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Pattern of heart disease in children attending Dessie referral hospital, Ethiopia, a facility cross-sectional study.

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Abstract

Background
Congenital heart disease (CHD) and rheumatic heart disease (RHD) represent a significant health burden in developing countries, contributing substantially to childhood morbidity and mortality. Both conditions are closely linked to socio-economic factors and are largely preventable.
Objectives: This study aimed to assess the magnitude and pattern of heart disease among children at Dessie Referral Hospital, Ethiopia, from October 2022 to March 2023.

Methods
A retrospective, institution-based cross-sectional study was conducted at Dessie Referral Hospital. Data were collected from patient charts using a simple random sampling method. The data were entered, cleaned, and analyzed using SPSS version 25, with descriptive statistics applied for analysis.

Results
Over the six-month study period, 275 cases of cardiac disease were identified out of 6,018 total cases, yielding an incidence rate of 4.5%. Rheumatic heart disease accounted for 153 cases (55.6%), with the most common presentations being mitral valve regurgitation (57.2%, n=95), tricuspid regurgitation (49.4%), mitral stenosis (32.5%), and aortic regurgitation (AR). Congenital heart disease was diagnosed in 112 cases (40.7%), with ventricular septal defect (47.5%) being the most frequent, followed by atrial septal defect (15.1%), atrioventricular septal defect (11.5%), and Tetralogy of Fallot (TOF) (8%).

Conclusion
Cardiac diseases remain a significant health concern, with an incidence rate of 4.5% over six months. Rheumatic heart disease accounted for the majority (55.6%) of cases, while congenital heart disease comprised 40.7%, with ventricular septal defect being the most common presentation.

Recommendation
These findings highlight the urgent need for improved prevention, early detection, and management strategies, particularly for RHD and CHD, to reduce their burden and associated complications.

Keywords: *Cardiac diseases, Rheumatic heart disease, Congenital heart disease, Disease pattern, Dessie, South Wollo, Dessie Referral Hospital, Ethiopia*
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Introduction

Heart disease is a significant non-communicable condition affecting pediatric populations, with varying patterns observed across different countries. While the prevalence of malnutrition and infectious diseases is declining in developing countries, the burden of heart disease is rising alarmingly (1).
In low-income countries, where access to medical care is limited, the pattern of heart disease in children differs significantly from that in developed countries. In developed nations, the incidence of rheumatic heart disease (RHD) has declined, while congenital heart disease (CHD) has become more prevalent due to improved diagnostic capabilities and healthcare systems (2). Conversely, studies from developing countries such as Pakistan, Malaysia, Afghanistan, and Sudan indicate an increasing incidence of CHD, attributed to improvements in healthcare delivery and socioeconomic conditions (2, 5, 6).
In Ethiopia, limited studies have been conducted on pediatric heart disease. Available evidence suggests that

RHD remains the dominant cardiac problem among children. For instance, a study by Abegaze in 1988 reported that 63.1% of pediatric cardiac cases were due to RHD, while 29.0% were attributed to CHD (6). Similarly, a study from Jimma University by Tewodros et al. found a high prevalence of acquired heart disease (70%), with RHD accounting for 74.5% of these cases (7). Another report from a teaching hospital in Addis Ababa revealed that RHD comprised 50% of cardiac admissions (8).

Despite efforts to promote health and prevent disease, heart diseases continue to pose serious health challenges in many developing countries. In nations with weak economies and low living standards, where over 30% of the population lives below the poverty line, the risk of communicable and non-communicable diseases remains high (9). Ethiopia, with a young population-over 70% under the age of 30 and 45% under 15-faces a particularly high risk of RHD and other cardiovascular diseases (10).

Although various factors contribute to the development of cardiovascular diseases, research on CHD and RHD in Ethiopia remains scarce. This study aims to address this gap by assessing the prevalence and pattern of heart diseases among children at Dessie Referral Hospital, Ethiopia. The findings will aid in the early identification of congenital heart diseases before complications arise, improve the prevention of acquired heart diseases, and inform regional, zonal, and local health officials in their decision-making processes regarding child health.

Methods

Study setting

The study was conducted at Dessie Referral Hospital, located 401 km northwest of Addis Ababa. As the only referral hospital in the South Wollo Zone, it serves the majority of the population in South Wollo and its surrounding areas. The hospital provides both inpatient and outpatient services, including specialty clinics for the follow-up of patients with chronic diseases.

Study design

This study employed an institution-based retrospective cross-sectional design. It was conducted at Dessie Referral Hospital in the South Wollo Zone, Amhara Region, Ethiopia, over six months from October 2022 to March 2023.

Source population

The source population included all children visiting the pediatric outpatient department (OPD) at Dessie Referral Hospital during the study period.

Study population

The study population comprised all children diagnosed with heart disease who visited the pediatric unit at Dessie Referral Hospital during the study period.

Inclusion criteria

All children visiting the pediatric OPD and diagnosed with any form of cardiac disease were included in the study.

Exclusion criteria

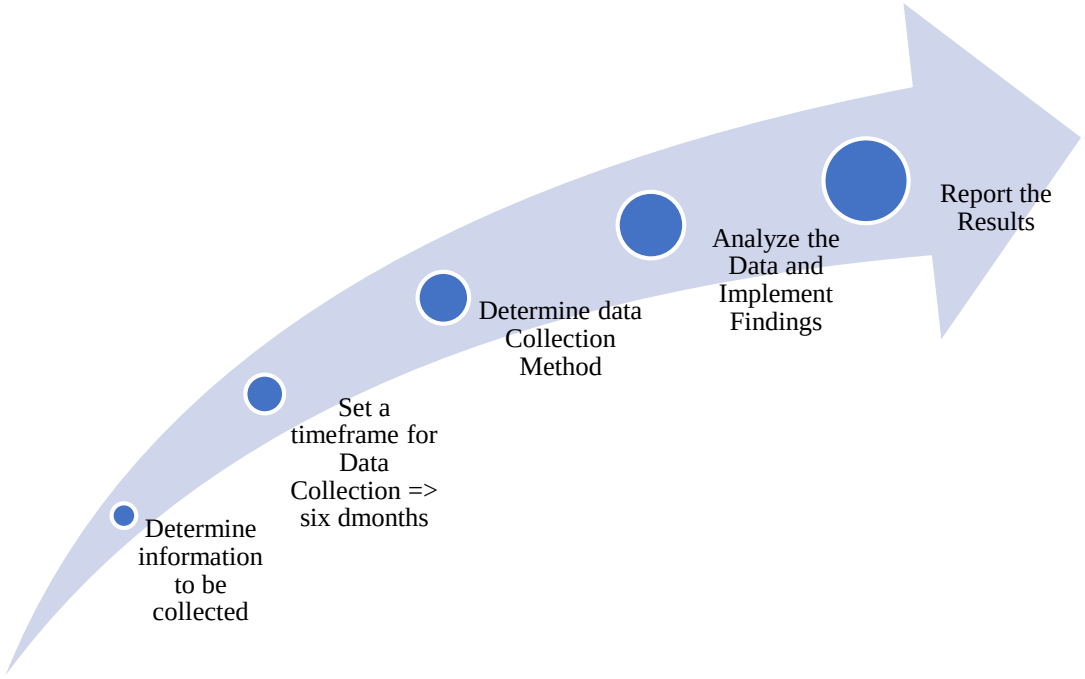
Children with incomplete or missing medical charts were excluded from the study.

Sample size and sampling technique

A simple random sampling method was employed. All cardiac patients who had follow-up visits during the study period were included in the sample.

Data collection procedure

Data were collected by trained data collectors using a structured checklist for chart reviews and registration logbooks. Two nurses were assigned to collect the data, and the principal investigator supervised the overall data collection process to ensure accuracy and completeness.



Variables

Dependent variable

- Heart disease pattern.

Independent variables

- Age.
- Gender

Data analysis

The collected data were entered, categorized, coded, summarized, and analyzed using SPSS version 25. Results were presented as frequencies and percentages. Data were collected using a structured, pretested format by well-trained nurses. Study participants were selected by name and card number from the outpatient clinic and emergency unit patient registration books. Individual patient charts were then traced and reviewed to complete the data collection forms.

To ensure data quality, the following measures were implemented:

Pretesting of data collection tools.

Training of data collectors and supervisors.

Regular checks for completeness and internal consistency of the data.

Data quality assurance

Pretesting: A pilot test of the structured questionnaire was conducted at Dessie Referral Hospital.

Supervision: The principal investigator provided supportive supervision to ensure adherence to the study protocol.

Daily Checks: Collected data were checked daily for accuracy and completeness.

Data Security: Data were stored in a secure location, with access restricted to the lead investigator.

Ethical clearance

Ethical approval for this study was obtained from the Research and Publication Committee of Wollo University College of Health Sciences prior to enrollment. A formal letter was submitted by the Department of Pediatrics to the relevant authorities, and permission was granted by the responsible bodies. Proper acknowledgment was given to all contributors, including authors, funding organizations, study participants, advisors, data collectors, supervisors, and individuals who provided suggestions and advice.

Results

Sociodemographic characteristics

During the six-month study period, a total of 6,018 pediatric patients were seen at Dessie Referral Hospital. Among these, 275 cases were diagnosed with cardiac disease, corresponding to a prevalence rate of 4.5%.

The majority of cardiac cases (32%) were in the age group of 5–10 years. Additionally, 56.7% of the participants were male.

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Table 1. The demographic characteristics of the study participants who had a cardiac disease at Dessie Referral Hospital

Variable	frequency	Percent
1-6month	19	6.9
7-12month	23	8.4
1-2 years	32	11.6
2-5years	37	13.5
5-10years	88	32.0
≥10years	76	27.6
Gender of the study participants		
Female	119	43.3
Male	156	56.7

Characteristics of cardiac disease

The study findings revealed that 59.3% of the patients were diagnosed with acquired heart disease (RHD), while 40.7% had congenital heart disease (CHD), as illustrated in Figure 1.

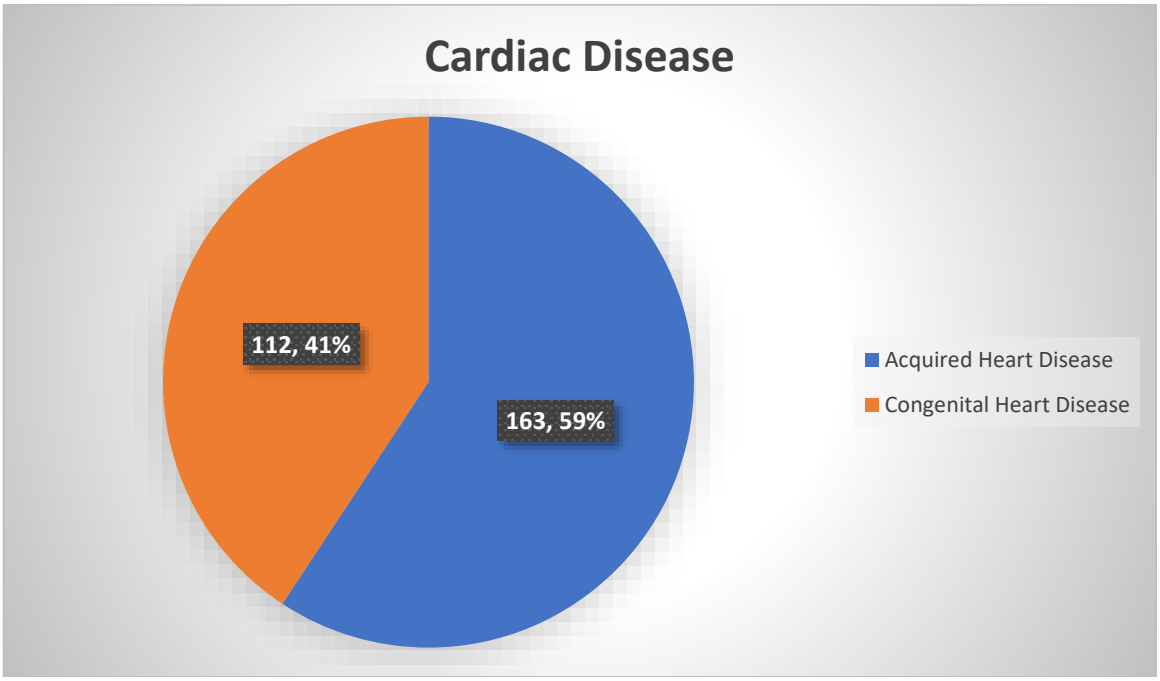

Figure 1. The types of cardiac disease by their occurrence

Congenital Heart Disease (CHD)

The study findings revealed that congenital heart disease (CHD) accounted for 40.7% (n=112) of all cardiac disease cases and 1.86% of all pediatric cases during the study period. From congenital heart disease The most common type of CHD was ventricular septal defect (VSD) (47.3%), followed by atrial septal defect (ASD) (15.1%), atrioventricular septal defect (AVSD) (11.6%), and patent ductus arteriosus (PDA) (8.0%), TETRALOGY OF FALLOT(TOF) (8.0%), as shown in Table 2.

Among the CHD patients, 16.9% had Down syndrome, and 79.4% had a nutritional disorder. Of those with nutritional disorders, 27.6% had severe acute malnutrition, 22.3% had moderate acute malnutrition, and 29.4% had stunting. Additionally, 16.4% of CHD patients had pulmonary hypertension, and 6.2% had Eisenmenger syndrome, Figure 2

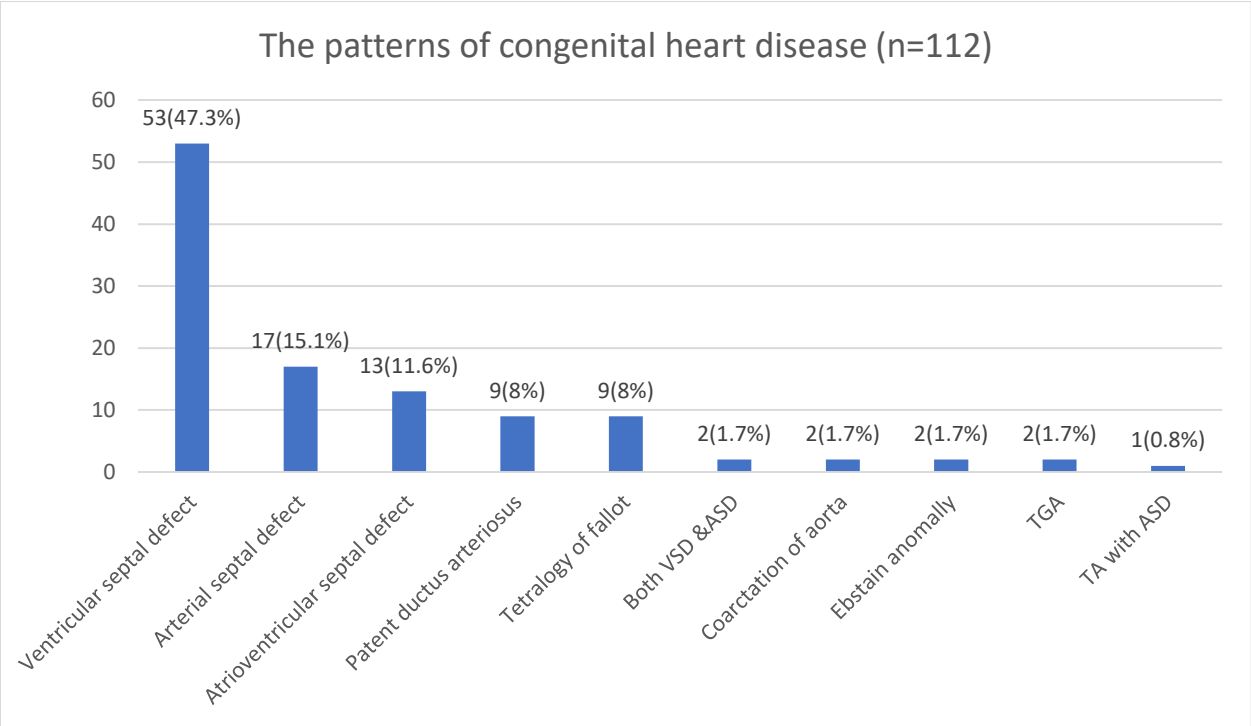

Figure 2. Congenital heart disease characteristics of the study participants

Table 2 Clinical profile of the congenital heart disease study participant

Associated syndrome (n=112)	Frequency	Percent
Down syndrome	19	16.96
No detected	93	83.03
Nutritional status (n=112)		
stunting	33	29.46
Severe acute malnutrition	31	27.67
Moderate acute malnutrition	25	22.32
normal	23	20.53
Cardiac complication		
Eisenmenger	7	6.2
pulmonary hypertension	19	16.9

Acquired heart disease pattern

In this study, acquired heart disease accounts for 59.2% (n 163) of total cardiac disease, of which rheumatic heart disease accounts for 93.8% (n = 153), 4.2% (n = 7) dilated cardiomyopathy, and 1.8% (n = 3) TB pericarditis, respectively.

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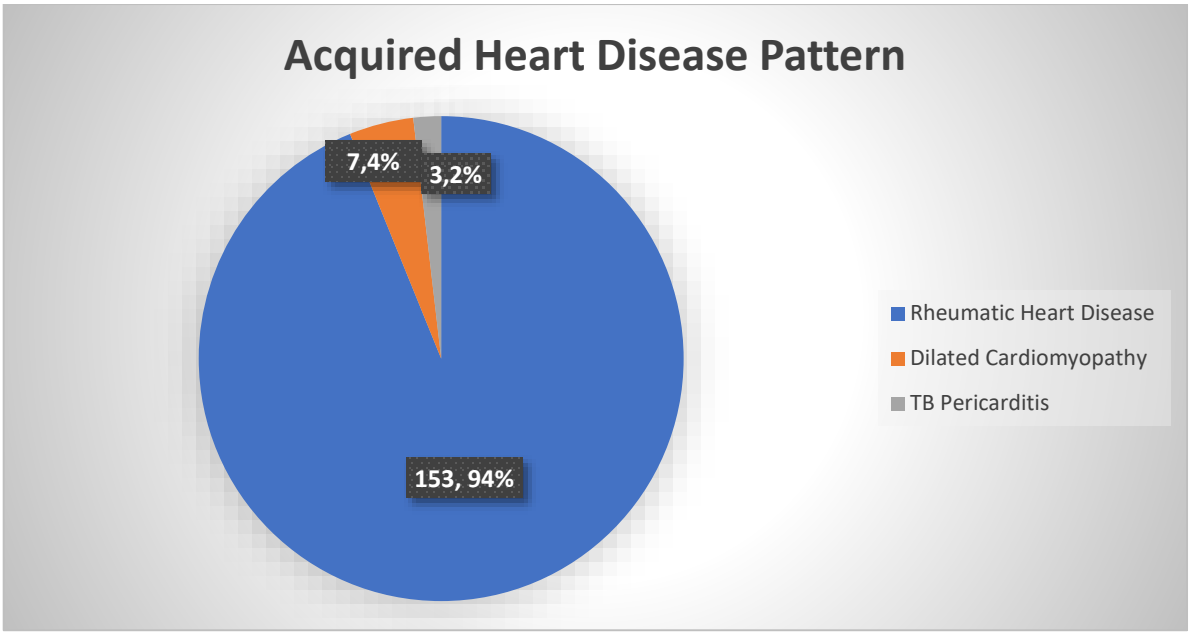

Figure 3: Acquired heart disease pattern

Rheumatic Heart Disease (RHD)

Rheumatic heart disease (RHD) accounted for 55.6% of all pediatric cardiac cases and 2.54% of all pediatric cases visiting Dessie Referral Hospital during the study period. Among the RHD cases, mitral valve regurgitation (MR) was the most common, accounting for 57.2% (n=95), followed by tricuspid regurgitation (TR) (49.4%), mitral stenosis (MS) (32.5%), and aortic regurgitation (AR) and chronic rheumatic valvular heart disease (CRVHD), as shown in Table 4.

Due to the lack of pediatric cardiologists in the area, only a small proportion of patients had their disease severity determined. The study findings revealed the following severity levels:

Mitral Regurgitation (MR): Out of 95 MR cases, severity was determined for 30 cases. Of these, 6 cases had mild MR, 14 had moderate MR, and 10 had severe MR.

Tricuspid Regurgitation (TR): Out of 82 TR cases, severity was determined for 8 cases. Of these, 6 had **mild TR**, and 1 had **severe TR**.

Aortic Regurgitation (AR): Out of 44 AR cases, severity was determined for 7 cases. Of these, 4 had **mild AR**, and 3 had **severe AR**.

Mitral Stenosis (MS): Out of 54 MS cases, severity was determined for 15 cases. Of these, 11 had **mild MS**, 3 had **moderate MS**, and 1 had **severe MS**.

These findings are summarized in Table 3.

Table 3. The types and level of rheumatic disease among pediatric patients in Dessie referral and teaching hospital

Pattern of rheumatic heart disease (n=153)	Frequency	Percent
Mitral regurgitation (MR)	95	62.0
Determined level of MR(n=30)		
Mild	*6*	*20*
Moderate	*14*	*46.7*
Severe	*10*	*33.3*
Tricuspid Regurgitation (TR)	82	49.4
Determined level of TR (n=8)		
Mild TR	*6*	*75*
Moderate TR	*1*	*12.5*
Severe TR	*1*	*12.5*
TRF	16	9.6
CRVHD	25	15.1
AR	44	26.5
Determined AR (n=7)		
Mild AR	*4*	*57.1*
Moderate AR	*3*	*42.9*
MS	*54*	*32.5*
Determined MS (n=15)		
Mild MS	*11*	*73.3*
Moderate MS	*3*	*20*
Severe MS	*1*	*6.7*
AS	4	2.4

Mean Age Distribution by Sex of Cardiac Patients on Follow-Up at Dessie Referral Hospital

The study revealed that 60% of mitral regurgitation (MR) cases occurred in male children, with a mean age of diagnosis at 114 months. The majority of the following conditions were also more prevalent in male children:

Tricuspid regurgitation (TR): 57.3%
Acute rheumatic fever (ARF): 68.8%
Chronic rheumatic valvular heart disease (CRVHD): 56%
Aortic regurgitation (AR): 68.2%

Table 4. Mean age distribution by sex of cardiac patients on follow-up at the cardiac clinic of Dessie referral hospitals

Selected cardiac disease	sex		Age at diagnosis in months	
	female	male	Mean	SD
MR	38(40%)	57(60%)	114	26.
TR	35(42.7%)	47(57.3%)	127.5	27.2
ARF	5(31.2%)	11(68.8%)	82.5	21.4
CRVHD	11(44%)	14(56%)	125.8	27.1
AR	14(31.8%)	30(68.2%)	129.8	29.4
MS	17(40.5%)	25(59.5%)	136.6	25.4
TB Pericarditis	1(33.3%)	2(66.7%)	68	13.8

Discussion

Cardiac disease represents a significant child health issue in the study area, with a prevalence rate of 4.5% at Dessie Referral Hospital over a six-month study period. This finding is higher than that reported in a study conducted in North Central Nigeria (0.45%) (29). The discrepancy may be attributed to differences in catchment population size, wealth index, health policies, and living standards between the two regions.

The majority of cardiac disease cases affected males, with a male-to-female ratio of 1.3:1. This finding aligns with a study conducted at Jimma University Specialized Hospital (30). The age of the patients ranged from 1 to 168 months, with a median age of 84 months. While the minimum and maximum ages were consistent with findings from a tertiary hospital in North Central Nigeria, the mean age differed (29).

Rheumatic Heart Disease (RHD)

Rheumatic heart disease (RHD) accounted for 55.6% (n=153) of all cardiac disease cases, consistent with findings from Jimma Referral and Teaching Hospital (30).

Among RHD cases, mitral valve regurgitation (MR) was the most common (57.2%, n=95), followed by tricuspid regurgitation (TR) (49.4%), mitral stenosis (MS) (32.5%), aortic regurgitation (AR) (26.3%), and chronic rheumatic valvular heart disease (CRVHD) (15.1%). These findings are consistent with studies conducted in Nigeria and Ethiopia (29, 30).

Severity levels were determined for a subset of cases due to the lack of pediatric cardiologists in the study setting:

MR: Of 95 cases, severity was determined for 30 cases—6 had mild MR, 14 had moderate MR, and 10 had severe MR.

TR: Of 82 cases, severity was determined for 8 cases—6 had mild TR, and 1 had severe TR.

AR: Of 44 cases, severity was determined for 7 cases—4 had mild AR, and 3 had severe AR.

MS: Of 54 cases, severity was determined for 15 cases—11 had mild MS, 3 had moderate MS, and 1 had severe MS.

Patients who received interventions for their cardiac disease severity likely benefited from a favorable family economic status and health-related awareness, enabling them to follow pediatrician recommendations and access echocardiography and pediatric cardiologists elsewhere.

Congenital Heart Disease (CHD)

Congenital heart disease (CHD) accounted for 40.7% (n=112) of pediatric cardiac cases. The most common CHD was ventricular septal defect (VSD) (47.5%), followed by atrial septal defect (ASD) (15.1%), atrioventricular septal defect (AVSD) (11.6%), and patent ductus arteriosus (PDA) (8%). These findings are supported by studies conducted in Malaysia and Ethiopia (21, 27, 30).

The majority of cases involving TR (57.3%), ARF (68.8%), CRVHD (56%), A R (68.2%), and AVSD (64.3%) occurred in male children, consistent with findings from Jimma University Teaching Hospital (30).

Conclusion

This study found that three-fifths of cardiac disease cases were due to rheumatic heart disease (RHD). A statistically significant difference in age at presentation was observed between RHD and congenital heart disease (CHD), with RHD occurring in older age groups. However, due to the limited availability of pediatric cardiologists, the severity of cardiac disease remained undetermined for the majority of patients.

Recommendations

These findings highlight the urgent need for improved prevention, early detection, and management strategies, particularly for RHD and CHD, to reduce their burden and associated complications.

Declaration

By signing below, I declare that this thesis is my original work. I have adhered to all ethical principles of scholarship in the preparation, data collection, data analysis, and completion of this paper.

Availability of data and materials

All data supporting the findings of this study are available from the corresponding author upon reasonable request.

Competing Interests

The authors declare that they have no competing interests.

Funding

This study was self-funded by the authors. The funding was limited and covered only a portion of the study activities.

Authors' contributions

Zehara Gashaw: Developed the proposal, conducted literature reviews, selected and trained data collectors, performed data analysis, and wrote the findings and discussion sections.

ACRONYMS

ARF	Acute rheumatic fever
CHD	Congenital heart disease
CI	Confidence Interval
CVD	Cardiovascular disease
EOPD	Emergency Outpatient Department
ETB	Ethiopian Birr
RF	Rheumatic fever
RHD	Rheumatic heart disease
HF	Heart Failure
PI	Principal Investigator
RHD	Rheumatic Heart Disease
SPSS	Statistical Package for Social Sciences
WHF	World Heart Federation
WHO	World Health Organization

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