

The Characteristics of Pregnant Women with Cardiac Disease in Prof. Dr. I.G.N.G. Ngoerah Hospital, Denpasar

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ABSTRACT

Introduction: Increased cardiac output, decreased systemic vascular resistance, and left ventricular hypertrophy are among the cardiovascular alterations brought on by pregnancy. Pregnancy-related heart problems can increase the risk of morbidity and death in both the mother and the newborn. The aim of this research is to characterizing the characteristics of pregnant women with heart disease patients in RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar, Indonesia.

Methods: This research is included in the type of retrospective descriptive research using medical record data at this hospital from 1 January 2020 to 31 December 2021 with a total sampling method. Inclusion criteria include all cardiac disease in pregnancy cases. Cases with incomplete data were excluded. Data were subsequently analyzed with SPSS 26th edition.

Results: There were 46 cases of cardiac disease in pregnancy recorded and 4 cases were excluded. The prevalence in pregnancy was 2.68%. The characteristics of most of the cases were in 20–35 years old group (71.4%), high school graduates (69.0%), normal body mass index (38.1%), multigravida (64.3%), diagnosed at ≥ 37 gestational age (52.4%), booked case (85.7%), with known previous cardiac disease (54.8%), diagnosed with congenital heart disease (23.8%), WHO class IV (33.3%), underwent cesarean section (71.4%), birth weight $< 2,500$ gram (52.4%), vigorous baby (71.4%), used IUD as postpartum contraception (45.2%), hospitalized in intensive ward after delivery (52.4%) and length of stay were 5–10 days (45.2%). There were 4 maternal mortality cases with case fatality rate (CFR) of 9.52% caused by respiratory failure, sepsis and cardiogenic shock.

Discussion: There was a slight increase in prevalence and decrease of CFR of cardiac disease in pregnancy in our hospital compared to previous data in 2016–2017 which may cause by better referral system and patient care.

Conclusion: In general, the characteristics of patients in our study were similar to previous studies in developing countries.

Keywords: Cardiac disease, Characteristics, Morbidity, Mortality, Pregnancy.

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INTRODUCTION

The body of a female alters physiologically throughout pregnancy to accommodate the growing and changing requirements of the unborn child. The cardiovascular system is an organ system that experiences significant changes during pregnancy. The body usually adjusts to these changes successfully in women with no previous medical issues. These adjustments, however, may increase mortality and morbidity in women who already have cardiac disease. About 1–4% of expectant mothers also have heart disease, and of them, 10–15% are in danger of passing away.^{1,2} Heart disease during pregnancy is the second most common cause of maternal mortality in the UK.³ Congenital heart abnormalities account for the bulk of heart disease cases during pregnancy in developed nations. In contrast, infections leading to structural heart problems, such as rheumatic heart disease, are the main cause of heart disease in pregnant women in underdeveloped countries.⁴

In Indonesia, the prevalence of heart disease-complicated pregnancy was recorded at 1.2% from 2005 to 2006. This indicates that out of every 100 pregnant women, approximately one person develops heart disease. Heart disease in pregnancy is a significant concern due to physiological changes that occur throughout pregnancy, which can exacerbate underlying cardiac conditions. A study conducted in Jakarta provided further insight into the effect of heart disease on pregnancy outcomes. The study reported a mortality rate of 1.21% between heart disease in expectant mothers.⁵ This means that for every 100 women with heart disease who became pregnant, about one woman succumbed to

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complications associated with her condition. This mortality rate highlights the critical nature of managing heart disease during pregnancy, as it poses substantial risks to both fetal and maternal health.⁶ Research conducted at this hospital revealed a significant rise in the incidence of pregnancy cases complicated by heart disease over several years. Specifically, the prevalence increased from 1.1% from 2012 to 2014 to 2.34% from 2016 through 2017.

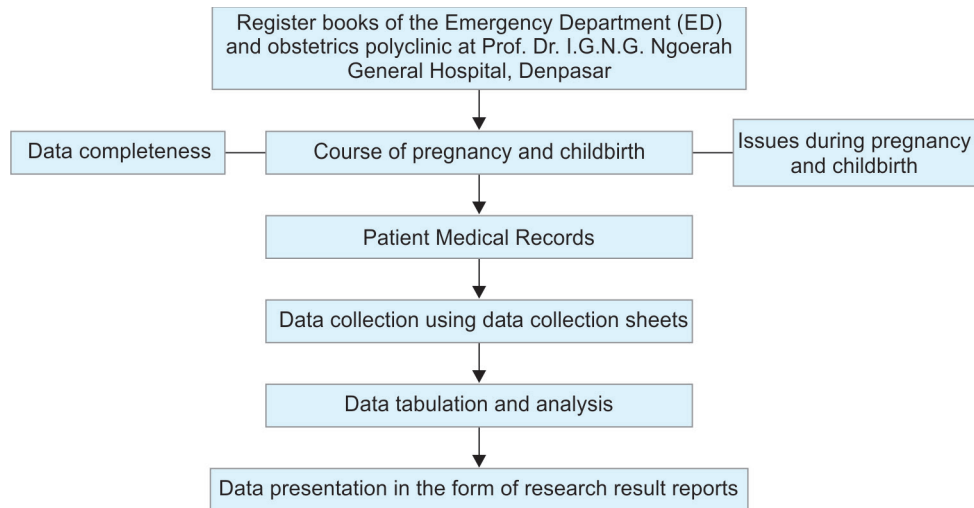


Fig. 1: Research flow diagram

This upward trend indicates that heart disease in pregnancy has become a growing concern within this population. The majority of these cases were attributed to RHD, which remains a prevalent and serious condition in many developing regions. Acute rheumatic fever is one of the factors that causes RHD, which can damage the heart valves, leading to chronic heart problems that pose significant risks during pregnancy. Other causes included congenital heart disease, non-rheumatic valve disease, cardiomyopathy, hypertensive heart disease, and other heart conditions.⁷

Heart disease significantly affects pregnancy through physiological changes like reduced systemic vascular resistance, heightened cardiac output, and natural left ventricular hypertrophy.^{8,9} These physiological changes that occur within pregnancy in women with heart disease can lead to potentially deadly effects such as peripartum cardiomyopathy, cardiac decompensation, and pulmonary edema.¹⁰ Furthermore, the fetus may be affected by heart illness, which may result in birth hypoxia, preterm delivery, and intrauterine growth restriction.¹ Numerous factors, such as the severity, onset, and gestational age at delivery, increase the risk of perinatal risk of mortality morbidity in pregnant women with heart issues.¹⁰ Now is the time to update research on heart disease in pregnant women. To update the data, the authors are therefore inspired to carry out research at this hospital, to evaluate the features of pregnancy with heart disease.

METHODS

Study Design

Data from the RSUP Prof. Dr. I.G.N.G. Ngoerah’s Medical Records Department in Denpasar were gathered for descriptive retrospective research. From 1 January 2020 to 31 December 2021, the research included all individuals with cardiac disease who were pregnant. To make sure the sample size was more typical for further study, two years were chosen.^{11–18} First, from 1 January 2020 to 31 December 2021, patient names and medical record numbers were taken from the obstetrics clinic and the Emergency Department (ED) register books at this hospital. This recording ensured the completeness of medical data, including the course of pregnancy, delivery, and issues encountered during pregnancy and delivery. Subsequently, medical records were traced in the central medical record storage,

and data collection was performed using data collection sheets. After gathering the data, it was tabulated and presented in tables, followed by a narrative explanation.^{19–27}

Population and Sample

From 1 January 2020 to 31 December 2021, every case of pregnancy with heart disease that was brought to the obstetrics clinic and emergency room of RSUP Prof. Dr. I.G.N.G. Ngoerah was included in the research sample. At this hospital, 46 expectant patients with heart disease sought treatment between 1 January 2020 and 31 December 2021. Since their care was continued outside of RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar, four patients were excluded, leaving their medical records incomplete. Pregnant women with cardiac problems meet the inclusion criteria for this research. The study’s exclusion criteria are incomplete data from pregnancy books or medical records.²⁸

Data Analysis

Version 26 of SPSS was used to analyze the data, which were then arranged into tables and narratives.¹⁹ The prevalence of cardiac disease during pregnancy, characteristics of heart disease in expectant mothers, types of heart conditions during pregnancy, characteristics of pregnant patients with heart disease categorized by delivery methods, perinatal outcomes based on newborn evaluations, types of postpartum contraception used, location of care and length of postpartum hospital stays, number of maternal deaths, and information about the causes of maternal mortality among women with heart disease who are pregnant were all assessed using descriptive analysis (Fig. 1).

RESULTS

Prevalence of Heart Disease in Pregnancy at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar Period January 2020–December 2021

At this hospital, there were 1,567 deliveries between 1 January 2020 and 31 December 2021. There were 42 cases of heart disease in expectant mothers, representing 2.68% of all deliveries. This prevalence rate necessitates focused clinical attention and aligns with global findings.²⁰ For instance, studies in China reported an

annual incidence of heart disease in pregnancy ranging from 2.4 to 8.9%, influenced by healthcare access and socioeconomic status. In the United States, the prevalence is between 1 and 4%, likely reflecting differences in healthcare systems and early detection. A systematic review of 25 South Asian studies from 2003 to 2020 found a prevalence rate of 1.46%. The variation in prevalence rates could be attributed to differences in study populations, healthcare infrastructure, and focus on specific heart conditions.^{21–27} The primary emphasis of our research was on congenital and rheumatic heart disorders, which are more prevalent in groups with restricted access to preventative healthcare. This underscores the necessity of implementing customized healthcare approaches.

A comprehensive study carried out at Surabaya’s Dr. Soetomo General Hospital revealed a notable prevalence of pregnancy cases complicated by heart disease, accounting for 5.19% of all pregnancies throughout 2019. Dr. Soetomo’s status likely influences this relatively high rate as a major referral center in a densely populated area, which naturally attracts many complicated cases from surrounding regions. The hospital’s advanced medical facilities and specialist services make it a central hub for managing high-risk pregnancies, including those complicated by cardiac conditions. In contrast, data from this hospital showed a prevalence of 2.68% for pregnancy cases with heart disease from January 2020 to 31 December 2021. This represents a slight increase from the 2.34% prevalence reported in prior research conducted between 2016 and 2017.⁷

The incremental rise in prevalence at this hospital may be attributed to several factors, primarily the improved diagnostic capabilities at peripheral healthcare centers.^{28–31} Over recent years, advancements in medical technology and enhanced training for healthcare professionals at these centers have likely led to more accurate and earlier diagnoses of heart disease in pregnant women. Consequently, more cases are being identified and appropriately referred to RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar for specialized management and care. This pattern emphasizes how critical early identification and treatment are to improving outcomes for mothers and fetuses in heart disease-complicated pregnancies.³² Furthermore, the demographic and geographic differences between Surabaya and Denpasar might contribute to the variance in prevalence rates.¹⁴ Surabaya, a larger metropolitan area with a higher population density, might see more complex cases, including those with heart disease, simply due to the larger population base.³³ In addition, cultural and socioeconomic factors could influence the health-seeking behavior of pregnant women, with those in larger urban areas potentially having better access to healthcare services and, thus, a higher likelihood of being diagnosed with cardiac conditions. Rheumatic heart disease, congenital heart disease, and other non-rheumatic valve diseases are heart diseases that commonly occur in pregnant women and are common in regions with varying levels of healthcare development.^{34,35} Rheumatic heart disease, in particular, remains a significant concern in many developing countries due to its association with untreated streptococcal infections (Table 1).⁷

Characteristics of Pregnant Patients with Heart Disease by Maternal Age at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

Most heart disease in expectant mothers at this hospital, within the age range of 20–35 years, comprising 30 patients (71.40%), according to Table 2. There were two patients (4.80%) under 20 years old and 10 patients (23.80%) over 35 years old. The average age of

Table 1: Prevalence of heart disease in pregnancy

Year	Cases of pregnancy with heart disease	Amount of labor	Percentage (%)
2020	19	690	2.75
2021	23	877	2.62
Total	42	1,567	2.68

Table 2: Characteristics of pregnant patients with heart disease based on mother’s age

Age	Total	Percentage (%)
<20	2	4.8
20–35	30	71.4
>35	10	23.8
Total	42	100

these women during 2020–2021 was 29.12 years, ranging from 17 to 44 years. These findings closely resemble those of a previous study in Surabaya, where 73.9% of heart disease in expectant mothers were aged between 20 and 34 years, averaging 29.2 years old, and spanning from 16 to 44 years old. These findings indicate a common age range for heart disease in expectant mothers across different regions in Indonesia.³⁶ The age-group of 20–35 years is typically considered the prime reproductive age, which might explain the higher prevalence of heart disease in this population.³⁷ Less typically impacted are younger women under 20 and elderly women over 35, although they still constitute significant portions of the patient population.³⁸ The younger age-group might be less prone to heart disease due to better cardiovascular health. At the same time, older women may have increased risks associated with age and prolonged exposure to risk factors. The similarity in average age and age distribution between the studies conducted in Denpasar and Surabaya highlights consistent patterns in the demographic characteristics of heart disease in expectant mothers in Indonesia.^{39–47} The average age of approximately 29 years in both studies suggests that heart disease during pregnancy is a concern predominantly for women in their late twenties and early thirties. This age-group is often balancing the demands of childbearing with the onset of potential lifestyle-related risk factors, such as hypertension, obesity, and diabetes, which can contribute to the development or exacerbation of heart disease. A comprehensive investigation carried out in Kenya between 2011 and 2016 looked at the demographic characteristics of heart disease-afflicted pregnant women, revealing a median age of 26 years among the affected population.^{48–55} This median age suggests that heart disease during pregnancy is most prevalent among women in their mid-twenties.^{56–61} This finding is significant as it points to the critical reproductive years when many women are planning and starting their families.⁶² Similar results were reported in Vietnam, where the average age of mothers with heart disease was 28.18 years, with the majority being under 35 years old (86.97%).⁶³ Heart disease in expectant mothers in developed countries, including the United States and New York City in particular, were found to be mostly between the ages of 24–35.⁶⁴

Although the results of this study align with certain previous research findings, they diverge from the broader literature, which generally indicates that the risk of heart disease during pregnancy increases significantly in women over the age of 35. This discrepancy

may arise from the age distribution of the study's cohort, which predominantly comprises women aged 20–35. This age-group, representing 71.40% of the study population, may skew the overall data, potentially masking the increased risk associated with older maternal age. The literature commonly identifies advanced maternal age (over 35 years) as a significant risk factor for various pregnancy complications, including heart disease.^{65,66} Older women are more likely to have preexisting health conditions and experience age-related physiological changes that can exacerbate cardiac issues during pregnancy. Such conditions include hypertension, diabetes, and a higher likelihood of comorbidities, which are known to compound cardiovascular risk. However, the findings of this study, which report a prevalence of 2.68% for heart disease in pregnancy, may not fully capture the risk profile for older pregnant women due to the relatively small proportion (23.80%) of women over 35 years in the dataset. This underrepresentation could result in an incomplete assessment of the risk factors and outcomes associated with advanced maternal age. As a result, the study might not offer a comprehensive view of how the risk of heart disease differs among women over 35.⁶¹

Characteristics of Pregnant Patients with Heart Disease Based on Education Level at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

Most of the pregnant patients with heart disease at this hospital had secondary education, which included completion of junior high school to high school, accounting for 29 cases, or 69.0% of the cohort. This suggests that a significant proportion of the patients have attained a level of education that is considered basic but not advanced. In contrast, there were 3 pregnant women (7.1%) with low education, defined as having less than junior high school education, and 10 women (23.8%) who had pursued higher education beyond high school. These findings are in line with previous research conducted in Brazil, which reported that the majority of heart disease in expectant mothers had secondary education levels, representing 53.5% of the study population. Additionally, the Brazilian study indicated that only 7.1% of participants had completed higher education. The similarity between the two studies highlights a common trend where secondary education is the most prevalent educational attainment among heart disease in expectant mothers in different regions.⁶⁷ The level of education among heart disease in expectant mothers is not just a demographic detail but also has implications for various aspects of maternal and neonatal health. Education is related to economic status, which can influence access to healthcare, health literacy, and the ability to manage health conditions effectively.^{68–70} Women with higher levels of education often have better access to resources, more health knowledge, and improved health-seeking behaviors, which can contribute to better outcomes in pregnancy. Conversely, lower educational attainment may correlate with limited access to healthcare services, lower health literacy, and increased risk of harm to the baby and mother (Table 3).⁶⁷

Characteristics of Pregnant Patients with Heart Disease Based on Body Mass Index at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

Body mass index is classified into four categories: BMI > 30 kg/m² is included in the obesity category, BMI 25–29.9 kg/m² is included

Table 3: Characteristics of pregnant patients with heart disease based on education level

Level of education	Total	Percentage (%)
Low (no school, finished elementary school)	3	7.1
Intermediate (graduated from middle school, high school, or equivalent)	29	69.0
High (D1/D2/D3, bachelor)	10	23.8
Total	42	100

in the overweight category, BMI 18.5–24.9 kg/m² is included in the normal category, and BMI < 18.5 kg/m² is included in the underweight category. Of the 42 instances of heart disease-related pregnancies, 16 cases (38.1%) had normal nutrition. Seven patients (16.7%) were classified as underweight, four cases (9.5%) as obese, and fifteen cases (35.7%) as overweight. These results are comparable to those of Ghanaian research that found that 37.3% of mothers had a BMI of 25 kg/m² or more, indicating that they were obese or overweight. With rising trends, obesity is becoming a bigger health problem. 38.9 million pregnant women were assessed to be overweight in global research conducted in 2014; 14.6 million of these were considered obese.⁶⁷

IOM provides detailed guidelines for weight gain during pregnancy based on BMI. These recommendations promote optimal maternal and fetal health by considering different BMI categories' varying nutritional needs and risks. For women who have a BMI < 18.5 kg/m² before pregnancy, which is classified as underweight, the IOM recommends a weight gain of 12.5–18 kg throughout the pregnancy. This higher range of weight gain is suggested to ensure adequate fetal growth and development, as underweight women may have a higher risk of babies with low birth weight. Women with a normal pre-pregnancy BMI, ranging from 18.5 to 24.9 kg/m², are advised to gain weight between 11.5 and 16 kg. This recommendation aims to balance the nutritional needs of both the developing fetus and mother, supporting healthy weight gain while minimizing the risk of excessive weight gain, which could lead to complications such as gestational diabetes or hypertension. For those with an overweight pre-pregnancy BMI of 25–29.9 kg/m², the IOM suggests a more modest weight gain of 7–11.5 kg. This lower weight gain target helps mitigate the risks associated with excess weight, such as increased chances of cesarean delivery, preeclampsia, and difficulty in managing blood sugar levels during pregnancy. Pregnant women with an obese pre-pregnancy BMI of 30 kg/m² or higher are advised to gain between 5 and 9 kg. This reduced weight gain range is designed to manage the additional health risks associated with obesity, including a higher likelihood of pregnancy-related complications such as gestational diabetes, hypertension, and increased risk of birth defects.^{71–75} Reducing the chance of complications for both the mother and the child and improving maternal outcomes can be achieved by maintaining a regulated weight increase.⁶⁸

Higher BMI (during pregnancy) is associated with several problems, such as preeclampsia, hypertension, and gestational diabetes. Preterm birth and small for gestational age (SGA) babies are increased by inadequate weight gain. On the other hand, macrosomia and big for gestational age (LGA) newborns are more likely to occur in cases of excessive weight growth. Preeclampsia risk might increase if a pregnant woman is obese. Obese pregnant women are also more likely to experience issues from heart

Table 4: Characteristics of pregnant patients with heart disease based on BMI

BMI	Total	Percentage (%)
Thin	7	16.7
Normal	16	38.1
Overweight	15	35.7
Obesity	4	9.5
Total	42	100

Table 5: Characteristics of pregnant patients with heart disease based on the number of pregnancies

Gravida	Total	Percentage (%)
Primigravida	15	25.7
Multigravida	27	64.3
Total	42	100

disease.^{68,69} Preconception education counseling and awareness of antenatal care are necessary to increase vigilance against excessive weight gain during pregnancy (Table 4).

Characteristics of Pregnant Patients with Heart Disease Based on Number of Pregnancies at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

There were 15 (35.7%) of primigravida patients and 27 (64.3%) of multigravida patients. These results are similar to the findings in Surabaya, which showed that multigravida patients were more prevalent, accounting for 63.8%.⁶¹ Studies in Vietnam and China also found that most patients were multigravida.^{58,63} In contrast, research conducted at this hospital in 2016–2017 found that 51.11% of the patients were primigravida.⁷

These results indicate the need for efforts to increase education and awareness among the public regarding the dangers of heart disease during pregnancy to minimize the occurrence of multigravida pregnancies with heart disease (Table 5).

Characteristics of Pregnant Patients with Heart Disease Based on Gestational Age at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

The characteristics of maternal gestational age at the time of heart disease diagnosis are categorized into five groups. The most prevalent category is gestational age >37 weeks, with 22 cases (52.4%). The group with gestational age 33–36 weeks includes 11 cases (26.2%), the 29–32 weeks group has four cases (9.5%), and the 20–28 weeks group has one case (2.4%). Additionally, there are four cases (9.5%) with a gestational age <20 weeks that resulted in abortion. These results are similar to previous research at this hospital, where most patients (57.78%) were diagnosed at a gestational age ≥37 weeks.⁷ Similarly, a study in Surabaya found that 40.6% of patients with heart disease during pregnancy were detected at a gestational age >37 weeks.⁶¹

Physiologically, in the third trimester, expectant women may experience symptoms such as dyspnea during activities, fatigue, and palpitations due to the enlarging uterus pressing against the

Table 6: Characteristics of pregnant patients with heart disease based on gestational age

Gestational age	Total	Percentage (%)
<20 weeks	4	9.5
20–28 weeks	1	2.4
29–32 weeks	4	9.5
33–36 weeks	11	26.2
≥37 weeks	22	52.4
Total	42	100

Table 7: Characteristics of pregnant patients with heart disease based on origin of reference

Origin of referral	Total	Percentage (%)
Booked case	36	85.7
Private hospital/general hospital	6	14.3
Obstetricians	0	0.00
Midwife	0	0.00
Public health center	0	0.00
Total	42	100

diaphragm and vena cava, as well as a plasma volume increase of up to 30%.⁷⁰ In women with heart disease, the physiological cardiovascular changes can exacerbate symptoms, leading to a majority of diagnoses occurring in the third trimester.^{76,77} The most frequently reported symptom of heart disease in expectant mothers is palpitations (63.38%).⁶³

Characteristics of Pregnant Patients with Heart Disease Based on Origin of Referral at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

A total of 36 cases of heart disease during pregnancy were scheduled cases from RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar’s obstetrics clinic; these cases accounted for 85.7% of the patients who presented to the obstetric emergency department. Cardiology colleagues sent all of these patients for prenatal care (ANC) and cardiac disease diagnosis to the obstetrics department at this hospital, from other healthcare institutions (Table 6). Private or regional hospitals recommended the final 6 cases (14.3%). No patients were sent to the emergency room of RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar, by midwives, obstetricians, or primary health clinics.^{78,79}

These results differ from a previous study conducted in 2016–2017 at this hospital, which showed referrals from midwives or primary health centers and obstetricians at 4.44% each. The highest number of referrals came from second-tier healthcare facilities (53.34%), and 37.78% of patients self-referred, having had a history of examination at the obstetrics clinic at this hospital.⁷

The absence of referrals from primary health centers or midwives may be due to the updated tiered referral system implemented in the government’s health insurance. This system requires patients to be referred to second-tier healthcare facilities before finally being referred to third-tier healthcare facilities (Table 7).

Table 8: Characteristics of pregnant patients with heart disease based on history previous heart disease

History of heart disease	Total	Percentage (%)
Yes	36	85.7
No	6	14.3
Total	42	100

Characteristics of Pregnant Patients with Heart Disease Based on Previous History of Heart Disease at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

Based on the history of previous heart disease, 23 cases (54.8%) were aware of their heart condition during pregnancy. This finding aligns with a study in Vietnam, where 80.63% of patients were aware of their heart disease before pregnancy.⁶³ Similarly, a previous study conducted in 2016–2017 at this hospital, found that 53.33% of patients had a history of heart disease.⁷ A study in Kenya also found that 53.8% of women had a history of heart disease before pregnancy.⁶²

In contrast, Chinese research found that 70.06% of patients had no prior history of cardiovascular disease.⁵⁸

This study has not assessed whether patients received preconception counseling beforehand. The findings underscore the significance of providing preconception counseling to patients with heart disease to raise awareness and alertness to the risks of pregnancy with heart disease, including the use of contraception. Preconception counseling is expected to reduce the number of complications due to heart disease during pregnancy (Table 8).

Distribution of Pregnancies with Heart Disease Based on Data Echocardiography at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

Between 1 January 2020 and 31 December 2021, congenital heart disease accounted for 10 cases (23.8%) of all heart disease in expectant mothers. Following this were nine cases (21.4%) of cardiomyopathy, eight cases (19.0%) of rheumatic heart disease, four cases (9.5%) each of valvular heart disease and hypertensive heart disease, and seven cases (16.7%) of other heart diseases.⁸⁰

These findings are consistent with research done in Surabaya, where 53.6% of patients had congenital cardiac disease, with atrial septal defect as the most common problem, followed by ventricular septal defects.⁶¹ Pregnancy can significantly increase cardiovascular stress in women with congenital heart disease, even if they have never had symptoms. Congenital cardiac disease refers to a variety of structural cardiac problems that are present from birth, which may include issues such as septal defects, valve abnormalities, or congenital cardiomyopathies. While many individuals with congenital heart conditions may lead relatively normal lives without experiencing symptoms, pregnancy introduces a range of physiological changes that place additional strain on the cardiovascular system. During pregnancy, the body's blood volume increases by approximately 30–50%, resulting in a greater workload for the heart. To keep the developing fetus and placenta supplied, the heart must pump more blood, which can exacerbate underlying cardiac conditions. Hormonal changes, increased cardiac output, and altered vascular resistance further stress the cardiovascular system, potentially revealing or worsening symptoms of heart disease that were previously controlled or asymptomatic. Serious

consequences may result from these alterations in women with congenital heart disease, such as heart failure, arrhythmias, or even life-threatening situations. The increased demands on the heart can lead to a deterioration in cardiac function, precipitating symptoms such as chest pain, fatigue, or shortness of breath. In severe cases, complications may arise that necessitate careful monitoring and potentially invasive interventions.²⁰ Interestingly, a previous study at this hospital in 2016–2017 found congenital heart disease to be the second most common (24.44%), below rheumatic heart disease (37.78%).⁷ A study (systematic review and meta-analysis) in South Asian countries from 2003 to 2020 also showed congenital heart disease (18.10%) as the second most common cause, following rheumatic heart disease (70.25%).⁶⁰

Cardiomyopathy accounted for 21.4% of the cases in this survey, making it the second most common. This research is distinct from others. For example, just 7.2% of cardiac problems in pregnancy were determined to be caused by cardiomyopathy, according to a study conducted in Surabaya.⁶¹ In Iran, 29.8% of patients with congenital heart disease were reported to have cardiomyopathy. This significant proportion highlights the prevalence of this condition, which involves the heart muscle's impaired ability to contract and pump blood effectively, leading to potential complications and requiring specialized management.²⁰ The study conducted at this hospital, during 2016–2017 identified a cardiomyopathy rate of 15.56% among patients with heart disease. This finding highlights a notable proportion of individuals affected by cardiomyopathy, a condition where the heart muscle becomes weakened and less effective at pumping blood. The elevated rate underscores the need for targeted diagnostic and treatment strategies to manage cardiomyopathy and improve patient care and outcomes.⁷ Pregnancy-related hypertension, older mother age, and multigravida status are risk factors for cardiomyopathy. Although the exact cause of cardiomyopathy is unknown, it is thought to be related to oxidative stress imbalance, inflammation, immunological reactions, pathological responses to hemodynamic stress, and latent viral reactivation.⁸¹ Cardiogenic shock, arrhythmias, and thromboembolism are three major causes of maternal mortality and morbidity (5–50%) that can result from cardiomyopathy.⁷⁰ The increased cardiac output during pregnancy raises the risk of heart complications, including cardiomyopathy.¹⁷ The increased percentage of cardiomyopathy cases may reflect a decrease in infection rates as a cause of heart disease in pregnancy.

RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar in 2016–2017, the most common heart disease that occurs during pregnancy is rheumatic heart disease. This condition, resulting from untreated rheumatic fever and frequently complicated pregnancies, highlights the need for effective management and prevention strategies,⁷ ranked third in this study (19%). Rheumatic heart disease is more common in poor nations than in industrialized ones due to risk factors such as low socioeconomic position, malnutrition, restricted access to healthcare, and crowded living circumstances.⁸² The decline in the prevalence of rheumatic heart disease might be attributed to advancements in healthcare services, health consciousness, and sanitation. Other cardiac illnesses, such as conduction anomalies and coronary heart disease, were identified in the remaining seven instances (16.7%). Atrial arrhythmias are frequent in pregnant women and can decrease cardiac output. Women with or without a history of cardiac disease are susceptible to arrhythmias.²⁰ The main risk factor for coronary heart disease, a rare pregnant illness, is pre-eclampsia (Table 9).

Table 9: Distribution of pregnancies with heart disease based on echocardiography

Types of heart disease	Total	Percentage (%)
Rheumatic heart disease	8	19.0
Valvular heart disease	4	9.5
Congenital heart disease	10	23.8
Cardiomyopathy	9	21.4
Hypertensive heart disease	4	9.5
Other heart diseases	7	16.7
Total	42	100

Distribution of Pregnancies with Heart Disease based on Classification WHO for Maternal Cardiovascular Risk at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

The distribution of heart disease in pregnancy, classified according to the WHO maternal cardiovascular risk classification, shows that the majority of cases fall into WHO class IV, with 14 cases (33.3%). There are nine cases (21.4%) classified as WHO class I, nine cases (21.4%) in WHO class II, and the remaining 10 cases (23.8%) in WHO class II–III. There are no cases classified in WHO class III. These findings are similar to a previous study at this hospital, in 2016–2017, which found that 40% of patients fell into WHO class IV.⁷

In contrast, a study in China found that the majority of heart disease cases in pregnancy were classified as WHO class I (33.98%).⁵⁸ Comparatively, a study in Kenya, a developing country, found that 68.4% of heart disease cases in pregnancy fell into WHO class IV.⁶¹ When assessing the risk of heart disease in mothers, the WHO categorization is helpful. Pregnant women in WHO class IV have a very high rate of maternal death or serious morbidity; the higher the WHO classification, the higher the danger of pregnancy. In women in WHO class IV, becoming pregnant is not advised. Termination should be taken into consideration if they get pregnant.²⁴

The high number of WHO class IV cases in this study indicates that the diagnosis and management of heart disease are still lacking compared to developed countries. Social and cultural factors also play a role, as certain communities still prioritize having children without fully understanding the risks of pregnancy in women with heart disease. Preconception counseling is essential to avoid increasing maternal mortality and morbidity among pregnant women (Table 10).⁸³

Characteristics of Pregnant Patients with Heart Disease Based on Delivery Method at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

The most common delivery method was perabdominal delivery, with 30 cases (71.4%). There were eight cases of vaginal delivery, with three cases (7.1%) being spontaneous vaginal deliveries and five cases (11.9%) assisted by forceps. Additionally, four cases (9.5%) underwent curettage for pregnancies <20 weeks due to abortion. These findings are similar to the study in Surabaya, which found that 63.7% of heart disease in expectant mothers underwent perabdominal delivery. A similar result was found in China, where 51.93% of the cases involved perabdominal delivery.⁵⁸

The mode of delivery for heart disease in expectant mothers is adjusted according to the condition of the pregnant woman.

Table 10: Distribution of pregnancies with heart disease based on WHO classification for maternal cardiovascular risk

WHO classification	Total	Percentage (%)
WHO Class I	8	19.0
WHO Class II	4	9.5
WHO Class II–III	10	23.8
WHO Class III	9	21.4
WHO Class IV	4	9.5
Total	42	100

Table 11: Characteristics of pregnant patients with heart disease based on delivery method

Delivery method	Total	Percentage (%)
Spontan	3	7.1
Forceps	5	11.9
Abdominal	30	71.4
Curettage	4	9.5
Total	42	100

Still, based on recommendations from The European Society of Cardiology, vaginal delivery is generally preferred. For pregnant women in WHO class IV, those taking oral anticoagulants, those with decompensated heart failure, and those with obstetric indications, perabdominal delivery is recommended. Heart disease in pregnancy increases the risk of perabdominal or instrument-assisted deliveries.^{70,72} The high rate of perabdominal deliveries in this study may indicate efforts to ensure a safe delivery for both mother and baby, aiming to prevent or manage cardiac complications that have already occurred (Table 11).

Characteristics of Pregnant Patients with Heart Disease Based on Baby Birth Weight at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

It was noted that the newborns in 22 cases (52.4%) weighed less than 2500 gm. On the other hand, the newborns in 20 cases (47.6%) weighed at least 2500 gm at delivery. These results are consistent with research conducted in Surabaya that showed 58.3% of kids delivered to pregnant moms with heart problems were underweight.⁶¹ Studies in India, the United States, China, and Vietnam have shown that heart disease during pregnancy increases the risk of giving birth to growth-restricted babies compared to pregnant women without heart disease.^{58,63,73,74}

One of the issues connected to heart disease during pregnancy is preterm birth. Low birth weight newborns can be a result of premature delivery. 17.63% of premature births in South Asian nations between 2003 and 2020 happened in heart disease in expectant mothers, according to a comprehensive study and meta-analysis.⁶⁰ Pregnant women who have heart disease run the risk of experiencing hemodynamic changes that might lower the flow of blood in the uterus.⁷³ Intrauterine growth restriction, a common issue in heart disease-related pregnancies, can result in low birth weight newborns (Table 12).⁷⁵ According to Kenyan research, 41.6% of infants delivered to moms with heart disease were born prematurely, and 30.4% of newborns had low birth weights.⁶²

Table 12: Characteristics of pregnant patients with heart disease based on baby's birth weight

Baby weight	Total	Percentage (%)
<2500 gm	22	52.4
≥2500 gm	20	47.6
Total	42	100

Characteristics of Pregnant Patients with Heart Disease Based on the Condition of Babies Born at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

Of the 42 women with heart disease who became pregnant, 36 of them gave birth to living children. Four incidences of abortion and two stillbirths were reported. Thirty cases (71.4%) of the cases were energetic newborns, whereas two cases (4.8%) had severe asphyxia, and four cases (9.5%) had mild asphyxia. These findings are comparable to the study conducted in Surabaya, in which 81.7% of the infants were active.⁶¹ Comparing the rates at this hospital, with the 2016–2017 research, which documented 8.51% cases of severe asphyxia and 8.51% of stillbirths, reveals a further decline in both conditions.⁷

These results suggest that most healthy baby outcomes during pregnancy can be attributed to successful management of heart disease, including integrated and comprehensive prenatal care, early detection of cardiac abnormalities in pregnancy, appropriate referrals, and multidisciplinary management. Pregnancy-related heart illness can result in hypoxic conditions, especially in placental tissues, which can have an immediate impact on the fetus. If severe hypoxia occurs too early in a pregnancy, it can cause abortion; if it occurs too late in pregnancy, it can cause problems such as intrauterine growth restriction, premature delivery, weak babies, or stillbirths. Pregnancies with heart disease are more likely to result in an abortion or intrauterine fetal mortality than pregnancies without heart disease.^{58,74}

A comprehensive meta-analysis and systematic review covering studies from India, Pakistan, Nepal, and Sri Lanka between 2003 and 2020 reported a concerning fetal mortality rate of 50.48% among heart disease in expectant mothers. This high rate underscores the significant risks associated with cardiac problems during pregnancy in South Asian countries. The review highlights that heart disease in pregnant women substantially increases the likelihood of adverse fetal outcomes, including stillbirths and neonatal deaths. Such findings emphasize the urgent need for improved prenatal care, advanced monitoring, and effective management strategies to enhance fetal survival and reduce mortality rates in this high-risk population.⁶⁰ A study in Kenya from 2011–2016 also found a high fetal mortality rate of 11.2% (Table 13).⁶² The high fetal mortality rates in these studies could be attributed to the healthcare services several years ago, which were not as advanced as they are today. It is hoped that with the improvement in healthcare services and increased health awareness in the community, the fetal mortality rate among heart disease in expectant mothers will decrease.

Table 13: Characteristics of pregnant patients with heart disease based on the condition of the baby at birth

The condition of the baby at birth	Total	Percentage (%)
Vigorous	30	71.4
Moderate asphyxia	4	9.5
Severe asphyxia	2	4.8
Stillbirth	2	4.8
Abortion	4	9.5
Total	42	100

Characteristics of Pregnant Patients with Heart Disease Based on Post-partum Contraception at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

Among the patients with heart disease, most chose an intrauterine device (IUD) as their immediate postpartum contraceptive method, with 19 cases (45.2%). Ten cases (23.8%) opted not to use any form of contraception, and the remaining 13 cases (31.0%) chose permanent contraception through tubal ligation (MOW). Of the 13 cases opting for MOW, nine were in WHO class IV, one in WHO class II, two in WHO class II–III, and one in WHO class I. WHO class IV is a contraindication to pregnancy; thus, permanent contraception like MOW is recommended. In this study, five patients with WHO class IV chose an IUD instead of permanent contraception. No patients in WHO class IV opted for no contraception.

These findings suggest an improvement in education and patient confidence, as a previous study at this hospital, indicated that most (44.55%) chose not to use contraception.⁷ Considering that 23.8% of women with heart disease did not use contraception after delivery, patient education should be emphasized to ensure they understand the dangers of pregnancy with untreated heart disease. Suggestions for women who suffer from heart disease should immediately use contraception after giving birth, with oral contraception generally avoided due to the increased risk of thromboembolism. Women with valvular heart disease should avoid IUDs due to the risk of infection and bleeding.²¹

A study conducted in Surabaya revealed that a significant proportion of postpartum patients, specifically 56.5%, chose permanent contraception methods following delivery. This high preference for permanent contraception indicates a strong inclination towards long-term family planning solutions among these women. In contrast, 10.1% of patients did not utilize any form of contraception postpartum, suggesting either a lack of access to or a preference for other methods. The findings highlight a critical aspect of postpartum care, where effective family planning is essential for managing reproductive health and preventing unintended pregnancies. This trend emphasizes the need for comprehensive contraceptive counseling and access to a range of options for postpartum women.⁶¹ It is hoped that with increased education and awareness, all patients, especially those with severe heart disease, will choose contraception, particularly permanent methods, in the future (Table 14).

Table 14: Characteristics of pregnant patients with heart disease based on postpartum contraception

Postpartum contraception	Total	Percentage (%)
No birth control	10	23.8
MOW	13	31.0
IUD	19	45.2
Total	42	100

Characteristics of Pregnant Patients with Heart Disease Based on Postpartum Care Room at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

During the period from 2020 to 2021, the majority of pregnant women with cardiac disease at this hospital were treated in the intensive unit (ICU). Specifically, 22 patients, accounting for 52.4% of the cases, received ICU care. This indicates a high level of severity among the patients, necessitating advanced monitoring and treatment. In contrast, two patients (4.8%) were managed in the obstetrics emergency department, reflecting cases that required immediate but less intensive intervention. Meanwhile, 18 patients (42.9%) were treated in routine care wards, suggesting their conditions were less acute but still required specialized care. This distribution of care aligns with a prior study at the same hospital, which also found that a substantial proportion, specifically 51.11%, of patients with cardiac disease required intensive care. These findings underscore the critical role of intensive care facilities in managing severe cases of cardiac disease during pregnancy and highlight the need for continued support and resources in such settings.⁷

Intensive care is closely associated with the severity of a patient’s symptoms, as indicated by the WHO classification system, which categorizes heart disease severity into different classes. Patients in higher WHO classes typically exhibit more severe symptoms and compromised hemodynamics, necessitating more intensive care. Patients with hemodynamic conditions, including blood pressure and cardiac output, play a critical role in determining the need for intensive monitoring and intervention. Additionally, a history of cardiac surgery during pregnancy further complicates the patient’s condition and often requires closer scrutiny in the ICU. Postpartum patients with unstable hemodynamics, characterized by significant fluctuations in vital signs or ongoing cardiovascular instability, require continuous monitoring and support in the ICU to manage potential complications effectively and ensure their stability. This comprehensive approach allows for timely interventions and adjustments to treatment, aiming to improve outcomes and minimize risks associated with severe cardiac conditions (Table 15).⁵⁸ In this study, all patients with WHO class II–III and IV classifications were treated in the ICU postpartum.

Characteristics of Pregnant Patients with Heart Disease Based on Length of Treatment at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

The most common duration of hospitalization for heart disease in expectant mothers was less than 5 days, with 16 cases (38.1%). Nineteen cases (45.2%) required 5–10 days of hospitalization, and 7 (16.7%) needed extended care for more than 10 days. Among the 16 cases hospitalized for less than five days, two cases resulted in death.

Table 15: Characteristics of pregnant patients with heart disease based on postpartum care room

Ward	Total	Percentage (%)
Obstetrics ER	2	4.8
Intensive room	22	52.4
Normal treatment room	18	45.9
Total	42	100

Table 16: Characteristics of pregnant patients with heart disease based on length of treatment

Length of treatment	Total	Percentage (%)
<5 days	16	38.1
5–10 days	19	45.2
>10 days	7	16.7
Total	42	100

These findings are similar to a previous study at this hospital, which showed that most patients (62.2%) were hospitalized for 5–10 days.⁷

These findings are relevant to the clinical practice guidelines established by the Department of Obstetrics and Gynecology at this hospital in 2015, which recommended a hospital stay of 5–10 days for heart disease in expectant mothers. This recommendation takes into account the need for a sufficient duration of antibiotic therapy to prevent infections, such as subacute bacterial endocarditis, and to monitor and manage the risk of acute cardiac decompensation. The guidelines aim to ensure comprehensive care, allowing adequate time for effective treatment and monitoring, thereby reducing the risk of complications and improving patient outcomes.⁷

In contrast, research from the United States, an industrialized country with advanced healthcare systems, revealed that pregnant patients with heart disease typically have an average hospital stay of 4.8 days. This relatively shorter duration reflects the high standard of medical care, including effective management strategies and timely interventions available in such settings. The findings underscore differences in healthcare infrastructure and resource availability between developed and developing countries, highlighting how advancements in medical practices and hospital care can lead to shorter recovery times for patients with complex conditions like heart disease during pregnancy.⁷⁴ It is anticipated that advancements in healthcare services in developing nations, including Bali, Indonesia, will lead to a reduction in the average length of hospital stays for heart disease in expectant mothers. As healthcare infrastructure improves, with enhanced diagnostic tools, treatment protocols, and specialized care, the efficiency of managing complex cases is expected to increase. This progress will not only improve patient outcomes but also reduce the duration of hospital stays by allowing for more effective and timely interventions. Consequently, these improvements could lead to a more efficient use of healthcare resources and better overall care for heart disease in expectant mothers (Table 16).

Number of Maternal Deaths in Pregnant Patients with Heart Disease in RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

Between January 2020 and December 2021, the case fatality rate (CFR) for maternal heart disease fatalities at this hospital, was 9.52%. In 2020 and 2021, the CFR was 10.53 and 8.70%, respectively.

Table 17: Number of maternal deaths in pregnant patients with heart disease

Year	Amount of labor	Pregnancy case with disease heart	Maternal death with disease heart	Case fatality rate (%)
2020	690	19	2	10.53
2021	887	23	2	8.70
Total	1,567	42	4	9.52

This CFR is far greater than those of research conducted abroad; one study conducted in China, for example, found that the CFR there was just 0.7% between 2010 and 2017.⁵⁸ Similarly, a study conducted in India reported a maternal mortality rate of 5.45% among heart disease in expectant mothers. This statistic underscores the significant risks associated with managing heart disease during pregnancy. The elevated mortality rate highlights the critical need for comprehensive prenatal care, early detection, and specialized management to improve outcomes for both the fetus and the mother. Addressing these challenges is essential to reduce maternal mortality and enhance care strategies for affected women.⁷³

In another developing country, Kenya, the mortality rate for heart disease during pregnancy was quite high at 9.3%.⁶² A systematic review and meta-analysis conducted across South Asian countries, including Nepal, Pakistan, Sri Lanka, and India, from 2003 to 2020 revealed a maternal mortality rate of 26.14% among heart disease in expectant mothers. This high rate highlights the severe challenges faced in managing cardiovascular conditions during pregnancy in this region. It underscores the urgent need for enhanced healthcare strategies, including better prenatal care, early detection, and effective management to improve maternal health outcomes and reduce mortality.⁶⁰ The high maternal mortality rates from these studies may be due to data collection over the past 20 years, during which healthcare services were not as advanced as they are today.

Compared to a study in Indonesia, specifically in Surabaya, the mortality rate is similar, with a reported rate of 8.7%.⁶¹ Compared to the research conducted at this hospital, in 2016–2017, which reported a case fatality rate (CFR) of 17.78%, the current study indicates a significant decrease in CFR. This reduction reflects improvements in the management and treatment of pregnancies complicated by heart disease at the hospital. The decline in CFR suggests that advancements in medical care and interventions have contributed to better outcomes for these high-risk patients.⁷ With the improvement of healthcare services and referral systems, it is hoped that the CFR for heart disease in expectant mothers can be further reduced (Table 17).

Characteristics of the Causes of Maternal Death in Pregnant Patients with Heart Disease at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

Among the four pregnant patients who died, the causes of death were varied. One patient (25.0%) succumbed to cardiogenic shock, while another (25.0%) died from sepsis. The remaining two patients (50.0%) experienced respiratory failure due to heart failure. Notably, three of these patients (75.0%) were classified as WHO class IV, indicating severe heart disease, while the fourth patient was categorized as WHO class II–III, reflecting a less severe but still

significant cardiac condition. This distribution highlights the severe impact of advanced heart disease on maternal outcomes and the critical need for targeted management in high-risk cases.

All heart diseases in expectant mothers who passed away were categorized as NYHA class IV in an Indian study.⁷³ A study conducted in China identified two maternal deaths attributed to pulmonary hypertension among heart disease in expectant mothers.⁶⁸ Similarly, research from Kenya found that pulmonary hypertension was the most common cause of maternal mortality in this population.⁶² This trend is echoed by a study in Surabaya, which also reported pulmonary hypertension as a significant cause of death among heart disease in expectant mothers. These findings highlight the critical impact of pulmonary hypertension on maternal health, highlighting the necessity of close observation and treatment of this illness to avert serious consequences and raise the overall survival rates of impacted expectant mothers.⁶¹

Under WHO class IV, pulmonary hypertension carries a high risk of maternal death. Because the right ventricle cannot support the higher cardiac output demands during pregnancy, it is poorly tolerated and frequently results in heart failure. Pregnancy is not advised in situations of pulmonary hypertension due to the disease’s high risks of death and morbidity.^{71,76} The most common cardiovascular consequence of heart disease in expectant mothers is heart failure. Pregnancy-related increases in cardiac output and intravascular volume give rise to this illness. Heart failure can lead to complications that increase the risk of maternal death, including respiratory failure, cerebrovascular illness, pulmonary edema, and renal failure.⁸¹ Heart failure reduces myocardial contractility, decreasing ejection fraction to <45%, resulting in systolic ventricular dysfunction. This dysfunction leads to fluid accumulation in the lungs, causing pulmonary edema. The incidence of pulmonary edema is about one in 1,000 pregnancies. Fluid accumulation in the lungs impairs the diffusion of oxygen and carbon dioxide, leading to respiratory failure. Although rare, respiratory failure is fatal and accounts for 30% of maternal deaths.^{77,78}

The most severe cardiovascular problem during pregnancy is cardiogenic shock, characterized by a decrease in cardiac output that fails to meet peripheral organ perfusion needs.⁷⁹ Cardiogenic shock during pregnancy is a rare but severe condition, with an incidence rate of approximately 3.8 cases per 1,00,000 hospitalized pregnant women. A study conducted in the United States from 2002 to 2013 reported a high peripartum mortality rate of 18.81% among those experiencing cardiogenic shock. Notably, this condition predominantly occurs postpartum, accounting for 58.3% of cases. Additionally, pregnant women with valvular heart disease face a significantly higher risk, with their likelihood of experiencing cardiogenic shock being nine times greater compared to those without such conditions. This underscores the need for heightened vigilance and management strategies in high-risk populations.⁸⁰

Cardiac arrest during pregnancy is a rare but serious event, occurring in approximately one in 12,000 hospitalizations, or about 8.5 cases per 1,00,000 deliveries. Among the various causes, sepsis is a significant contributor, responsible for 11.2% of these cardiac arrest cases. This highlights the critical need for vigilant monitoring and management of pregnant women to promptly identify and treat sepsis and other conditions that could lead to such severe outcomes.⁸¹ Sepsis arises from an uncontrolled immune response to infection, which results in severe organ dysfunction that poses a life-threatening condition. It is a significant reason for admissions to intensive care units among pregnant women. Sources of infection

Table 18: Characteristics of the causes of maternal death in pregnant patients with heart disease

Death cause	Total	Percentage (%)
Cardiogenic shock	1	25.0
Sepsis	1	25.0
Respiratory failure (heart failure)	2	50.0
Total	4	100

can include uterine infections, septic abortions, wound infections, and non-obstetric causes like pneumonia. In pregnant women with preexisting heart disease, heart failure and cardiopulmonary arrest can exacerbate the development of sepsis. Prompt identification and management of sepsis are crucial to prevent mortality, which has been reported to reach up to 13% in the United States (Table 18).⁸¹

Characteristics of Infant Outcomes in Pregnant Patients with Disease Heart at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

The majority of newborns born to mothers with heart disease exhibited favorable outcomes. Of the 37 babies assessed, 33 (89.1%) were born with good muscle tone, effective breathing, and vigorous crying. Among these, 26 babies (78.8%) had APGAR scores ranging from 8 to 9, while seven babies (21.2%) scored between 7 and 8. Conversely, four babies (10.9%) experienced moderate asphyxia. Of these, one baby had an APGAR score of 4–6 (25%), and three babies had scores of 4–5 (75%). This highlights the generally positive neonatal outcomes despite the presence of maternal heart disease.

The promising outcomes observed at this hospital are likely attributed to its status as a leading referral center with a Type A classification. This classification signifies that the hospital is equipped to offer comprehensive, high-level care for complex medical cases, including those involving pregnant patients with cardiac issues. At this hospital, patients benefit from a well-coordinated, multidisciplinary approach to their care. This approach involves a team of specialized professionals across various fields, including cardiology, anesthesiology, obstetrics and gynecology, and neonatology. The cardiology team addresses the specific cardiovascular needs of the pregnant patients, while the anesthesiology team manages any anesthesia requirements and potential complications. Obstetricians and gynecologists provide specialized care related to pregnancy and childbirth, and neonatologists focus on the immediate care and monitoring of newborns. Integrating these specialties ensures patients receive thorough and tailored care throughout their pregnancy, labor, and postpartum period. This comprehensive, end-to-end care model enhances the ability to manage complex cases effectively, improves outcomes for mothers and their babies, and underscores the hospital's role as a critical hub for high-quality maternal and cardiac care.

Nonetheless, newborns delivered to women with cardiovascular illness or at high cardiovascular risk experience a significantly higher rate of complications. Research consistently indicates that conditions such as preeclampsia, major cardiac events, maternal complications, and pre-existing diabetes mellitus independently increase the likelihood of neonatal adverse cardiac events (NACE). These maternal health issues can compromise fetal well-being in several ways. Inadequate fetal oxygenation is a common

Table 19: Characteristics of infant outcomes in pregnant patients with heart disease with APGAR score

APGAR score	Total	Percentage (%)
Strong baby	33	89.1
8–9	26	78.8
7–8	7	21.2
Moderate asphyxia	4	10.9
4–6	1	25.0
4–5	3	75.0
Total	37	100

Table 20: Characteristics of COVID-19 prevalence in pregnant patients with the diseased heart

COVID-19	Total	Percentage (%)
Yes	4	9.5
No	38	90.5
Total	42	100

consequence of poor cardiovascular health during pregnancy. When the mother's cardiovascular system is impaired, it can lead to decreased blood flow and oxygen delivery to the fetus, which is crucial for healthy development. Similarly, inadequate nutrition supply due to compromised maternal circulation can affect fetal growth and development. Placental dysfunction, another result of maternal cardiovascular problems, can exacerbate this problem by disrupting the efficiency of transferring oxygen and nutrients from mother to baby. The impact of these complications is profound. They can lead to developmental delays and prenatal growth abnormalities, which in turn may result in poor newborn outcomes such as preterm birth, low birth weight, and increased risk of neonatal respiratory and cardiac issues. Addressing cardiovascular health during pregnancy is therefore crucial for improving both maternal and neonatal outcomes, highlighting the need for vigilant monitoring and management of women with cardiovascular risk factors (Table 19).⁸²

Characteristics of the Prevalence of COVID-19 in Pregnant Patients with Heart Disease at RSUP Prof. Dr. I.G.N.G. Ngoerah, Denpasar (January 2020–December 2021)

Four people (9.5%) had COVID-19 in total, and one of the four patients (25%) passed away. Several studies show that SARS-CoV-2 can cause thrombosis, arrhythmias, myocarditis, and acute coronary syndrome, among other cardiovascular disorders. Heart disease linked to COVID-19 is linked to conditions such as ischemia, viral myocarditis, and cytokine storm. Research utilizing cardiac magnetic resonance (CMR) imaging has detected indications of COVID-19 individuals' involvement of both ventricles, fibrosis, left ventricular hypertrophy, and myocardial inflammation. More investigation is required to ascertain whether COVID-19 directly contributes to the mortality of pregnant women who have heart disease (Table 20).

CONCLUSION

This study at RSUP Prof. Dr. I.G.N.G. Ngoerah from January 2020 to December 2021 identified 42 cases of pregnancy complicated

by heart disease, with a prevalence of 2.68%. Most women aged 20–35 had secondary education and a normal BMI. Congenital heart disease was the most common, and many patients were diagnosed after 37 weeks. Delivery methods were primarily perabdominal, and over half of the babies weighed less than 2500 gm. Postpartum care often requires ICU treatment, with many using the intrauterine device (IUD). The study noted a 9.52% case fatality rate, with respiratory failure as the leading cause of mortality. These findings highlight the need for improved management and further research, including broader risk factors and collaboration with other hospitals to enhance care strategies for heart disease in expectant mothers.

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