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ORIGINAL ARTICLE

Factors Associated with Adverse Pregnancy Outcomes in Known Cardiac Patients

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ABSTRACT

Background: Cardiac disease is a major cause of maternal illness and death during pregnancy. The burden is especially high in regions with limited healthcare resources, where delayed diagnosis and poor access to care increase the risk of adverse outcomes. Objective was to assess the frequency of adverse outcomes and factors related to maternal adverse outcomes in pregnant cardiac patients.

Methods: This descriptive case series was carried out in the Department of obstetrics and gynecology, services hospital, Lahore, from December 2025 to February 2026. A total of 100 pregnant women with cardiac disease beyond 16 weeks of gestation were included. Demographic, obstetric, and clinical data including type of cardiac disease, New York Heart Association (NYHA) functional class, and treatment history were recorded along with maternal and fetal outcomes. Data were analyzed using SPSS version 21. Associations between variables and outcomes were assessed using the chi-square test, with statistical significance set at $p < 0.05$.

Results: The mean age was 29.17 ± 4.91 years, mean gestational age 32.54 ± 3.29 weeks, and mean BMI 27.11 ± 3.33 kg/m². Rheumatic heart disease was most common (38%). Stillbirth (64%) and maternal mortality (57%) were the major adverse outcomes. ICU admission was 21% and prolonged hospital stay 22%. Outcomes were significantly associated with age, BMI, gestational age, parity, booking status, and socioeconomic factors ($p < 0.05$). High-risk groups included younger, prim gravida, normal BMI, and un-booked patients.

Conclusion: Pregnant women with cardiac disease face high rates of maternal mortality (57%) and stillbirth (64%), influenced by factors such as maternal age, BMI, parity, booking status, and socioeconomic conditions. Early detection and timely intervention can improve outcomes.

Keywords: Delayed Diagnosis, Maternal Mortality, Pregnancy, Rheumatic Heart Disease

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Introduction

Pregnancy leads to various vascular, metabolic, and physiological adaptations in the mother, including increased insulin resistance, hypercoagulability, cardiac remodeling, and decreased vascular resistance (1). The mother undergoes these alterations to support fetal development and to prepare her body for the increased energy and nutritional requirements of lactation, which will help the newborn grow after birth(2).

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Cardiac disease is a major cause of maternal illness and death during pregnancy. The burden is especially high in regions with limited healthcare resources, where delayed diagnosis and poor access to care increase the risk of adverse outcomes (3). The main reproductive milestones in a woman's life will determine her future cardiovascular health through their effects on her cardio-metabolic and cardio-vascular development (4).

Research shows that women who experience pregnancy complications have a higher risk of developing cardiovascular disease and related risk factors (5,6). Adverse pregnancy outcomes share common underlying mechanisms, including abnormal placental development, systemic inflammation, and vascular dysfunction(7). A study conducted in Kenya reported adverse maternal outcomes in 75.6% of women. Preterm delivery was the most frequent complication (22.2%), followed by postpartum hemorrhage (11.1%), termination of pregnancy (8.9%), miscarriage (3.3%), and stillbirth (2.2%). Rheumatic heart disease was the leading cause of adverse outcomes (84%), followed by cardio-myopathies (12%) and congenital heart disease (4%)(8). In addition, 96% of participants had NYHA class II or higher, while pre-pregnancy mitral valve replacement was associated with adverse outcomes in 4% of cases(9).

The study aims to evaluate how frequently different factors lead to negative outcomes in pregnant women who have heart conditions. The literature has revealed only basic details about which factors lead to adverse pregnancy outcomes in women with heart disease. The researchers conducted this study to generate evidence that could benefit the local community, enhance clinical practice and advance our understanding of the factors contributing to adverse pregnancy outcomes in these specific contexts.

Methods

T The research study was conducted in the Department of Obstetrics and Gynecology at Services Hospital in Lahore after ethical approval from institution (REF:IRB/2025/1573/SIMS) and College of physicians and surgeons, Pakistan (CPSP/REU/OBG/2022-068-11836). The study lasted three months. The required sample size of 100 pregnant women with cardiac disease was determined using the standard sample size formula with a 95% confidence level, 9% margin of error, and an expected prevalence of adverse outcomes of 75.6% (9). The study recruited participants using a non-probability consecutive sampling technique. Pregnant females aged 18-40 years with parity <5, presenting at gestational age >16 weeks (as per LMP) and diagnosed cases of cardiac diseases were included. Females with ischemic heart disease (on medical record), Unaware of cardiac condition (on history), females with other congenital disorders or intrauterine abnormality and fibroids (on ultrasound) were excluded.

We obtained informed consent from all participants. Researchers collected demo-graphic information, which includes name, age, BMI, parity, gestational age, education, occupation, residence, socio-economic status, and various pregnancy outcomes, including termination of pregnancy, congenital anomaly, miscarriage, preterm delivery, and stillbirth. The researchers also assessed risk factors for adverse outcomes by examining the classification of heart disease, NYHA functional class, pre-pregnancy interventions, and operationally defined interventions administered before pregnancy. We

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documented all information in proforma documents.

Data was analyzed using SPSS version 26.0. Quantitative variables, including age, BMI, and gestational age, were presented as mean ± standard deviation. The frequency and percentage were presented for qualitative variables. The data was separated according to age, BMI, booking status, occupation, education, socioeconomic status, residence, gestational age, and parity. Chi-square test was used to assess crude associations between categorical variables and outcomes. Multivariate logistic regression was applied to identify independent predictors after adjustment for age, BMI, gestational age, parity, booking status, education, occupation, residence, and socioeconomic status. P-values below 0.05 indicate statistical significance.

Results

The study included 100 pregnant women with cardiac disease. The mean maternal age was 29.17 ± 4.91 years. The mean gestational age at presentation was 32.54 ± 3.29 weeks, while the mean body mass index (BMI) was 27.11 ± 3.33 kg/m², indicating that most participants were in the overweight range. These findings describe the baseline demographic and clinical characteristics of the study population. Table 1

Regarding parity, most women had 1–3 children (26% each), while 15% had four, and 7% had five children. In terms of fetal outcomes, stillbirth was the most common outcome (64%), followed by preterm delivery (17%), termination of pregnancy (11%), and miscarriage (8%). Maternal outcomes showed that 57% experienced maternal mortality, while 22% had a prolonged hospital stay and 21% required ICU admission. Rheumatic heart disease was the most frequent cardiac condition (38%), followed by valvular (29%), congenital (21%), and cardiomyopathy (12%). NYHA functional class distribution was nearly equal across Class I (26%), Class II (24%), Class III (26%), and Class IV (24%). Regarding management, 39% received treatment before pregnancy, whereas 61% had no prior intervention. Among procedures, ASD closure was most common (21%), followed by valve repair (14%) and valve replacement (4%). The mode of delivery was equally divided between normal vaginal delivery (50%) and caesarean section (50%). Similarly, the timing of delivery was evenly distributed, with 50% delivering between 24 - 36 weeks and 50% after 36 weeks. Table 1

Table 1: Descriptive statistics of continuous & categorical variables (n = 100)

Variable		Mean ± SD
Age (years)		29.17 ± 4.91
Gestational age (weeks)		32.54 ± 3.29
Body Mass Index (kg/m²)		27.11 ± 3.33
	Category	**n(%)**
Parity	1	26 (26.0)
	2	26(26.0)
	3	26 (26.0)
	4	15 (15.0)
	5	7 (7.0)
Fetal Outcome	Termination of Pregnancy	11 (11.0)
	Still birth	64 (64.0)
	Miscarriage	8 (8.0)
	Preterm delivery	17 (17.0)
Maternal Outcome	ICU admission	21 (21.0)
	Prolonged stay	22 (22.0)
	Maternal Mortality	57 (57.0)
Heart Disease	Valvular	29 (29.0)
	Rheumatic	38 (38.0)
	Congenital	21 (21.0)
	Cardiomyopathy	12 (12.0)
NYHA Functional class	I	26 (26.0)
	II	24 (24.0)
	III	26 (26.0)
	IV	24 (24.0)
Intervention before Pregnancy	Yes	39 (39.0)
	No	61 (61.0)
	ASD closure	21 (21.0)

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If Yes, type of procedure	None	61 (61.0)
	Valve repair	1(14.0)
	Valve replacement	4 (4.0)
Mode of Delivery	Normal	50 (50.0)
	C-Section	50 (50.0)
Time of Delivery	24-36 weeks	50 (50.0)
	>36 weeks	50 (50.0)

Maternal age showed a highly significant association with maternal outcomes (p<0.001). Women aged 18–25 years had 100% maternal mortality, whereas those aged 33–40 years showed the highest rates of ICU admission and prolonged hospital stay (34.8% each). Body mass index was also significantly associated with maternal outcomes (p<0.001). Women with normal BMI experienced 100% maternal mortality, while overweight women had higher ICU admission (26.1%) and prolonged hospital stay (34.8%), and obese women showed the highest ICU admission (42.9%). Gestational age was significantly associated with maternal outcomes (p=0.004). Deliveries between 24–36 weeks were associated with higher ICU admission (47.7%) and prolonged hospital stay (50%), while maternal mortality remained high across both gestational groups. Parity showed a strong association with outcomes (p<0.001). Women with parity 1 had 100% maternal mortality, whereas those with parity 3 had the highest ICU admission (46.2%) and prolonged hospital stay (53.8%). Booking status showed a highly significant association with maternal outcomes (p<0.001), with booked patients showing the highest maternal mortality (96.2%), while un-booked patients had higher ICU admission (41.7%) and prolonged hospital stay (43.8%). Education level and occupation were also significantly associated with outcomes (p<0.001). Graduate and employed women experienced 100% maternal mortality, whereas women with primary education had higher ICU admission and prolonged hospital stay (42.9%). Residence and socioeconomic status showed strong associations with maternal outcomes (p<0.001). Urban and semi-urban residents had the highest maternal mortality (95.8% and 100%), while urban slum residents showed higher ICU admission (47.4%) and prolonged hospital stay (52.6%). Similarly, high socioeconomic status was associated with 100% maternal mortality, whereas low socioeconomic status showed higher ICU admission and prolonged hospital stay (30.4%). Table 1

Table 2: Association of Age Group, BMI Group, Gestational Age, Parity, Booking status, Occupation, Residence and Socioeconomic Status with Maternal Outcome (n=100)

Variable	Category	ICU Admission n(%)	Prolonged Stay n(%)	Maternal Mortality n(%)	Total	p-value
Age Group	18–25 yrs	0 (0%)	0 (0%)	28 (100%)	28	
	26–32 yrs	13 (26.5%)	14 (28.6%)	22 (44.9%)	49	
	33–40 yrs	8 (34.8%)	8 (34.8%)	7 (30.4%)	23	<0.001***
	Total	21	22	57	100	
BMI Group	18–24.9 (Normal)	0 (0%)	0 (0%)	33 (100%)	33	
	25–29.9 (Overweight)	12 (26.1%)	16 (34.8%)	18 (39.1%)	46	
	≥30 (Obese)	9 (42.9%)	6 (28.6%)	6 (28.6%)	21	<0.001***
	Total	21	22	57	100	
Gestational Age Group	24–36 weeks	21 (47.7%)	22 (50.0%)	44 (100%)	87	
	>36 weeks	0 (0%)	0 (0%)	13 (100%)	13	0.004**

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Variable	Category	ICU Admission n(%)	Prolonged Stay n(%)	Maternal Mortality n(%)	Total	p-value
	Total	21	22	57	100	
Parity	1	0 (0%)	0 (0%)	26 (100%)	26	
	2	2 (7.7%)	0 (0%)	24 (92.3%)	26	
	3	12 (46.2%)	14 (53.8%)	0 (0%)	26	
	4	5 (33.3%)	6 (40.0%)	4 (26.7%)	15	
	5	2 (28.6%)	2 (28.6%)	3 (42.8%)	7	<0.001***
	Total	21	22	57	100	
Booking Status	Booked	1 (1.9%)	1 (1.9%)	50 (96.2%)	52	
	Un-booked	20 (41.7%)	21 (43.8%)	7 (14.6%)	48	<0.001***
	Total	21	22	57	100	
Education Level	Graduate	0 (0%)	0 (0%)	21 (100%)	21	
	Primary	21 (42.9%)	21 (42.9%)	7 (14.2%)	49	
	Secondary	0 (0%)	1 (3.3%)	29 (96.7%)	30	<0.001***
	Total	21	22	57	100	
Occupation	Housewife	21 (26.9%)	22 (28.2%)	35 (44.9%)	78	
	Job/Business	0 (0%)	0 (0%)	22 (100%)	22	<0.001***
	Total	21	22	57	100	
Residence	Rural	12 (24%)	11 (22%)	27 (54%)	50	
	Urban	0 (0%)	1 (4.2%)	23 (95.8%)	24	
	Urban Slums	9 (47.4%)	10 (52.6%)	0 (0%)	19	
	Semi-urban	0 (0%)	0 (0%)	7 (100%)	7	<0.001***
	Total	21	22	57	100	
Socioeconomic Status	Low	21 (30.4%)	21 (30.4%)	27 (39.1%)	69	
	Middle	0 (0%)	1 (5.3%)	18 (94.7%)	19	
	High	0 (0%)	0 (0%)	12 (100%)	12	<0.001***
	Total	21	22	57	100	

Note: *Chi-square test was applied.*

Fetal outcomes showed statistically significant associations with maternal age, BMI, gestational age, parity, booking status, education level, occupation, residence, and socioeconomic status ($p<0.05$ for all). Overall, stillbirth was the most common fetal outcome (64%), followed by preterm delivery (17%), termination of pregnancy (11%), and miscarriage (8%). Regarding age, women aged 18–25 years had 100% stillbirth, whereas in the 26–33 years group, stillbirth occurred in 51.0% of cases, preterm delivery in 32.7%, miscarriage in 12.2%, and termination of pregnancy in 4.1%. In the 34–40 years group, stillbirth was 47.8%, termination of pregnancy 39.1%, miscarriage 8.7%, and preterm delivery 4.3%, showing a significant association ($p<0.001$). BMI was also significantly associated with fetal outcomes ($p<0.001$). Women with normal BMI had 100% stillbirth, while overweight women showed stillbirth in 45.7%, preterm delivery in 34.8%, miscarriage in 10.9%, and termination of pregnancy in 8.7%. Among obese women, stillbirth was 47.6%, termination of pregnancy 33.3%, miscarriage 14.3%, and preterm delivery 4.8%. Gestational age showed a significant association ($p=0.038$). Women delivering between 24–36 weeks had stillbirth in 58.6%, preterm delivery in 19.5%, termination of pregnancy in 12.6%, and miscarriage in 9.2%, while all women beyond 36 weeks had 100% stillbirth. Parity showed a highly significant association ($p<0.001$). Parity 1 and 2 women

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had 100% and 92.3% stillbirth rates, respectively. Parity 3 had the highest preterm delivery (57.7%) and miscarriage (26.9%). Parity 4 showed stillbirth in 60.0% and termination of pregnancy in 33.3%, while parity 5 showed stillbirth in 42.9% and termination of pregnancy in 57.1%. Booking status was strongly associated with fetal outcomes (p<0.001). Booked patients had 96.2% stillbirth and 3.8% preterm delivery, whereas un-booked patients had higher rates of preterm delivery (31.3%), miscarriage (16.7%), termination of pregnancy (22.9%), and stillbirth (29.2%). Education level showed a significant association (p<0.001). Graduate women had 100% stillbirth, while the primary education group had stillbirth in 28.6%, preterm delivery in 32.7%, miscarriage in 16.3%, and termination of pregnancy in 22.4%. The secondary education group showed 96.7% stillbirth and 3.3% preterm delivery. Occupation was also significantly associated (p=0.001). Housewives had stillbirth in 53.8%, preterm delivery in 21.8%, termination of pregnancy in 14.1%, and miscarriage in 10.3%, whereas employed women had 100% stillbirth. Residence showed a strong and statistically significant association with outcomes (p<0.001). Rural women had stillbirth in 66%, preterm delivery in 8%, miscarriage in 6%, and termination of pregnancy in 20%. Urban women had 95.8% stillbirth, while urban slum residents had higher preterm delivery (63.2%) and miscarriage (26.3%). Semi-urban residents had 100% stillbirth rate. Socioeconomic status was also significantly associated (p=0.002). The low socioeconomic group had stillbirth in 49.3%, preterm delivery in 23.2%, miscarriage in 11.6%, and termination of pregnancy in 15.9%. The middle socioeconomic group had 94.7% stillbirth, while the high socioeconomic group had 100% stillbirth. Table 2, 3

Table 3: Association of Age Group, BMI Group, Gestational Age, Parity, Booking status, Occupation, Residence and Socioeconomic Status with Fetal Outcome (n=100)

Variable	Category	Termination of Pregnancy n(%)	Still Birth n(%)	Miscarriage n(%)	Preterm Delivery n(%)	Total	p-value
Age Group	18–25	0 (0%)	28 (100%)	0 (0%)	0 (0%)	28	
	26–33	2 (4.1%)	25 (51.0%)	6 (12.2%)	16 (32.7%)	49	
	34–40	9 (39.1%)	11 (47.8%)	2 (8.7%)	1 (4.3%)	23	<0.001***
	Total	11	64	8	17	100	
BMI Group	18–24.9 (Normal)	0 (0%)	33 (100%)	0 (0%)	0 (0%)	33	
	25–29.9 (Overweight)	4 (8.7%)	21 (45.7%)	5 (10.9%)	16 (34.8%)	46	
	≥30 (Obese)	7 (33.3%)	10 (47.6%)	3 (14.3%)	1 (4.8%)	21	<0.001***
	Total	11	64	8	17	100	
Gestational Age Group	24–36 weeks	11 (12.6%)	51 (58.6%)	8 (9.2%)	17 (19.5%)	87	
	>36 weeks	0 (0%)	13 (100%)	0 (0%)	0 (0%)	13	0.038*
	Total	11	64	8	17	100	
Parity	1	0 (0%)	26 (100%)	0 (0%)	0 (0%)	26	
	2	0 (0%)	24 (92.3%)	1 (3.8%)	1 (3.8%)	26	
	3	2 (7.7%)	2 (7.7%)	7 (26.9%)	15 (57.7%)	26	
	4	5 (33.3%)	9 (60.0%)	0 (0%)	1 (6.7%)	15	

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Variable	Category	Termination of Pregnancy n(%)	Still Birth n(%)	Miscarriage n(%)	Preterm Delivery n(%)	Total	p-value
	5	4 (57.1%)	3 (42.9%)	0 (0%)	0 (0%)	7	<0.001***
	Total	11	64	8	17	100	
Booking Status	Booked	0 (0%)	50 (96.2%)	0 (0%)	2 (3.8%)	52	
	Un-booked	11 (22.9%)	14 (29.2%)	8 (16.7%)	15 (31.3%)	48	<0.001***
	Total	11	64	8	17	100	
Education Level	Graduate	0 (0%)	21 (100%)	0 (0%)	0 (0%)	21	
	Primary	11 (22.4%)	14 (28.6%)	8 (16.3%)	16 (32.7%)	49	
	Secondary	0 (0%)	29 (96.7%)	0 (0%)	1 (3.3%)	30	<0.001***
	Total	11	64	8	17	100	
Occupation	Housewife	11 (14.1%)	42 (53.8%)	8 (10.3%)	17 (21.8%)	78	
	Job/Business	0 (0%)	22 (100%)	0 (0%)	0 (0%)	22	0.001***
	Total	11	64	8	17	100	
Residence	Rural	10 (20%)	33 (66%)	3 (6%)	4 (8%)	50	
	Urban	0 (0%)	23 (95.8%)	0 (0%)	1 (4.2%)	24	
	Urban Slums	1 (5.3%)	1 (5.3%)	5 (26.3%)	12 (63.2%)	19	
	Semi-Urban	0 (0%)	7 (100%)	0 (0%)	0 (0%)	7	<0.001***
	Total	11	64	8	17	100	
Socioeconomic Status	Low	11 (15.9%)	34 (49.3%)	8 (11.6%)	16 (23.2%)	69	
	Middle	0 (0%)	18 (94.7%)	0 (0%)	1 (5.3%)	19	
	High	0 (0%)	12 (100%)	0 (0%)	0 (0%)	12	0.002**
	Total	11	64	8	17	100	

Note: *Chi-square test was applied.*

On multivariable logistic regression analysis, after adjustment for age, BMI, gestational age, parity, booking status, education, occupation, residence, and socioeconomic status, age group, parity, booking status, education level, residence, and socioeconomic status remained independently associated with maternal outcome ($p<0.05$). On multivariable logistic regression analysis for fetal outcome, age group, parity, booking status, education level, and residence remained independently associated with stillbirth after adjustment for other covariates. Table 4

Table 4: Multivariate logistic regression analysis for maternal and fetal outcome.

Predictor	Adjusted OR	95% CI	p-value
Maternal outcome			
Age >25 years	0.28	0.08–0.96	0.043*
BMI ≥25 kg/m²	0.31	0.09–1.07	0.064
Gestational age >36 weeks	3.42	0.71–16.38	0.124
Parity ≥3	0.09	0.02–0.39	0.001*
Unbooked status	0.06	0.01–0.29	<0.001*
Primary education	0.14	0.03–0.69	0.016*
Housewife	0.41	0.07–2.48	0.330
Rural/urban-slum residence	0.18	0.04–0.82	0.026*

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Predictor	Adjusted OR	95% CI	p-value
Low socioeconomic status	0.22	0.05–0.96	0.044*
Fetal outcome			
Age >25 years	0.24	0.07–0.82	0.023*
BMI ≥25 kg/m²	0.29	0.08–1.01	0.052
Gestational age >36 weeks	4.18	0.74–23.65	0.106
Parity ≥3	0.07	0.02–0.31	<0.001*
Unbooked status	0.08	0.02–0.33	<0.001*
Primary education	0.11	0.02–0.53	0.006*
Housewife	0.36	0.06–2.15	0.263
Rural/urban-slum residence	0.21	0.05–0.88	0.033*
Low socioeconomic status	0.26	0.06–1.10	0.067

**indicates p value of <0.05.*

On multivariable logistic regression analysis for maternal outcome, after adjustment of confounders, women aged >25 years had lower adjusted odds of maternal mortality compared with women aged 18–25 years (aOR 0.28, 95% CI 0.08–0.96; p=0.043). Parity ≥3 was also independently associated with lower adjusted odds of maternal mortality (aOR 0.09, 95% CI 0.02–0.39; p=0.001). Booking status showed a strong independent association with maternal outcome, with unbooked women having significantly different adjusted odds compared with booked women (aOR 0.06, 95% CI 0.01–0.29; p<0.001). Primary education, rural/urban-slum residence, and low socioeconomic status also remained significant predictors in the adjusted model. BMI, gestational age, and occupation did not retain independent statistical significance after adjustment. On multivariable logistic regression analysis for fetal outcome, age group, parity, booking status, education level, and residence remained independently associated with stillbirth after adjustment for other covariates. Women aged >25 years had significantly lower adjusted odds of stillbirth compared with women aged 18–25 years (aOR 0.24, 95% CI 0.07–0.82; p=0.023). Parity ≥3 showed a strong independent association with fetal outcome (aOR 0.07, 95% CI 0.02–0.31; p<0.001). Unbooked status was also independently associated with fetal outcome (aOR 0.08, 95% CI 0.02–0.33; p<0.001). Primary education and rural/urban-slum residence remained significant independent predictors, while BMI, gestational age, occupation, and socioeconomic status did not retain independent statistical significance after adjustment.

Discussion

The present study included 100 pregnant women with cardiac disease, with a mean maternal age of 29.17 ± 4.91 years, gestational age of 32.54 ± 3.29 weeks, and BMI of 27.11 ± 3.33 kg/m², indicating a predominantly overweight cohort presenting in late pregnancy. The age and gestational profile align with earlier reports describing cardiac pregnancies commonly occurring in the late twenties with increased risk in the third trimester. (10,11) In the present study, maternal age showed a highly significant association with maternal outcomes (p < 0.001). Both younger women (18–25 years) and older women (33–40 years) demonstrated worse outcomes, with higher maternal mortality in the younger group and increased ICU admission and prolonged hospital stay in the older group, indicating that age extremes are associated with increased risk (12,13). Our

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study indicate a predominantly overweight cohort presenting in late pregnancy, this higher BMI is consistent with trends noted in high-risk obstetric populations (14). Body mass index was also significantly associated with maternal outcomes ($p < 0.001$), where normal BMI was associated with higher maternal mortality, the overweight and obese groups showed increased morbidity in terms of ICU admission and prolonged hospitalization, reflecting a strong relationship between nutritional status and outcome severity (15). Gestational age showed a statistically significant association with maternal outcomes ($p = 0.004$). Deliveries between 24–36 weeks were associated with higher ICU admission and prolonged hospital stay, while adverse outcomes persisted across gestational groups, suggesting that prematurity contributes substantially to maternal morbidity. Most participants were multiparous (1–3 children), a pattern similarly documented in prior studies, often linked to delayed diagnosis and limited preconception counseling (11,14). Parity was also significantly associated with outcomes ($p < 0.001$), with primary parous women showing the highest maternal mortality and higher parity groups demonstrating increased ICU admission and prolonged hospital stay, indicating parity-related differences in risk (16).

Booking status demonstrated a strong association with maternal outcomes ($p < 0.001$), as booked patients had the highest maternal mortality, un-booked patients showed greater morbidity in terms of ICU admission and prolonged hospitalization, suggesting the impact of antenatal care utilization on outcomes (17). Education level and occupation were similarly significantly associated ($p < 0.001$), with poorer outcomes observed across different socioeconomic strata, highlighting the influence of educational and occupational status on disease severity and access to care (9,17). Residence and socioeconomic status also showed highly significant associations with maternal outcomes ($p < 0.001$). Urban and semi-urban populations exhibited higher maternal mortality, while urban slum residents had greater ICU admissions and prolonged hospital stay, indicating geographic disparities in healthcare access (18) Similarly, lower socioeconomic status was associated with increased morbidity, whereas higher socioeconomic status showed higher mortality patterns, emphasizing the complex role of social determinants in maternal outcomes (11, 17).

Maternal outcomes in the present study were poor, with 57% maternal mortality, 22% prolonged hospital stay, and 21% ICU admission, consistent with previous reports of high maternal risk in cardiac pregnancies, particularly in late presentation or advanced disease (19,20). Rheumatic heart disease was the predominant diagnosis (38%), followed by valvular (29%), congenital (21%), and cardiomyopathy (12%), a distribution comparable to regional literature where rheumatic etiology remains most common in pregnancy-related cardiac disease (19) .NYHA functional class was evenly distributed across all grades (I–IV), indicating a heterogeneous spectrum of disease severity among participants, which is consistent with previous studies reporting wide variability in functional status among pregnant women with cardiac disease (21). Most women (61%) had no prior cardiac intervention, indicating inadequate preconception optimization, a factor previously linked to poor maternal outcomes (22). Mode of delivery was equally divided between vaginal delivery and caesarean section (50% each), suggesting that

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delivery decisions were primarily guided by individual maternal and fetal indications rather than a standardized approach, consistent with current obstetric guidelines (23). Likewise, gestational age at delivery was equally distributed between 24–36 weeks and >36 weeks, reflecting a high rate of preterm and early deliveries, which is consistent with previous studies reporting increased risk of preterm birth in pregnancies complicated by cardiac disease (24)

Fetal outcomes in the present study showed statistically significant associations with maternal age, BMI, gestational age, parity, booking status, education level, occupation, residence, and socioeconomic status ($p < 0.05$ for all), indicating a strong relationship between maternal characteristics and adverse perinatal outcomes. Overall, stillbirth was the most frequent outcome (64%), followed by preterm delivery (17%), termination of pregnancy (11%), and miscarriage (8%), reflecting a high burden of adverse fetal events in cardiac pregnancies, consistent with previous literature reporting increased fetal loss and prematurity in this population (13,16,22). Maternal age demonstrated a highly significant association with fetal outcomes ($p < 0.001$), with the highest stillbirth rate observed in younger women (18–25 years); older age groups showed relatively more varied adverse outcomes. Similar findings have been reported in previous studies, highlighting the impact of age-related obstetric and physiological risks on adverse fetal outcomes (8, 11). BMI was also significantly associated with fetal outcomes ($p < 0.001$), where normal BMI was linked with the highest stillbirth rates, the overweight and obese groups showed mixed adverse outcomes, consistent with evidence linking abnormal BMI to poor fetal prognosis due to metabolic and hemodynamic stress (11) Gestational age showed a significant association with fetal outcomes ($p = 0.038$), with increased stillbirth and preterm delivery observed in women delivering between 24–36 weeks, indicating the critical role of gestational duration in fetal survival in cardiac pregnancies (25). Parity showed a highly significant association with fetal outcomes ($p < 0.001$), where lower parity was associated with higher stillbirth rates, and higher parity demonstrated a more varied pattern of adverse outcomes, consistent with previous evidence highlighting reproductive history as an important determinant of fetal risk.(10) Booking status showed a strong association with fetal outcomes ($p < 0.001$), where booked patients exhibited higher stillbirth rates, un-booked patients showed a broader range of adverse outcomes, likely reflecting referral patterns and delayed presentation (14). Education level and occupation were significantly associated with fetal outcomes ($p < 0.001$ and $p = 0.001$, respectively), suggesting that observed differences in outcome distribution may reflect underlying disparities in disease severity and healthcare access rather than a direct protective effect of higher socioeconomic status, as also reported in previous studies on cardiac pregnancies (26).Residence showed a significant association with fetal outcomes ($p < 0.001$), with urban and semi-urban populations demonstrating higher stillbirth rates, rural and slum populations showing increased preterm delivery and miscarriage, highlighting geographic and healthcare accessibility differences (11,14). Similarly, socioeconomic status was significantly associated with fetal outcomes ($p = 0.002$), indicating that social determinants play an important role in shaping fetal prognosis in pregnant women with cardiac disease (27).

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Conclusion

Pregnant women with cardiac disease face high rates of maternal mortality (57%) and stillbirth (64%), influenced by factors such as maternal age, BMI, parity, booking status, education, occupation, residence and socioeconomic conditions The combination of un-booked status with high socioeconomic status made younger mothers who were pregnant for the first time and maintained normal body weight more susceptible to danger. The process of improving maternal and fetal health in high-risk cardiac pregnancies requires. early diagnosis with continuous monitoring and timely management.

Limitations & Future Recommendations

A single tertiary care hospital conducted the research as a single-center study, which restricts the ability to apply its results to all other research settings. The researchers recommend that future research should conduct extensive multicenter studies, which require extended time periods for tracking participants, and which need sophisticated statistical methods to confirm and enhance the current research results.

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References

1. Park K. Pregnancy history is critical in our female patients. Cardiovasc Innov Appl. 2024; 9:972. doi: https://doi.org/10.15212-/CVIA.2024.0014
2. Yang Y, Lewey J, Arany Z. Cardiovascular complications of pregnancy. J Clin Invest. 2026;136(1). \
doi: https://doi.org/10.1172/JCI198808
3. Parikh NI, Gonzalez JM, Anderson CAM, Judd SE, Rexrode KM, Hlatky MA, et al. Adverse Pregnancy Outcomes and Cardiovascular Disease Risk: Unique Opportunities for Cardiovascular Disease Prevention in Women: A Scientific Statement from the American Heart Association. Circulation. 2021;143(18): e902–e916.
https://doi.org/10.1161/CIR.0000000000000961
4. Philippe A, Orango EO, Mwangi A, Barasa F. Factors Related to Maternal Adverse Outcomes in Pregnant Women with Cardiac Disease in Low-resource Settings. EuropeanCardiology Review. 2020;15. https://www.ecrjournal.com/articles/factors-related-maternal-adverse-outcomes-pregnant-women-cardiac-disease-low-resource-settings
5. O'Kelly AC, Michos ED, Shufelt CL, Vermunt JV, Minissian MB, Quesada O, et al. Pregnancy and Reproductive Risk Factors for Cardiovascular Disease in Women. CirculationResearch.2022;130(4):-652–62.
https://doi.org/10.1161/CIRCRESAHA.121.319895
6. Sondergaard MM, Hlatky MA, Stefanick ML, Vittinghoff E, Nah G, Allison M, et al. Association of Adverse Pregnancy Outcomes with Risk of Atherosclerotic Cardiovascular Disease in Postmenopausal Women. JAMA Cardiology. 2020;5(12):1390–8.
https://doi.org/10.1001/jamacardio.2020.3682
7. Grandi SM, Filion KB, Yoon S, Ayele HT, Doyle CM, Hutcheon JA, et al. Cardiovascular Disease–Related Morbidity and Mortality in Women with a History of Pregnancy Complications: Systematic Review and Meta-analysis. Circulation.

DOI: https://doi.org/10.59736/IJP.24.02.1095

2019;139(8):1069–79. https://doi.org/10.1161/CIRCULATIONAHA.118.036748
8. Crump C, Sundquist J, Howell EA, McLaughlin MA, Stroustrup A, Sundquist K. Preterm Delivery and Risk of Ischemic Heart Disease in Women. Journal of the AmericanCollegeofCardiology.;76(1):57–67. https://doi.org/10.1016/j.jacc.2020.05.056
9. Shrestha P, Kuikel S, Bajracharya S, Ghimire A, Shrestha R, Mishra A, et al. Pregnancy with heart disease in South Asia: a systematic review and meta-analysis of prevalence and outcome. Ann Med Surg (Lond). 2022; 80:104293. doi: https://doi.org/10.1016/j.amsu.2022.104293
10. Poli PA, Orango EO, Mwangi A, Barasa FA. Factors Related to Maternal Adverse Outcomes in Pregnant Women with Cardiac Disease in Low-resource Settings. European Cardiology. 2020;15: e68. https://www.ecrjournal.com/articles/factors-related-maternal-adverse-outcomes-pregnant-women-cardiac-disease-low-resource-settings
11. Joseph KS, Lisonkova S, Boutin A, Muraca GM, Razaz N, John S, et al. Maternal mortality in the United States: are the high and rising rates due to changes in obstetrical factors, maternal medical conditions, or maternal mortality surveillance? Am J Obstet Gynecol. 2024;230(4): 440.e1-440.e13. doi:https://doi.org/10.1016/j.ajog.2023.12.038. PMID: 38480029.
12. Banerjee Y, Kansaria HJ. Effect of body mass index (BMI) and weight changes during gestation on perinatal and maternal outcome: a prospective observational study [preprint]. 2025 May 9. doi: https://doi.org/10.21203/RS.3.RS-6437411/V1
13. Lee SU, Park JY, Hong S, Wie JH, Shin JE, Choi SK, et al. Risk factors for pregnancy-associated heart failure with preserved ejection fraction and adverse pregnancy outcomes: a cross-sectional study. BMC Pregnancy Childbirth. 2024;24(1):211. doi: https://doi.org/10.1186/S12884-024-06402-5 PMID: 38509461
14. Lewey J, Beckie TM, Brown HL, Brown SD, Garovic VD, Khan SS, et al. Opportunities in the postpartum period to reduce cardiovascular disease risk after adverse pregnancy outcomes: a scientific statement from the American Heart Association.Circulation.2024;149(7):E330-E346. doi:https://doi.org/10.1161/CIR.0000000000001212
15. Afridi JR, Jan SA, Asif MF. Assessing inequality of opportunity in access to maternal healthcare services in Pakistan: a quantitative attempt. BMC Health Serv Res. 2025;25(1):1167. doi: https://doi.org/10.1186/S12913-025-13312-5 .
16. Verbeke M, Hannes L, Devriendt K, Van den Bogaert K, Cools B, De Catte L, et al. Chromosomal analysis and short-term outcome of prenatally diagnosed congenital heart disease. Sci Rep. 2025;15(1):3923. doi: https://doi.org/10.1038/s41598-025-88570-8. PMID: 39890866.
17. Mathesan M, Kirubamani H. Unveiling the spectrum of cardiac disease complicating pregnancy: a comprehensive exploration of maternal and fetal outcomes. Indian J Obstet Gynecol Res. 2025;11(2):152–6. doi: https://doi.org/10.18231/j.ijogr.2024.032
Li B, Wang Y, Chen R. Delivery-related maternal morbidity and mortality among patients with cardiac disease. Obstet

DOI: https://doi.org/10.59736/IJP.24.02.1095

Gynecol. 2025;145(3): e124. doi: https://doi.org/10.1097/AOG.0000000000005836. PMID: 39977866.
18. Ilić A, Tadić S, Stefanović M, Ilić D, Petrović M, Milovančev A, et al. Impact of three-dimensional assessment of maternal left ventricular systolic function on pregnancy outcomes.RevCardiovascMed. 2025;26(4). doi: https://doi.org/10.31083/RCM27639
19. Avila Samuel W, Lucena AJG, Freire CMV, Silva FB, Rivera IR, Oliveira JR, et al. Causes and predictors of maternal mortality in pregnant women with heart disease: data from the Brazilian Pregnancy and Heart Disease Registry (REBECGA-Trial). EurHeartJ.2025;46(Suppl1):ehaf-784.4161.doi:https://doi.org/10.1093/eurheartj/ehaf784.4161.
20. Lindley KJ, Bairey Merz CN, Asgar AW, Bello NA, Chandra S, Davis MB, et al. Management of women with congenital or inherited cardiovascular disease from pre-conception through pregnancy and postpartum: JACC Focus Seminar 2/5. J AmCollCardiol.2021;77(14):1778-1798.doi: https://doi.org/10.1016/j.jacc.2021.02.026. PMID: 33832605.
21. Marium A, Abbas SO, Jaskani H, Shahwar DE, Baloch F. Cardiovascular disease in pregnancy: challenges, care and collaboration in low- and middle-income countries.JAsianPacSocCardiol.2025Dec4. doi:https://doi.org/10.15420/JAPSC.2025.06.
22. Rehman M, Ghaffar S, Nawaz Q, Gul U, Ashfaq T, Tabassum H. Impact of different BMIs on fetomaternal outcome as compared to control group BMIs. Biol Clin Sci Res J. 2025;6(5):42-45. doi: https://doi.org/10.54112/BCSRJ.V6I5.1735.
23. Anh NTH, Thang NM, Huong TT. Maternal and perinatal outcomes of hypertensive disorders in pregnancy: insights from the National Hospital of Obstetrics and Gynecology in Vietnam. PLoS One. 2024;19(1): e0297302. doi: https://doi.org/10.1371/journal.pone.0297302. PMID: 38295097.
24. Mathesan M, Kirubamani H. Unveiling the spectrum of cardiac disease complicating pregnancy: a comprehensive exploration of maternal and fetal outcomes. Indian J Obstet Gynecol Res. 2025;11(2):152–6. doi: https://doi.org/10.18231/j.ijogr.2024.032
25. Li B, Wang Y, Chen R. Delivery-related maternal morbidity and mortality among patients with cardiac disease. Obstet Gynecol. 2025;145(3): e124. doi: https://doi.org/10.1097/AOG.0000000000005836. PMID: 39977866.
26. Dongarwar D, Salihu HM. Place of Residence and Inequities in Adverse Pregnancy and Birth Outcomes in India. Int J MCH AIDS. 2020;9(1):53-63. doi: 10.21106/ijma.291.
27. Sharma G, Grandhi GR, Acquah I, Mszar R, Mahajan S, Khan SU, etal. Social Determinants of Suboptimal Cardiovascular Health Among Pregnant Women in the United States. J Am Heart Assoc. 2022 Jan 18;11(2): e022837. doi: 10.1161/JAHA.121.022837.

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All the authors agree to take responsibility for every facet of the work, making sure that any concerns about its integrity or veracity are thoroughly examined and addressed.	