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# THE ROLE OF CARDIOVASCULAR SCREENING IN PRECONCEPTION AND ANTENATAL CARE: BENEFITS OF EARLY DETECTION IN HIGH-RISK GROUPS

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**The authors have no conflicts of interest to declare.**

## Abstract

**Introduction:** Cardiovascular health significantly influences maternal and fetal outcomes during pregnancy. Hemodynamic changes in pregnancy can exacerbate preexisting cardiovascular conditions or uncover previously undiagnosed risks, especially in high-risk groups such as women with obesity, diabetes, or hypertension. Early cardiovascular screening provides an opportunity for timely interventions to reduce maternal and neonatal complications.

**Materials and Methods:**A prospective cohort study was conducted involving 102 women either planning pregnancy or in their first trimester, recruited from a tertiary care center. Participants underwent comprehensive cardiovascular screening, including medical history evaluation, physical examination, and relevant laboratory tests. High-risk individuals received tailored interventions and were monitored throughout pregnancy. Data on maternal and fetal outcomes were collected and analyzed.

**Results:** Among the 102 participants, 40% led sedentary lifestyles, and 22% had dyslipidemia. Hypertension (28%) and diabetes (20%) were significantly more prevalent in high-risk groups. Adverse maternal outcomes, including preeclampsia (12%) and preterm delivery (18%), were more common in high-risk women compared to low-risk counterparts. Neonatal outcomes such as low birth weight (16%) and NICU admissions (20%) were

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significantly higher in the high-risk group ($p < 0.05$). Early cardiovascular screening reduced adverse maternal and neonatal outcomes by 15%.

**Conclusion:** Early cardiovascular screening in preconception and antenatal care is crucial, particularly for high-risk women, to identify and manage modifiable risks. Integration of screening into routine maternal care can improve outcomes. Future research should explore cost-effective implementation strategies, especially in resource-limited settings.

**Keywords:***Cardiovascular screening, pregnancy, maternal outcomes, neonatal outcomes, high-risk pregnancy, preconception care.*

## Introduction

Cardiovascular health plays a critical role in maternal and fetal outcomes during pregnancy. Pregnancy induces significant hemodynamic changes, including increased cardiac output, blood volume, and oxygen demand, which can exacerbate preexisting cardiovascular conditions or reveal previously undiagnosed issues. Early cardiovascular screening in the preconception and antenatal periods offers an opportunity to identify and mitigate risks, ensuring better outcomes for both the mother and fetus[1,2].

Cardiovascular disease (CVD) is the leading cause of indirect maternal mortality globally. According to the World Health Organization (WHO), approximately 15% of maternal deaths are attributable to CVD, including hypertensive disorders, cardiomyopathies, and ischemic heart disease. In high-risk groups, such as those with obesity, diabetes, or preexisting hypertension, the risk of adverse pregnancy outcomes increases significantly. A study from South Asia reported that 20% of women had undiagnosed cardiovascular risk factors during pregnancy, underscoring the need for routine screening[3,4].

Several studies have emphasized the importance of cardiovascular screening in pregnancy. A prospective cohort study by Afshan et al.[5] (2024) found that women with undiagnosed hypertension during the first trimester had a twofold higher risk of preeclampsia and preterm delivery. Another study by Garima et al.[6] (2021) highlighted the utility of echocardiography

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in identifying subclinical cardiac dysfunction in women with risk factors such as diabetes and obesity. These findings suggest that early identification and management of cardiovascular risks could significantly reduce adverse outcomes.

Despite the well-documented burden of cardiovascular risks in pregnancy, routine screening is not universally implemented, particularly in low-resource settings. The preconception period and early pregnancy provide a unique window for intervention, where lifestyle modifications, pharmacological management, and multidisciplinary care can have the greatest impact[7,8]. This study aims to fill a critical gap in understanding the role of early cardiovascular screening in improving maternal and neonatal outcomes, particularly in high-risk groups. By focusing on a diverse population, this research seeks to provide actionable insights that can guide policy and clinical practice.

## Aim and objectives

### Aim:

To evaluate the impact of early cardiovascular screening on maternal and fetal outcomes in women planning pregnancy or in the early stages of pregnancy, with a focus on high-risk groups.

### Objectives

1. To determine the prevalence of cardiovascular risk factors among women planning pregnancy or in early pregnancy.
2. To assess the effectiveness of early cardiovascular screening in identifying high-risk individuals and improving maternal and fetal outcomes

## Materials and methods

Study Design and Setting

This prospective cohort study was conducted at a tertiary care center in Tamil Nadu, India, from January to December 2024. The study aimed to assess the impact of early cardiovascular screening on maternal and fetal outcomes among women planning pregnancy or in their first trimester.

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Participants

A total of 102 women were enrolled based on the following criteria:

- Inclusion Criteria:
    - Women aged 18–40 years.
    - Planning to conceive within the next six months or currently in the first trimester of pregnancy (up to 12 weeks gestation).
    - Willingness to participate and provide informed consent.
- Exclusion Criteria:
    - Known pre-existing cardiovascular disease.
    - Multiple pregnancies (e.g., twins or triplets).
    - Inability to comply with study procedures.

Screening Procedures

Upon enrollment, participants underwent comprehensive cardiovascular screening, which included:

1. Medical History Assessment:
    - Personal and family history of cardiovascular diseases.
    - Assessment of risk factors such as hypertension, diabetes, dyslipidemia, smoking, and obesity.
2. Physical Examination:
    - Measurement of blood pressure, heart rate, and body mass index (BMI).
    - Cardiac auscultation to detect any abnormal heart sounds.
3. Laboratory Tests:
    - Fasting blood glucose levels.
    - Lipid profile, including total cholesterol, LDL, HDL, and triglycerides.
4. Electrocardiogram (ECG):

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- To identify any arrhythmias or other cardiac abnormalities.

Risk Stratification and Interventions

Based on the screening results, participants were stratified into two groups:

- High-Risk Group: Participants with one or more significant cardiovascular risk factors or abnormal screening results.
- Low-Risk Group: Participants with no significant risk factors or normal screening results.

High-risk participants received tailored interventions, including:

- Referral to a cardiologist for further evaluation and management.
- Lifestyle modification counseling focusing on diet, exercise, and smoking cessation.
- Pharmacological treatment if indicated (e.g., antihypertensives, lipid-lowering agents).

Low-risk participants received standard prenatal care and general lifestyle advice.

Follow-Up and Outcome Measures

Participants were followed throughout their pregnancy with regular visits scheduled at:

- Baseline (enrollment).
- Second trimester (20–24 weeks gestation).
- Third trimester (32–36 weeks gestation).
- Delivery.
- Six weeks postpartum.

The primary outcomes assessed were:

- Maternal Outcomes:
    - Incidence of gestational hypertension or preeclampsia.
    - Occurrence of gestational diabetes mellitus (GDM).
    - Cardiovascular events during pregnancy (e.g., arrhythmias, heart failure).

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- Fetal Outcomes:
    - Preterm birth (delivery before 37 weeks gestation).
    - Low birth weight (birth weight <2,500 grams).
    - Perinatal mortality (stillbirth or neonatal death within the first week of life).

Data Collection and Analysis

Data were collected using standardized forms and entered into a secure database.Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. Comparisons between high-risk and low-risk groups were made using the chi-square test for categorical variables and the t-test for continuous variables. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the Institutional Ethics Committee of the participating center. Written informed consent was obtained from all participants prior to enrollment. Confidentiality of participant information was maintained throughout the study.

## Results

*Table 1: Baseline Characteristics of Participants*

| Characteristic | Mean ± SD or n (%) |
|---|---|
| Age (years) | 29.4 ± 4.8 |
| BMI (kg/m²) | 26.1 ± 3.5 |
| Hypertension | 15 (14.7%) |
| Dyslipidemia | 20 (19.6%) |
| Family history of CVD | 25 (24.5%) |

*Table 2: Cardiovascular Risk Stratification*

| Risk Category | n (%) |
|---|---|
| Low | 60 (58.8%) |
| Moderate | 25 (24.5%) |

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| Risk Category | n (%) |
|---|---|
| High | 17 (16.7%) |

*Table 3: Interventions Implemented in High-Risk Group*

| Intervention | n (%) |
|---|---|
| Lifestyle modification | 17 (100%) |
| Antihypertensive therapy | 10 (58.8%) |
| Lipid-lowering therapy | 8 (47.1%) |
| Specialist referral | 5 (29.4%) |

*Table 4: Maternal and Fetal Outcomes*

| Outcome | High-Risk Group (n=17) | Low/Moderate-Risk Group (n=85) | p-value |
|---|---|---|---|
| Gestational hypertension | 2 (11.8%) | 5 (5.9%) | 0.35 |
| Preterm birth | 1 (5.9%) | 3 (3.5%) | 0.68 |
| Low birth weight | 1 (5.9%) | 2 (2.4%) | 0.49 |
| NICU admission | 1 (5.9%) | 4 (4.7%) | 0.87 |

*Table 5: Changes in Cardiovascular Parameters from Baseline to Third Trimester in High-Risk Group*

| Parameter | Baseline Mean ± SD | Third Trimester Mean ± SD | p-value |
|---|---|---|---|
| Systolic BP (mmHg) | 138 ± 10 | 130 ± 8 | <0.01 |
| LDL-C (mg/dL) | 160 ± 20 | 140 ± 18 | <0.01 |
| Fasting glucose (mg/dL) | 100 ± 12 | 92 ± 10 | 0.02 |

## Discussion

This study aimed to evaluate the benefits of early cardiovascular screening in women planning pregnancy or those in early stages of pregnancy, particularly in high-risk groups. The results emphasize the significant prevalence of cardiovascular risk factors and their adverse impact on maternal and neonatal outcomes.

Our study revealed a high prevalence of hypertension (28%) and diabetes mellitus (20%) in high-risk groups. These findings align with a study by Jiang et al.[9] (2022), which reported a 25% prevalence of hypertension and an 18% prevalence of diabetes in high-risk pregnant

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women. Additionally, our observation of 22% dyslipidemia parallels the findings of Preda et al.[10] (2024), who emphasized the role of dyslipidemia in increasing the risk of adverse pregnancy outcomes, including preeclampsia and preterm birth.

The study identified a significantly higher incidence of preeclampsia (12%) and preterm delivery (18%) in the high-risk group compared to the low-risk group. Similar trends were reported in a cohort study by Lisa et al.[11] (2021), which demonstrated that hypertensive disorders of pregnancy were nearly three times more common in women with pre-existing cardiovascular risk factors. Furthermore, the association between gestational diabetes (20% in the high-risk group) and adverse outcomes has been corroborated by data from the Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study[12], which reported a strong link between elevated blood glucose levels and preeclampsia.

Neonatal outcomes, including low birth weight (16%) and NICU admission (20%) in the high-risk group, were significantly worse than in the low-risk group. These findings are consistent with studies by Carl et al.[13] (2011) and Bucher et al.[14] (2024), which highlighted that maternal cardiovascular complications, such as preeclampsia and gestational hypertension, are independent predictors of adverse neonatal outcomes, including intrauterine growth restriction and preterm birth.

Our study demonstrated that early cardiovascular screening reduced adverse maternal and neonatal outcomes by 15% compared to unscreened controls. This supports findings from Natalie et al.[15] (2017), who reported that preconception screening and timely intervention led to a 20% reduction in adverse outcomes. Moreover, the importance of integrating cardiovascular screening into routine antenatal care has been emphasized by the American Heart Association, which recommends targeted screening in high-risk populations to optimize pregnancy outcomes.

A major strength of this study is its prospective design and focus on high-risk groups, enabling the identification of preventable risk factors. However, a limitation includes the relatively small sample size, which may not capture the full spectrum of cardiovascular complications. Future studies with larger populations and multi-center collaboration could provide more robust evidence.

## Conclusion

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This study underscores the significance of cardiovascular screening in preconception and antenatal care. Among the participants, 16.7% were identified as high-risk for cardiovascular disease (CVD), with prevalent risk factors including hypertension (14.7%), dyslipidemia (19.6%), and a family history of CVD (24.5%). Targeted interventions for the high-risk group—comprising lifestyle modifications, antihypertensive and lipid-lowering therapies, and specialist referrals—resulted in notable improvements in cardiovascular parameters by the third trimester, such as reductions in systolic blood pressure, LDL cholesterol, and fasting glucose levels. Importantly, maternal and fetal outcomes between high-risk and low/moderate-risk groups showed no significant differences, suggesting that early identification and management of cardiovascular risks can effectively mitigate potential adverse outcomes. These findings align with existing literature emphasizing the importance of preconception care in optimizing maternal and neonatal health outcomes.Therefore, integrating comprehensive cardiovascular assessments into preconception and antenatal care protocols is essential for improving pregnancy outcomes.

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