The research proposal submitted to the Department of Pediatrics and Child Health, School of Medicine, College of Health Sciences, Addis Ababa University partially fulfills the requirements for a specialty certificate in Pediatrics and Child health.

Title: Assessment of Behavioral Abnormalities among children with congenital heart disease aged 4-14 years attending follow-up at Pediatric cardiac Clinic in Tikur Anbessa Specialized Hospital and cardiac center between October 2023-March 2024, Addis Ababa, Ethiopia

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Sincerely,

Contents

Acronyms

ADHD	Attention Deficit Hyperactivity Disorder
CHD	congenital heart disease
SDQ	Strengths and Difficulties Questionnaire
SPSS	Statistical Package for Social Sciences
TASH	Tikur Anbessa Specialized Hospital
WHO	World Health Organization

Abstract

Background:

Congenital heart disease (CHD)is a gross structural abnormality of the heart or intrathoracic great vessels that is actually or potentially of functional significance. Congenital heart disease is one of the most frequently diagnosed congenital disorders affecting approximately 0.8% of live births worldwide.(Liu et al., 2019)

Children with CHD are experiencing challenges throughout their development. They can be affected by several circumstances that may contribute to serious behavioral problems, which interfere with their normal development, socialization, or future life (Dahlawi et al., 2020).

Objectives:

The purpose of this study is to assess behavioral abnormalities among children with congenital heart disease aged 4-14 years on follow up at the Pediatric cardiac Clinic in Tikur Anbessa Specialized Hospital, Addis Ababa, from October 2023 to March 2024.

Methods:
A hospital based cross sectional study design was conducted among children with congenital heart disease aged 4-14 years attending cardiac clinic at TASH and their primary caretakers. A total of 231 selected patient were studied, pre- test questionnaire was used to assess socio-demographic characteristics, and Strengths and Difficulties Questionnaire (SDQ), was used to assess the behavioral problems, data were collected through ODK and analyzed using SPSS version 27 software package. Mean, median, mode and standard deviation were used to describe Continuous data; and frequency and percentage were used to describe categorical data. To identify factors associated with behavioral abnormalities Bivariable and Multivariable binary logistic regression analyses were done. Statistical significance was considered at level of significance of 5% (p-value 0.05). Adjusted odds ratio (AOR) with 95% confidence interval (CI) was used to present the estimates of the strength of the association.

Result: the over all prevalence of behavioral abnormalities was 61% with a 95% CL. The prevalence of emotional symptoms was 17.7%, conduct problems 9.5%, hyperactivity 2.6% and peer problems was 38.5%. first birth order (AOR = 1.4, 95% CL, (1.15,8.72) , family size (1-4) (AOR = 10.8 , 95% CL , (4.94 , 23.68) , cyanotic CHD (AOR = 1.8 , 95% CL , (1.37, 2.88), present of pulmonary hypertension (AOR = 1.5 , 95% CL, (1.17 , 2.81) and if the child has a history of hospitalization or history of heart failure(AOR = 8.4 ,95% CL , (3.82 , 18.74) were more likely to have any form of behavioral disorder than their counterparts.

Conclusion: the magnitude of behavioral abnormalities among children with congenital heart disease is significant. children with cyanotic CHD, present of pulmonary hypertension and previous history of hospitalization or history of heart failure are more likely to suffer from a behavioral and mental abnormality. we recommend children with congenital heart disease especially cyanotic CHD should be provided with better counseling services.

Key word: CHD, abnormal behavior, SDQ

1. Introduction

1.1 Background

Congenital heart disease (CHD)is a gross structural abnormality of the heart or intra-thoracic great vessels that is actually or potentially of functional significance.

It is detected either at the time of birth or later in life. There are several ways of classifying CHDs and one of which is into a category of cyanotic and a cyanotic heart defect.

Some CHD are fatal, and if not treated or diagnosed early, it will lead to death; globally, it is the most common heart disease in children and is one of the major causes of infant mortality.

The incidence of CHD globally is 8 per 1000 live birth [(1)(Liu et al., 2019)].

The prevalence of CHD in Africa is thought to be relatively similar to the world over with variations between regions and countries due to genetic, environmental and epigenetic differences(Zühlke et al., 2013) .

The etiology of CHD is unknown, and however, in most cases, it could be hereditary or secondary to intrauterine infections, radiation or exposure to toxic substances during pregnancy. In addition, children with CHD are at a higher risk of developing complications such as congestive heart failure, polycythemia, hyper cyanotic attacks, cerebrovascular accidents, malnutrition and repeated infections which further add to already high mortality rate.

Children with chronic physical illnesses are vulnerable for behavioral problems (LeBlanc et al., 2003). In the Ontario Child Health Study of 3294 children and adolescents between 4 and 16 years of age in the general community. They compared children having chronic medical illnesses with those children free of such problems. Results showed that children with chronic physical disorders had greater than threefold risk for psychological disorders and social adjustment problems. (Boyle, 1987)

1.2 Statement of the Problem

Children with CHD often face multiple medical interventions, hospitalizations, and ongoing medical care. These experiences, along with the potential physiological effects of CHD, can impact their development and behaviour. Understanding the prevalence and impact of behavioural problems in this population is crucial for providing appropriate support and interventions.
Behavioural problems can significantly impact the quality of life for children with CHD and their families. These problems may include emotional difficulties, attention and learning difficulties, social challenges, and impaired adaptive functioning. By studying these behavioural problems, researchers can identify specific areas of concern and develop interventions to improve the overall well-being and quality of life for affected children.

1.3 the rationale of the study

Available international literature show that behavioral problems are significantly high among children with CHD, local date to support or refute this is scarce.

Literature review

A study done in India about physical and psychological changes in children with CDH and they found that CHD have impact on various aspects of physical activity, psychological health in children. According to this study there is more impact seen on physical activity than physical health because the children with CHD have a tendency to get easily fatigue, decreased exercise tolerance thus leading to rapid breathing (tachypnea)(Dahlawi et al., 2020) .

In an article by McCusker elaborated that maternal mental health and other family-related factors excel the impact of medical risk factors on the behavioral outcome in children with CHD(McCusker et al., 2006).

A systematic review done by university children hospital Zurich Switzerland find that a significant proportion of survivors of open –heart surgery for CHD is at risk for psychological maladjustment and impaired health –related quality of life (Miatton et al., 2007).

A study was done in India about behavior problems in children with CHD found that scientific evidence shows that children with CHD have more behavioral problem than their healthy peers, these children are at risk of long-term motor and behavioral problem, preoperative and post-operative factors contribute to behavioral outcome (Finkel et al., 2023).

A prospective cohort study was done in Switzerland including 125 children about social and behavioral difficulties in 10 years old children with congenital heart disease prevalence and risk factor, general behavioral difficulties measured with SDQ revealed abnormal overall behavior in 22% abnormal internalizing problem in 23.6% and abnormal externalizing behavior 17.9% (Werninger et al., 2020).

A study was done in Netherlands about behavior and self-perception in children with a surgically corrected CHD and they found that parents of CHD children described their children as less competent in school , having worse school performances and having a greater need to repeat a school grade additionally , they saw social and attention problems as well as more aggressive behavior in their children .the children themselves did not rate their competence in school ,social acceptance , sportive skills, physical appearance ,behavior , or or global self-worth to be different to those of healthy peers. they were not more anxious than peers, but they did indicate more depressive symptom [(Miatton et al., 2007)].

A long case-cohort study done in Norway about emotional reactivity in infants with CHD showed elevated increased probability of emotional reactivity already at 6months of 6months of age in infants with moderate to severe CHD after controlling for a range

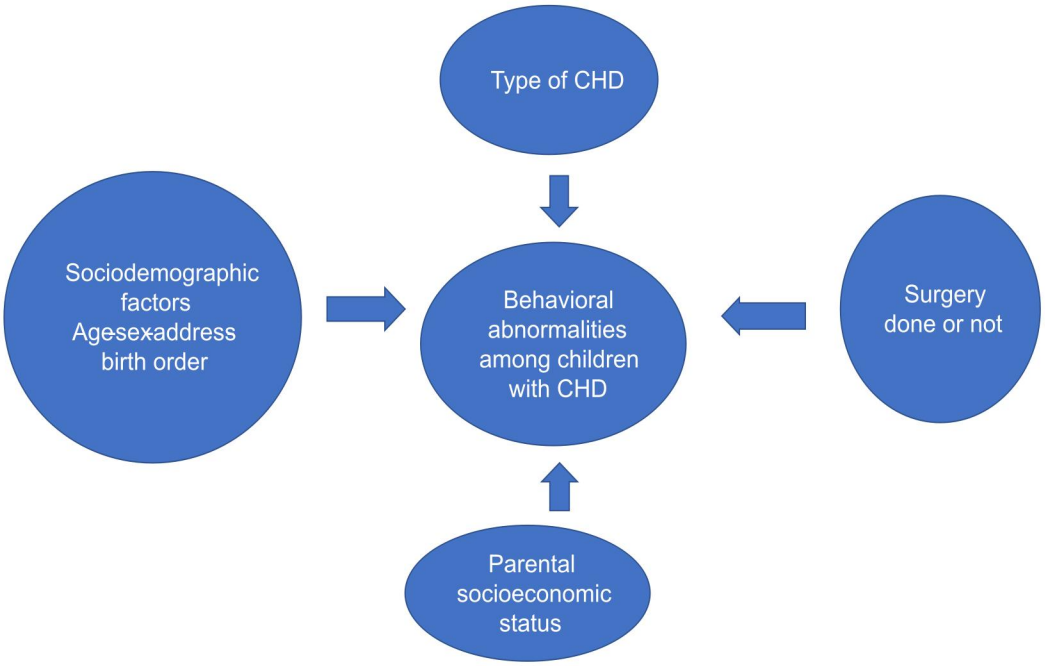
of potential confounders. infants with mild form of CHD showed no increased probability of emotional reactivity at 6 months of age [(Stene-Larsen et al., 2011)].

A study done in Norway by P.M Fredriksen he found that boys scored significantly higher than girls in total problem score and externalizing scores with more social problems, attention problems, delinquent behavior and aggressive behavior [(Fredriksen et al., 2009)].

In a systematic review on the psychological adjustment in children and adolescents following open heart surgery for CHD [(Latal et al., 2009)], concluded that a significant number of children who survived, have risk for psychological problems and impairment in the quality of life. Nonspecific effects of cardiac surgery with extracorporeal circulation can lead to cognitive impairment, especially, problems with attention [(Latal et al., 2009)].

A longitudinal study done in Norway about exploring causal pathways of child behavior and maternal mental health in families with a child with CHD found that the burden of CHD in child is shared between family members but is also specific to the individual. this study points to a need for both an individual and family –based approach to provide psychological support to children with CHD and their parents [(Landolt et al., 2014)].

3.Conceptual framework



4. Objectives

4.1. General Objective

To assess the magnitude of behavioral abnormalities among children with congenital heart disease aged 4- 14 years on follow-up at the cardiac clinic at TASH.

4.2. Specific Objectives

To determine the prevalence of behavioral abnormalities among children with congenital heart disease aged 4-14 years on follow up at TASH.
To identify factors associated with behavioral abnormalities among congenital heart disease patients.

5.Methodology

5.1. Study area and period

The study was conducted in Tikur Anbessa Specialized Hospital Department of

Pediatrics and Child Health, pediatric cardiac clinics and cardiac center from October ,2023, to March 2024. Tikur Anbessa specialized hospital is the largest referral hospital in the country, and it was established in 1964 and with over 800 beds at different units. It
offers diagnostic testing and treatment for approximately 370,000 to 400,000 patients
per year. The hospital has more than 23 departments. The Department of Pediatrics and Child Health is one of the departments in the institution, which has several inpatient and outpatient clinics with different subspecialty (namely neurology, cardiac, chest, hematology-oncology, infectious, pediatric ART, endocrine, high risk infant clinic, renal and gastrointestinal. From all these clinics there are about 3200 – 3400 patients who are seen on each month.

5.2. Study design

- ❖ Hospital based cross-sectional study was conducted between October 2023 – March 2024.

5.3. Population

5.3.1. Source population

❖Children with CHD aged (4-14) attending follow up a pediatric cardiac clinic and cardiac center.

children aged (4-14) who came to pediatric cardiac clinic and cardiac center for follow up.

5.3.2 Study Population

children aged (4-14) who are attending follow up at pediatric cardiac clinic and cardiac center during study period.

5.3.3 sampled population

selected children who attended cardiac clinic and cardiac center from October, 2023 to March 2024and who fulfilled the eligibility (Liu et al., 2019)criteria.

5.4 Eligibility

5.4.1. Inclusion criteria

Age between (4-14yrs)

Children with CHD

Children with attending parents/ guardian who consent.

5.4.2. Exclusion criteria

Acute illness at the time of the study requiring medical attention.

Coexisting other chronic illness

Syndromes involving CHD with other conditions.

Previously diagnosed psychiatric illness or developmental delays

Children with concomitant Rheumatic heart disease

No attending parent/guardian (who knows the child for the past 6 months) or a guardian who will not consent.

5.5. Sample size determination and sampling technique.

5.5.1. Sample size determination.

The total sample will be determined by using single population proportion formula by considering the following assumptions.
95% confidence level,
Margin of error = 5%,
Sample size was calculated using the following formula.

$$N = \frac{Z^2 P(1-P)}{D^2} \qquad \frac{1.96^2 \times 0.22 \times 0.22}{(0.05)^2} = 412$$

N= Sample size
Z= Z score
P= prevalence of behavioral problems in study done in Switzerland (22%)
D= Margin of error
Therefore, the total population in this study are less than 10.000 so using the reduction formula.
S = n/ (1 + n/N)
n = sample size for population of size

N = number of children age between 4-14 at cardiac clinic is 430
S=412/ 1+412/430) =210.4 adding 10 % (21) for non-response rate, therefore, the required sample size of this study is 247+24.7 = 231.

5.5.2. Sampling technique and p

From a sampling frame of 231 children who are attending follow up at cardiac clinic every patient who came for follow up during the study period fulfilling the inclusion criteria were included in the study. Willing study subjects were included sequentially in the study until the minimum sample size is attained.

5.6 Data Collection Tool and Procedures

A pretest structured questionnaire was used. It consists of four sections.

- *Section 1*- socio-demographic characteristics of the child and the parent
- *Section 2* –health related information of the child
- *Section 3* – strengths and difficulties questionnaire for behavioral assessment

Nurses at cardiac clinic and some medical students were recruited to collect the data. ODK software was used to collect the data along with the google server to store the collected data.

5.7 Data Quality Control and Management

A head of data collection, short training was given for data collectors on data collection method, and the ODK software. The collected data were reviewed and checked for completeness every day by the principal investigator and timely corrective measures were also given. The overall activity of data collection was supervised and coordinated by the principal investigator.

Study variables

Independent variables

-Socio-demographic data – Age, sex, address, religion, child's level of education, primary caregiver, marital status of parents, primary caregiver's highest level of education, Primary caregiver's monthly income, whether or not the child is intervened

Dependent variables

Behavioral symptoms score

5.9 Operational definitions

CHD is a problem of a heart structure and function presented at birth.

SDQ behavioral symptom scores: the score shall be interpreted as per the table provided below.

Parent rated SDQ			
	Close to **average** unlikely to be clinically significant	Slightly **raised** may reflect clinically significant problems	**High** substantial risk of clinically significant problems
Total difficulties score (Total 40)	0-13	14-16	17-40
Emotional symptoms score (10)	0-3	4	5-10
Conduct problems score (10)	0-2	3	4-10
Hyperactivity score (10)	0-5	6	7-10
Peer problem score (10)	0-2	3	4-10
	Close to **average** not clinically significant	**Slightly low** may be clinically significant	**Low** substantial risk of clinically significant problems
Prosocial behaviour score (Total 10)	6-10	5	0-4
Impact score (Total10)	0	1	2-10

5.10. Data processing and Analysis

During the data collection, regular supervision was made by the primary investigator to assure the quality and completeness of the collected data, with timely corrections and feedback given to data collectors.

After data cleaning and entry, the analysis was done using the Statistical Package for Social Sciences (SPSS) version 27. Variables were defined, categorised and recorded. Descriptive statistics were done using frequency distribution tables. Analytical statistics were done using cross-tabulations and bivariate logistic regression analysis to define associations between the dependent and independent variables. Variables that were associated or borderline with the outcome variable were included in the model for multivariable analysis. Data were displayed using crude and adjusted odds ratios with their 95% CI.

5.11. Ethical consideration

Ethical clearance was obtained from the Department of Research and Ethical Review Committee (DRERC). All the information obtained from children was held with

confidentiality and used only for the intended purpose, patient identifying information was not included in the study. The collected information was kept in a secured place.

5.12. Dissemination and utilization of results

The finding of this research will be submitted to Addis Ababa University, College of Health Science, School of Medicine Department of Pediatrics and Child Health and will be presented during the final defense for partial fulfillment of specialty. The finding of the study will also be shared other concerned bodies like federal minister of health and as well Ethiopian pediatrics society. Subsequently an attempt will be made, to present the findings on different review meetings, seminars, and workshops. Furthermore, the manuscript will be published on peer reviewed journals.

6 Result

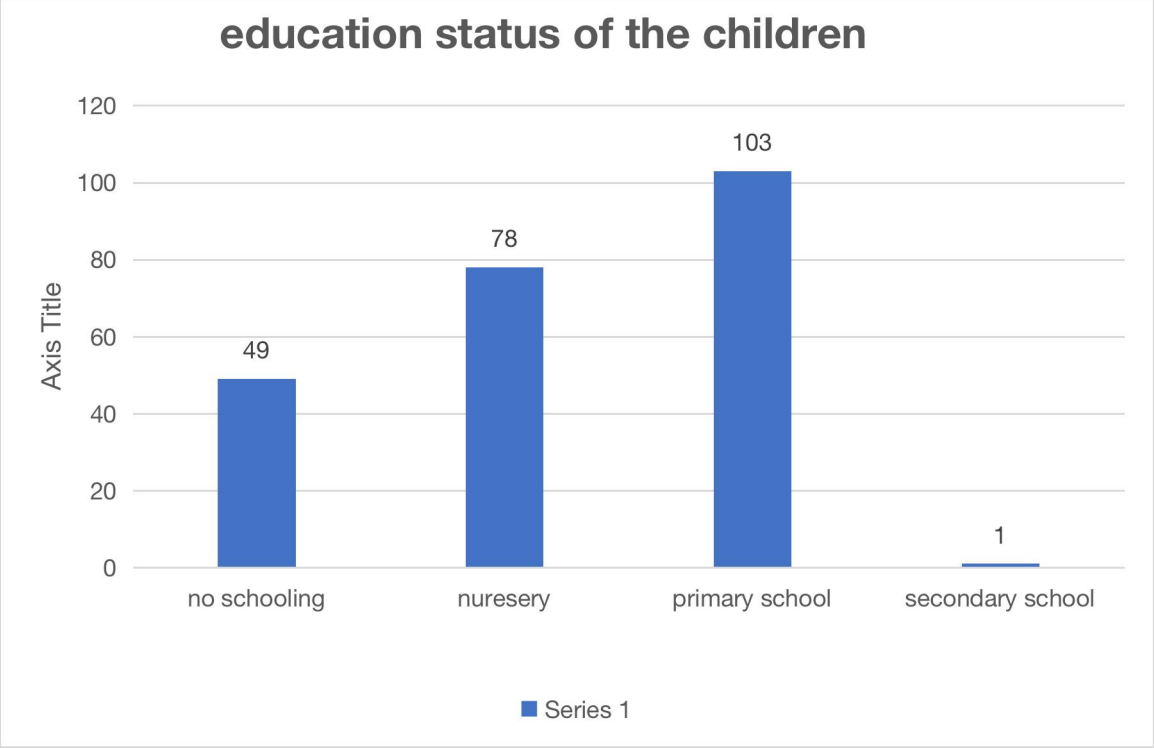
6.1 Sociodemographic characteristics of the children and caregivers

In the study period, a total of 231 responses were collected from eligible participants. Eight one percent of the children were in the age group of 4-10 years and 50.6% were male and 43.3% were first birth order. 58.4% were 1-4 family members and 52.8% were leave in Addis Ababa. Almost forty-five percent of the children were in primary education level and 85.3% were no repeated a grade. Almost sixty percent of the children primary care giver were mother and 37.7% of primary care giver education level of primary level.

Table 1. socio- demographic characteristics of children with CHD attending follow up at pediatric cardiac clinic of TASH and cardiac center.

variable	Frequency	Percent
Age in years		
4-10	188	81.4
11-14	43	18.6
Sex of the study participants		
Male	114	49.4
Female	117	50.6
Birth order		
First	100	43.3
Second	63	27.3
Third	32	13.9
More	36	15.6

Family size		
1-4	135	58.4
>=5	96	41.6
Residency		
Addis Ababa	122	52.8
Outside of Addis Ababa	109	47.2
Religion		
Orthodox Christian	128	55.4
Muslim	77	33.3
Other Christian	26	11.3
Child's level of education		
No schooling	49	21.2
Nursery	78	33.8
Primary school	103	44.6
Secondary school	1	.4
School grade of the child		
Not repeated a grade	197	85.3
Repeated a grade	34	14.7
Primary care giver		
Mother	138	59.7
Father	70	30.3
Both parents	6	2.6
Adult relative	15	6.5
Non relative adult	1	.4
Orphanage	1	.4
Primary care giver education level		
Illiterate	14	6.1
Can read and write	9	3.9
Primary education	87	37.7
Secondary education	75	32.5
College and above	46	19.9
Primary care giver occupation		
Government employed	36	15.6
Private	55	23.8
Merchant	26	11.3
Labor work	13	5.6
Unemployed	80	34.6
farmer	21	9.1
Monthly income		
<5000	60	26.0
5000-10000	147	63.6
>10000	24	10.4

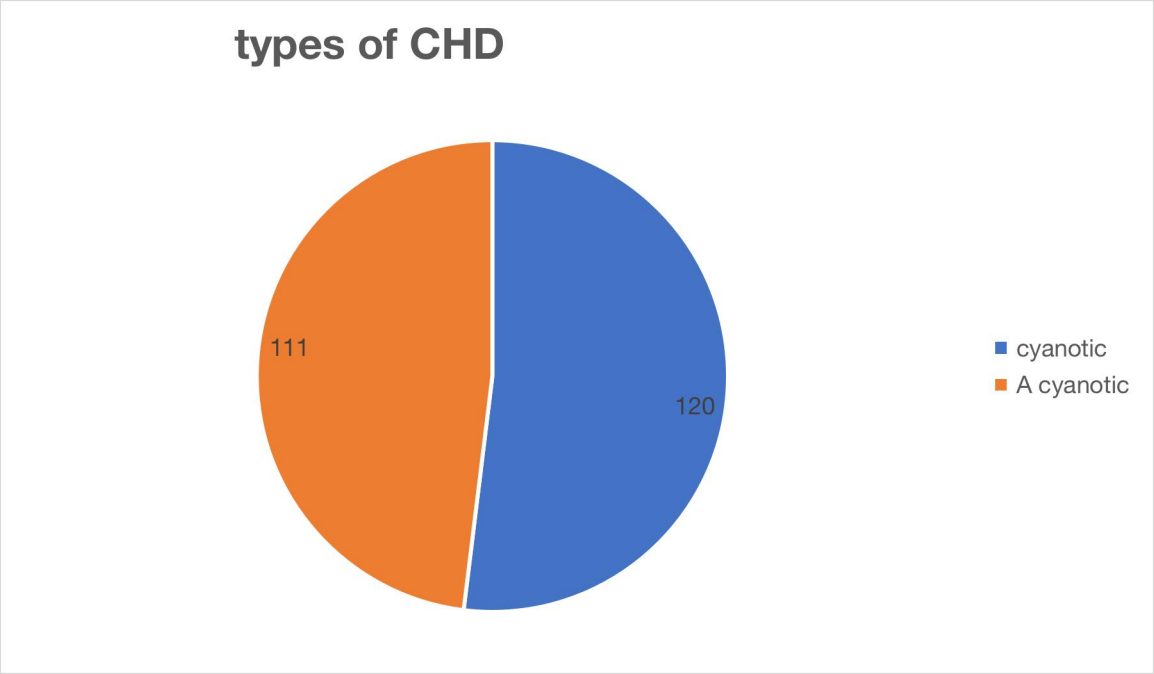


6.2 Health related conditions

Table 2. health related conditions of children with congenital heart diseases attending follow up at pediatric cardiac clinic of Tikur Anbessa specialized hospital and cardiac center.

variable	frequency	Percent
Echo report		
A cyanotic	111	48.1
Cyanotic	120	51.9
If shunt lesion s– size of the shunt		
Small	45	19.5
Moderate	76	32.9
Larg	110	47.6
Degree of obstruction lesion		
Mild	108	46.8
Moderate	65	28.1

Severe	58	25.1
pulmonary blood flow		
Increased pulmonary blood flow	116	50.2
Decreased pulmonary blood flow	115	49.8
The patient has pulmonary hypertension		
Yes	113	48.9
No	118	51.1
Age at diagnosis in month		
<=12	160	69.3
13-60	54	23.4
61-120	14	6.1
>121	3	1.3
Nutritional assessment using BMI		
severely wasted	25	10.8
moderately wasted	51	22.1
normal	153	66.2
overweight	2	.9
Hemoglobin in g/dl		
<7	2	0.9
7-11	21	9.1
>11	208	90
the patient has history of heart failure		
Yes	90	39.0
No	140	60.6
History of previous hospitalization		
Yes	183	79.2
No	48	20.8
History of cyanotic spell		
Yes	75	32.5
No	156	67.5
Specific management the child received for the CHD		
Surgery/ catheter intervention done	38	16.5
surgery not done	193	83.5



6.3 Characteristics of behavioral abnormality

The finding of the study revealed that 17.7%, 9.5%, 2.6%, 38.5%, and 3.9% of the participants had very high difficulty on behavioral, emotional, conduct, hyperactivity, peer and prosocial abnormality and 2.73% of the participants had total behavioral difficulties.

Table 3. The behavioral abnormalities among children with congenital heart diseases attending follow up at pediatric cardiac clinic of Tikur Anbessa specialized hospital and cardiac center.

Behavioral abnormality	Score of difficulties			
	Close to average	Slightly raised	high	Very high
Emotional problem	127(55%)	35(15.2%)	28(12.1%)	41(17.7%)
Conduct problem	127(55%)	47(20.3%)	35(15.2%)	22(9.5%)
Hyperactivity	189(81.8%)	26(11.3%)	10(4.3%)	6(2.6%)

Peer problem	22(9.5%)	102(44.2%)	18(7.8%)	89(38.5%)
Prosocial	168(72.7%)	34(14.7%)	20(8.7%)	9(3.9%)
Total difficulties	91(39.4%)	39(16.9%)	38(16.5%)	63(27.3%)

6.4 The prevalence of overall behavioral abnormality

6.5 The sociodemographic characteristic Relates of abnormal behavioral problems in children with congenital heart disease.

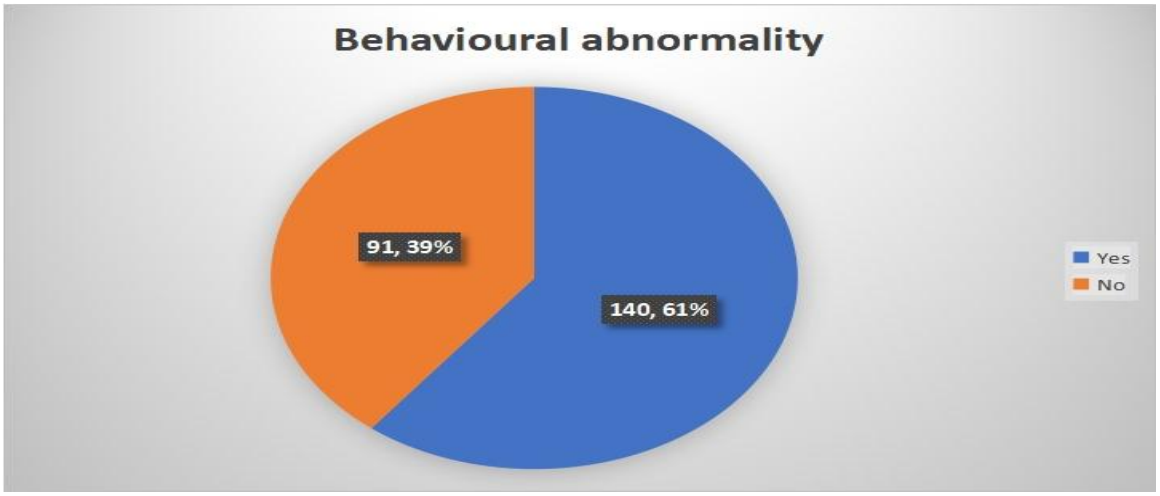


Figure 1. The prevalence of overall behavioral abnormality

In this study family size and birth order were an association with total behavioral abnormality by bivariate logistic regression. The multivariate logistic regression revealed that study participant having first birth order of children were 1.4 folds increase its total behavioral abnormality compared to those of having four birth order

(AOR=1.4, 95%CI=1.15, 8.72) and study participant having 1-4 family member had 10.8 folds increase its children behavior abnormality than having five and above family member (AOR=10.8, 4.92, 23.68). The study participant primary caregiver occupation of government employer had 1.8 folds increase its total behavioral abnormality compared to occupation farmer caregiver (AOR=1.8, 95%CI=1.14, 4.26)

Table 4. The sociodemographic correlates of abnormal behavioral problems in children with congenital heart disease attending follow up at pediatric cardiac clinic of Tikur Anbessa specialized hospital and cardiac center.

Variable	Total behavioral abnormality		p-value	COR with 95%CI	P-value	AOR with 95%CI
	yes	no				
Age						
4-10	115	73	0.214	1.2(0.58, 2.22)	0.585	0.79(0.34, 1.85)
11-14	25	18	1		1	
Sex					0.427	0.77(0.40, 1.47)
Male	73	41	1		1	
Female	67	50	0.243	0.75(0.44, 1.28)	0.142	0.84(0.42, 7.14)
Birth order						
First	63	37	0.045	2.7(1.79, 3.67)	0.012	**1.4(1.15, 8.72)**
Second	38	25	0.320	1.5(0.66, 3.47)	0.671	0.8(0.29, 2.21)
Third	21	11	0.196	1.9(0.72, 5.08)	0.596	1.4(0.42, 4.46)
More	18	18	1		1	
Family size						
1-4	106	29	0.000	6.7(3.7, 11.97)	0.000	**10.8(4.94, 23.68)**
≥5	34	62	1		1	
Residency						
Addis Ababa	79	43	0.173	1.4(0.85, 2.46)	0.847	0.93(0.45, 1.92)
Outside of Addis Ababa	61	48	1		1	
School grade of the child						
Not repeated	122	75	0.324	1.4(0.69, 3.01)	0.176	1.9(0.76(4.54)
Repeated	18	16	1		1	

Primary caregiver's highest level of education						
Illiterate	7	7	1		1	
Can read and write	3	6	0.434	0.5(0.11, 2.84)	0.365	0.38(0.05, 3.06)
Primary	49	38	0.659	1.3(0.42, 3.99)	0.365	0.53(0.14, 2.08)
Secondary	53	22	0.137	2.4(0.76, 7.68)	0.837	0.86(0.19, 3.73)
College and above level	28	18	0.472	1.6(0.47, 5.18)	0.564	0.61(0.11, 3.30)
Primary caregiver's occupation						
Government employed	23	13	0.126	2.4(0.79, 7.09)	**0.027**	**1.8 (1.14, 4.26)**
Private	34	21	0.140	2.2(0.78, 5.99)	0.963	1.1(0.24, 4.46)
Merchant	18	8	0.073	3.0(0.90, 9.96)	0.380	1.9(0.44, 8.45)
Labor work	3	10	0.247	0.40(0.09, 1.89)	0.101	0.21(0.03, 1.36)
Unemployed	53	27	0.054	2.6(0.98, 6.98)	0.601	1.4(0.39, 4.96)
farmer	9	12	1		1	

6.6 The associated with abnormal behavioral problems in children with congenital heart disease

The bivariate logistic regression revealed that size of shunt lesion, degree of obstruction, having pulmonary hypertension, history of heart failure, previous hospitalization and history of cyanotic spell were an association with total behavioral abnormality. The multivariate logistic regression revealed that study participant who had cyanotic echo report had 1.8folds increase its total behavioral abnormality compared a cyanotic (AOR=1.8, 95%CI=1.37, 2.86) and study participant having pulmonary hypertension had 1.5 folds increase its behavioral abnormality compared to its opposite compartment. The study participant having a history of heart failure had 8.4 folds increase its behavioral abnormality compared to its opposite compartment (AOR=8.4, 95%CI=3.82, 18.74) and study participant having history of cyanotic spell

had 2.7 folds increase its behavioral abnormality compared its opposite compartment (AOR=2.7, 95%CI=1.76, 3.74)

Table 5. The associated with abnormal behavioral problems in children with congenital heart disease attending follow up at pediatric cardiac clinic of Tikur Anbessa specialized hospital and cardiac center.

Variable	Total behavioral abnormality		p-value	COR with 95%CI	P-value	AOR with 95%CI
	Yes	No				
Echo report						
A cyanotic	60	51	1		1	
Cyanotic	80	40	0.051	1.7(0.98, 2.89)	**0.035**	**1.8(1.37, 2.86)**
Size of shunt lesion						
Small	18	27	1		1	
Moderate	54	22	0.001	3.7(1.69, 7.99)	0.372	1.6(0.58, 4.32)
large	68	42	0.014	2.4(1.19, 4.94)	0.152	1.9(0.79, 4.62)
Degree of obstruction lesion						
Mild	61	47	1			
Moderate	48	17	0.023	2.2(1.11, 4.26)	0.573	1.3(0.51, 3.34)
severe	31	27	0.708	0.89(0.47, 1.68)	0.935	0.96(0.41, 2.28)
Patients have pulmonary hypertension						
Yes	79	34	0.005	2.2(1.27, 3.73)	**0.022**	**1.5(1.17, 2.81)**
No	61	57	1		1	
History of heart failure						
Yes	80	10	0.000	10.7(5.10, 22.31)	**0.000**	**8.4(3.82, 18.74)**
No	60	80	1		1	
Previous hospitalization						
Yes	124	59	0.000	4.2(2.14, 8.26)	**0.023**	**2.7(1.76, 3.74)**
No	16	32	1		1	
History of cyanotic spell						
Yes	54	21	0.015	2.1(1.16, 3.78)	0.439	1.4(0.62, 3.04)
No	86	70	1		1	

7. Discussion

In this study the magnitude of behavioral abnormality among CHD children was 61% ,This finding was higher than the study done in Switzerland showed that the prevalence of behavioral abnormalities 22% , this may be due to socioeconomic and health system differences also the delay in surgical intervention especially for cyanotic CHD can have a significant impact on the child well –being and behaviors.
In our study we found being a first birth order increased the total behavioral difficulty by 1.4-fold if thought there is no date to support this finding, but this can be due to children who are firstborn may initially receive more attention from their parents, but if a younger sibling is born, the focus may shift towards the younger sibling. This change in attention could potentially affect the firstborn's behavior, as they may feel neglected.

The risk of behavioral difficulties among children with cyanotic CHD is increased by1.8folds, this has been supported by a study done in India show that Children with cyanotic CHD had increased fear, anxiety, depression and delinquent behaviors compared to a cyanotic CHD. some research suggests that children with CCHD may have an elevated risk of developing behavioural and psychological difficulties compared to their healthy peers. These behavioural problems can include attention deficit hyperactivity disorder (ADHD), anxiety, depression, and problems with executive functioning.

The exact mechanisms underlying the increased risk of behavioural problems in children with CCHD are not entirely understood. However, several factors may contribute to this association. Prolonged periods of low oxygenation in the brain during critical periods of development, especially in the prenatal and early postnatal stages, could potentially impact brain development and function. Additionally, the stress associated with chronic illness, hospitalizations, medical procedures, and potential neurodevelopmental delays may also contribute to the development of behavioural problems.

our study found that present of pulmonary hypertension in association with CHD increased the risk of having behavioral abnormalities by 1.5 folds, according to literature review done in UK about behavior and emotions of children and young people with CHD ,frequent or prolonged hospitalization can cause stress and emotional challenges, which may contribute to behavioral problems.

8. Limitations of the study

A few limitations must be borne in mind in the interpretation of the results of this study Because the study population included only a single tertiary care hospital.
setting, the results cannot be generalized to cover all children in Ethiopia. However, it could be a representative of all children visiting similar settings.
We could have used SDQ self-report for children 11years and above.

9. Conclusion

In our study, we found the magnitude of behavioral abnormalities among children with CHD to be significant.
children with cyanotic CHD, pulmonary hypertension and previous history of hospitalization are more likely to suffer from behavioral problems.
We recommend incorporate routine screening for behavioral problems in the stander care protocol for children with CHD.
Multidisciplinary collaboration among healthcare professionals (cardiologists, psychologists and social workers) in managing CHD child.

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