy, and provides insights into the near, intermediate, and distant determinants contributing to maternal outcomes.

Hypertension in pregnancy emerged as the leading cardiovascular complication, affecting 58.5% of the patients. This finding underscores the critical role of hypertensive disorders as a major contributor to adverse maternal outcomes. Other significant cardiovascular complications included congenital heart disease and pulmonary hypertension (15.4%), as well as cardiomyopathy and heart failure (14.6%). These findings align with global trends, emphasizing the importance of early detection and management of cardiovascular conditions during pregnancy to reduce maternal morbidity and mortality.[10, 11]

The data reveal that maternal age is a significant factor influencing maternal outcomes. Women aged >35 years accounted for 28.5% of cases, highlighting the increased risk of maternal death in this age group[4]. Conversely, women aged 21-35 years, who are generally considered to have a lower risk, showed no significant differences across subgroups. Notably, the largest proportion of cases occurred in the 21-25 age group (26.0%), followed by the 26-30 age group (21.1%) and the 31-35 age group (19.5%). These findings suggest that while advanced maternal age poses a higher risk, younger age groups are not immune to complications, necessitating vigilance across all age ranges.

The majority of patients (65%) presented with cardiovascular complications during the third trimester, with 70% delivering in the same trimester. Preterm births (gestational age <37 weeks) were predominant, accounting for 65.0% of cases, while term births (gestational age 37-42 weeks)

comprised 18.7%[12]. Additionally, 3.3% of patients died during pregnancy without delivering. These findings highlight the association between late gestational age and the onset of cardiovascular complications, as well as the increased likelihood of preterm deliveries among affected patients. The incomplete data on gestational age for 13.0% of cases further underscores the need for comprehensive medical records to enhance data accuracy.

Multigravida (60.2%) and multiparous (56.9%) women were the dominant groups in this study, both of which are recognized risk factors for maternal death[13]. These findings suggest that women with multiple pregnancies and deliveries are at higher risk of developing complications, potentially due to cumulative physiological stress and associated comorbidities. This emphasizes the importance of targeted interventions for these high-risk groups to improve maternal outcomes.

Cesarean section was the most common mode of delivery, accounting for 74.8% of cases. This high rate can be attributed to the fact that the study was conducted in a type A hospital, the highest referral center, where complex cases are more likely to be managed. The predominance of cesarean deliveries reflects the critical need for surgical interventions in high-risk pregnancies to ensure maternal and fetal safety.[11]

The majority of patients were housewives (53.7%), reflecting the broader demographic trend in Indonesia, where being a housewife is the most common occupation for women. This finding highlights the need for targeted health education and support for this group, who may have limited access to healthcare resources and information.[12]

## Conclusion

This study underscores the multifactorial nature of maternal health complications, with near, intermediate, and distant determinants all playing significant roles. The findings emphasize the importance of early detection and management of cardiovascular complications, targeted interventions for high-risk groups such as older mothers and multiparous women, and improved access to healthcare for housewives. Addressing these determinants through comprehensive maternal health programs and policies can contribute to reducing maternal morbidity and mortality in Indonesia.

Targeted interventions, including early cardiovascular screening, enhanced antenatal care, and public health education, are essential to mitigate maternal mortality risks associated with cardiovascular diseases. Collaboration between healthcare providers, policymakers, and communities is crucial to achieving sustainable improvements in maternal health outcomes.

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