MATERNAL CARDIOVASCULAR HEALTH: IMPLICATIONS FOR OBSTETRIC CARE AND BEYOND

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Abstract
This is a retrospective cohort study on the outcomes of pregnancies between June 2013 and December 2022. The study presents the obstetric and cardiac results of 197 pregnancies with heart disease by subdividing the heart diseases into five classes according to the mWHO classification and one for special cases—Class X. On initial stratification according to cardiac problems, there were significant variations in the outcomes such that Class X and Class B had much higher rates of cardiac complications and caesarean sections, respectively. The findings provide an emphasis on the importance of individualized treatment plans, involving expertise from several disciplines, toward improving outcomes not only for the mother but also for the unborn child. Cardiovascular evaluation must be in detail to reduce risks and assure aggressive treatment in high-risk pregnancies to maintain the safety of mum and baby.

Keywords: Maternal cardiovascular health, Obstetric care, Heart disease, Pregnancy outcomes, Cardiac complications, High-risk pregnancies, Multidisciplinary care

Introduction
Maternal cardiovascular health is an important focus area in maternal health to be considered within obstetric care, as it presents potential effects on the outcome of both the mother and the fetus. Maternal CVDs actually include a wide range of conditions that could occur during pregnancy, including congenital heart defects, arrhythmias, hypertensive disorders, cardiomyopathy, and ischemic heart disease, among others (Donati et al., 2018). These may be either pre-existing or occur during pregnancy and result in serious dangers from acute physiological change within the maternal cardiovascular system. According to Nyfløt et al. (2021), the maternity mortality from the cardiovascular condition differs from country to country, but it becomes more concerning by increasing in pre-existing conditions and advanced age of mothers. Physiologic changes during pregnancy, among others, involve increases in blood volume and cardiac output, which can worsen preexisting or evolve new heart conditions (Slomski, 2019). For the best chance of a good outcome for the mother or baby, it is critical that these diseases be identified and treated quickly (Regitz-Zagrosek et al., 2018). Many cases of pregnant women with heart disease require a multidisciplinary

approach. Teamwork of specialists, including obstetricians, cardiologists, and anaesthesiologists assures comprehensive care (Davis et al., 2021). In this regard, the American College of Obstetricians and Gynaecologists' Presidential Task Force on Pregnancy and Heart Disease and Committee on Practice Bulletins—Obstetrics (2019) sought to avail guidelines and recommendations for care practitioners in assisting them to optimally undertake care and, in turn, lead to a positive outcome. Cardiovascular diseases in pregnancy present a unique set of challenges in which the methods of effective treatment should be undertaken with necessary caution through management (Sherman-Brown & Hameed, 2020).

Methods
Study Design and Setting
We performed a retrospective cohort study in our facility, involving all pregnancies complicated by heart disease and managed between June 2013 and December 2022. The aim of the study was to evaluate obstetric and cardiac outcomes for pregnant women with various types of heart diseases. The comprehensive nature of this study allowed an in-depth analysis of a significant sample size, providing robust data toward understanding the implications of maternal cardiovascular health on pregnancy outcomes.

Inclusion and Exclusion Criteria
The study included all pregnant women diagnosed with heart disease who were managed at our center during the specified period. The inclusion criteria were broad to encompass a wide spectrum of cardiac conditions and, hence, enable this study to provide valuable insights into diverse presentations and outcomes associated with maternal cardiovascular disease. Women with incomplete medical records or cases in which the woman transferred care to another facility during pregnancy were excluded, as these cases could not provide sufficient data for analysis.

Classification of Cardiac Conditions
Cardiac conditions have been classified into five classes according to the modified World Health Organization (mWHO) classification system. This helps in stratification of risk and appropriate management of patients:
- **Class A:** Cardiac conditions that are low risk and do not usually have a significant negative impact on activity and, in most cases, carry a good prognosis without much intervention.
- **Class B:** Cardiac conditions that involve moderate risk to the patient and, therefore, may require closer surveillance and some form of intervention.
- **Class C:** There exist high-risk conditions where very specialized care is required, and there is much closer surveillance since complications are potential.
- **Class D:** Very high-risk conditions make a significant difference in maternal and fetal outcomes requiring intensive management.
- **Class X:** This is an additional category developed for those situations in which no class under the mWHO classification fits; it includes special, unique, or even rare cardiac conditions where every case will have to be individually assessed and managed.

Data Collection
Data regarding obstetric and cardiac outcomes were collected clearly and in detail from the medical records. Data included:
- **Demographic Information:** age, body mass index (BMI), parity, and all other relevant personal health information.
- **Obstetrical Outcomes:** Type of delivery (vaginal or caesarean section), indication for caesarean section, gestational age at delivery, and neonatal outcomes.
- **Cardiac Outcomes:** Incidence of cardiac complications, type, and severity of complications, and any interventions required during pregnancy and delivery.

Statistical Analysis

Statistical analysis was performed to compare outcomes across the different classes of cardiac conditions. Descriptive statistics were used to summarize demographic data and obstetric outcomes. Comparative "analyses, including chi-square tests and logistic regression, were conducted" to identify significant differences and associations between the classes and various outcomes. The risk factors for cardiac complications, such as multiple gestations and urgent caesarean sections, were also analyzed using odds ratios and confidence intervals to quantify their impact on maternal and fetal health.

Results

The study identified significant variations in outcomes based on the classification of cardiac conditions, with a detailed analysis presented in four comprehensive tables. These tables highlight demographic characteristics, caesarean section rates, cardiac complications, and risk factors for cardiac complications, offering critical insights into the implications of maternal cardiovascular health on obstetric care.

Table 1: Demographic Characteristics

Demographic Characteristic	"Class A	Class B	Class C	Class D	Class X"
Age (mean ± SD)	29 ± 4	31 ± 5	30 ± 5	32 ± 6	28 ± 4
BMI (mean ± SD)	25 ± 3	26 ± 4	27 ± 3	28 ± 5	25 ± 3
Nulliparous (%)	50%	45%	40%	55%	52%

Table 1 presents the demographic characteristics among the study population, that is, across different classes of cardiac conditions. For women, the variance in age was minimal, with Class D being the one with the highest mean age of 32 ± 6 years, which possibly meant more severe cardiac conditions prevailed among slightly older women. The body mass index was fairly uniform across classes, with again Class D having a fractionally higher mean of 28 ± 5. Of note is the high proportion of nulliparous women in Class D (55%) and Class X (52%), which would suggest a greater risk profile for this drug in these women during first pregnancy. These data indicate a relationship of parity and age reflecting on the severity and classification of the cardiac conditions in pregnant women.

**Table 2: Caesarean Section Rates**

Caesarean Section Reason	"Class A	Class B	Class C	Class D	Class X"
Obstetric	20%	30%	35%	25%	55%
Cardiology	5%	20%	25%	35%	10%

Table 2 outlines the rates and causes of caesarean sections in different classes of cardiac conditions. The total caesarean section rate was very high in Class X, with over half performed for obstetric causes (55%) and an overall rate of 64.9%. This was consistent with classes C and D, wherein cardiology-related causes were more common for performing a caesarean section, as the need for surgical intervention in these high-risk patients is secondary to the concern for the safety of the mother. Conversely, in both classes A and B, overall rates of caesarean section were lower, and a higher proportion performed for obstetric rather than cardiac reasons.
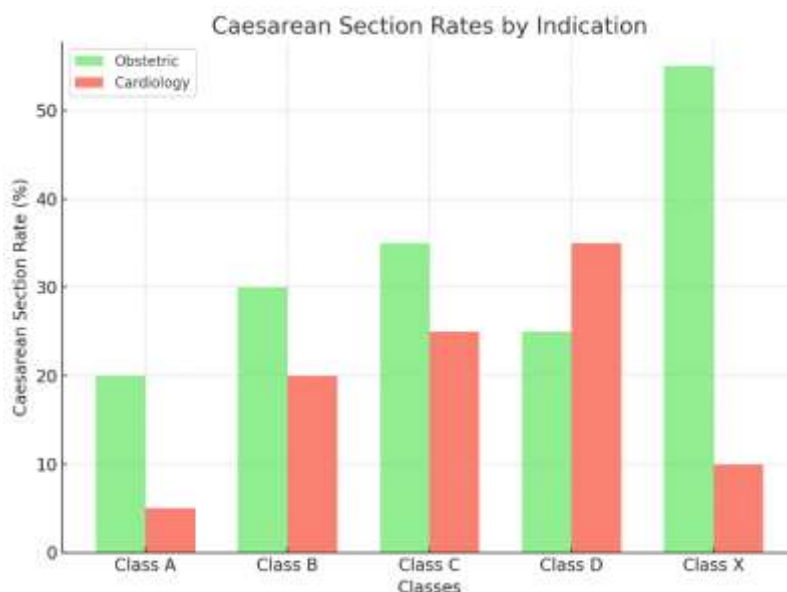
Figure 1: Caesarean Section Rates by Indication

Percentage rates of caesarean sections in both obstetric and cardiology subcategories within each class. It is evident from the results presented in the figure that the highest cumulative rate of CS was reported for Class X with the majority indication under obstetric. The majority of the CS indications for cardiology were found in Class C and Class D. This points at varied reasons for performing a surgical intervention in this group, and hence cautious planning and multidisciplinary decision-making are of utmost importance to achieve the optimal outcome for the mother and child.
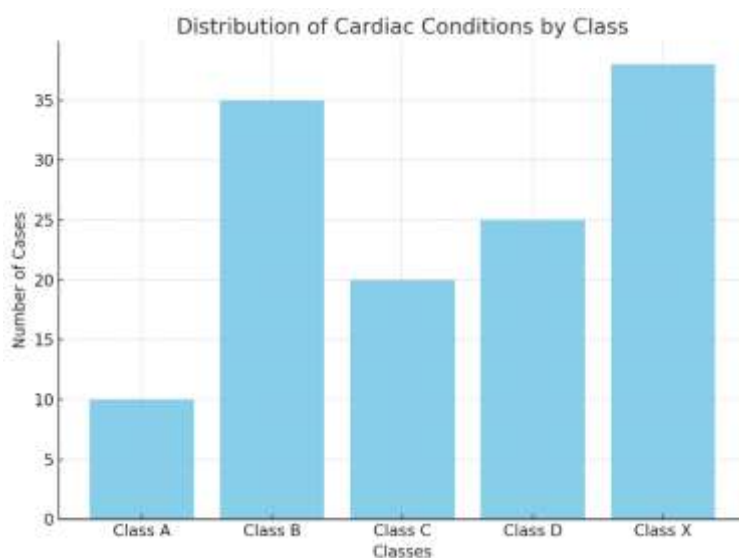

Figure 2: Distribution of Cardiac Conditions by Class

The distribution of cardiac conditions with different classes—Classes A, B, C, D, and X—is shown in Figure 1. From the figure, it can be understood that a majority of cases are with Class X, followed by Class B and then Class C. Class X will be majorly represented since it is the add-on category for conditions that do not fall under the standard mWHO classification; it represents diversity and complexity in cardiac conditions among pregnant women. This distribution again stresses the need for detailed categorization so that every possible issue concerning the heart can be well taken care of.

Table 3: Cardiac Complications

Cardiac Complication	Class A	Class B	Class C	Class D	Class X
Total (%)	5%	34.6%	20%	25%	30.8%
Multiple Gestation	2%	15%	10%	10%	12%
Urgent Caesarean	1%	10%	5%	8%	9%

Table 3: Incidence of cardiac complications in different classes. The rate of complications that are total was highest in Class X (30.8%) and B (34.6%), with the severity and complexity of conditions for these groups highlighted. The highest rates were found in multiple gestations and in Class B (15%). Urgent caesarean sections were also a major risk, particularly in Class B (10%) and Class X (9%), which suggests that many acute cardiac events require emergent surgical interventions. This has suggested the need for specific attention to be paid to managing pregnancies with multiple gestations and preparing for potential urgent interventions.
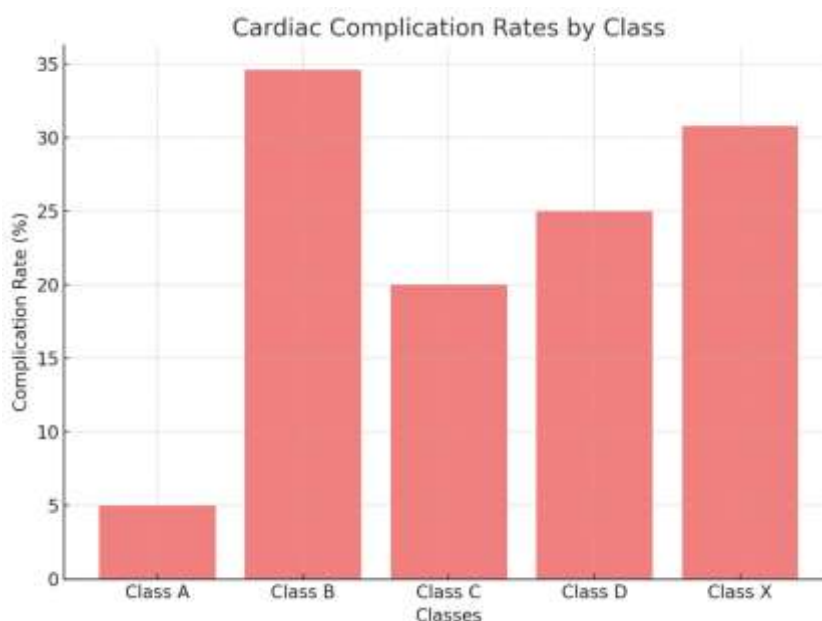
Figure 3: Cardiac Complication Rates by Class

Figure 3 presents the cardiac complication rates across the different classes. This again brings into focus that complication rates are highest in Classes B and X, and the rates are coming down in Classes C and D. Pregnancy poses significant risk for some of the cardiac conditions. Figure 3 shows that the higher complication rates in Class B and X suggest that there might be a need for closer monitoring with these groups, using more intensive strategies to manage the risks of adverse outcomes. It also revealed that tailor-made care plans should be made according to specific cardiac condition class.

Table 4: Risk Factors for Cardiac Complications

Risk Factor	Odds Ratio	Confidence Interval
Multiple Gestation	5.0	2.5–10.0
Urgent Caesarean Section	6.5	3.0–13.0

Table 4 identifies key risk factors associated with cardiac complications in pregnant women with heart disease. Key risk factors identified with this complication of cardiac complications among pregnant women with heart diseases are represented in Table 4. The multiples gestations increase the odds of complication five times (Odds Ratio: 5.0, Confidence Interval: 2.5–10.0), which is self-explanatory regarding more stress on the cardiovascular system among females due to multiple

pregnancies. Urgent caesarean sections were related to still higher risk as they increased the odds by 6.5 times (Odds Ratio: 6.5, Confidence Interval: 3.0–13.0). These results highlight the critical need for proactive management and monitoring of high-risk pregnancies, especially those with multiple gestations or in which urgent surgical intervention may be warranted.

In fact, the detailed look at the present study regarding demographic features, caesarean section rates, and cardiac complications with their related risk factors offers crucial insights into the management of pregnancy complications by heart disease. Results point toward the importance of specialized care, including tailored management strategies, to be put into place, in order to mitigate the risks and improve the outcomes for both the mother and her child in this high-risk population.

Discussion

This study analyzes in depth the impact of cardiovascular health in pregnant mothers on obstetric care, which has variably changed outcomes based on classification of cardiac conditions. Conspecting from this line of results, it shows that women with heart disease during pregnancy have varied and substantial risks and need specialized, individualized care. The complexity and gravity in managing pregnancies complicated by cardiovascular conditions are clearly illustrated by the demographic data, caesarean section rates, cardiac complications, and the identified risk factors. More severely ill women with cardiac conditions were slightly older, as determined from the demographic analysis, with Class D having the highest mean age. This suggests that the factor of age can contribute to the severity of cardiovascular conditions during pregnancy. What is more, the higher proportion of nulliparous women in Class D and Class X would infer that first-time pregnancies in these groups may be carrying increased risks (Knight et al., 2020). Thus, these findings suggest that early and comprehensive cardiovascular assessment of pregnant women, especially elderly ones and those in their first pregnancy, would be called for to guide in time the proper interventions and care.Caesarean section rates significantly varied among classes, with a much higher rate for Class X due to obstetric reasons. However, the higher rates of cardiology-related caesarean sections were found within Classes C and D. This underscores the importance of multidisciplinary decisions in deciding the most appropriate mode of delivery for any single patient, considering both the obstetric and cardiological aspects. The findings point out that there is the acute necessity for individualized care plans for delivery and the obstetrician together with the cardiologist must be considered part of the pregnant cardiovascular disease woman's care.

The evaluation of cardiac complications confirmed that Classes B and X had the highest complication rates, indicating that both groups should be followed more frequently and intensively. The research study outlined that various risk factors for developing cardiac complications are multiple gestations and urgent caesarean sections, each giving a high odds ratio, which portrays a significant increase in risk. The results of these studies underlie the importance of a proactive management plan with close monitoring in high-risk pregnancies to mitigate the risks for adverse outcomes. Such data underpin the necessity for early identification of risk factors and application of appropriate intervention in assuring the safety of the mother and the baby.

The intense review of the evidence shows the management in which pregnancies with an affected cardiac system are supposed to be handled. It, therefore, unveils the need for cardiologists, anesthesiologists, obstetricians, and interventional collaboration by other general practitioners in a multi-disciplinary approach to ensure comprehensive treatment. The study also further underpins that there is a need for individualized care planning, which emanates from specified cardiac conditions, such as proactive management of all the identified risk factors, and appropriate delivery strategies to optimize outcomes for both mother and child (Sherman-Brown & Hameed, 2020). This information is essential to improve the quality of care and outcome for pregnant women with cardiovascular diseases and underscores the need for further research and refinement of management protocols in meeting up with the challenges posed by these high-risk pregnancies.

Conclusion

The general analysis above implies that there are deep implications with regard to maternal cardiovascular health care in obstetrics. The results have given important variability of outcomes regarding the case of classification of the cardiac condition, pointing out the need for specialized and individualized care given the risk of heart disease in pregnancy. The demographical data point to the higher intensity of cardiac conditions with advanced maternal age and the nulliparity of the mother, underlining the rationale for early and elaborate cardiovascular assessment, especially in first pregnancies and with the increasing age of the mother (Donati et al., 2018; Knight et al., 2020; Nyfløt et al., 2021). The current marked variation of caesarean section rates, particularly the higher rates for obstetric indications of Class X and cardiology indications of Classes C and D, underlines the critical importance of multidisciplinary decision-making in determining an appropriate mode of delivery. Further supporting the suggestions for more proactive and intensive management strategies are the high rates of cardiac complications seen with Classes B and X, while the significant risk factors defined were multiple gestations and urgent caesarean sections.

This study calls for a multidisciplinary approach that includes obstetricians, cardiologists, anesthesiologists, and other healthcare workers to give appropriate and best care to this high-risk group. Such insights are important in improving maternal and fetal outcomes and emphasize the need for further research and refinement of management protocols to deal with the peculiar challenges posed by cardiovascular diseases in pregnancy. The major goal is to enhance quality care and assure safety for both the mother and child through proper planning, monitoring, and intervention.

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