

Assessing the Psychological Impact of chronic heart disease on Adolescents at Qassim Region, Saudi Arabia: A Cross-Sectional Study

Zainab Habib

z.h.alnakhli@gmail.com

Maternity and Children's Hospital

James Orwa

Aga Khan University

Anfal Khalid AlGhumayzi

Maternity and Children's Hospital

Norah Homoud Alharbi

Maternity and Children's Hospital

Research Article

Keywords: Adolescents, anxiety, congenital heart disease, depression, health-related quality of life, psychological well-being, Saudi Arabia

Posted Date: September 29th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10798325/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Introduction:

Adolescents with chronic heart disease may experience psychological distress and impaired health-related quality of life (HRQoL) among other problems during this stage. However, evidence from Middle Eastern populations remains limited. This study assessed depression, anxiety, and HRQoL among adolescents with chronic heart disease in the Qassim Region of Saudi Arabia and examined factors associated with these outcomes.

Methods:

A cross-sectional study was conducted among adolescents aged 13–18 years attending follow-up care at Prince Sultan Cardiac Center-Qassim, Saudi Arabia, between July 2025 and May 2026. Sociodemographic and clinical data were collected using a structured questionnaire. Depression, anxiety, and HRQoL were assessed using the Patient Health Questionnaire-9 (PHQ-9), Generalized Anxiety Disorder-7 (GAD-7), and Pediatric Quality of Life Inventory (PedsQL), respectively. Multivariable linear regression models were fitted to identify factors associated with depression, anxiety, and HRQoL.

Results:

A total of 158 adolescents participated. The median age was 13 years (IQR: 12–16), and 51.9% were male. Most participants were classified as New York Heart Association (NYHA) class I (81.0%), while 57.6% were categorized as Group C according to the simple congenital heart disease (CHD) severity classification. Median PHQ-9 and GAD-7 scores were 1 (IQR: 0–6) and 2 (IQR: 0–7), respectively, and the median PedsQL total score was 93 (IQR: 75–99). Most participants reported minimal depressive symptoms (68.4%), minimal anxiety symptoms (63.9%), and good HRQoL (67.1%). In adjusted analyses, school absence of less than one day per week was associated with lower depression scores ($\beta = -3.5$, 95% CI: -5.3 to -1.6; $p < 0.001$), lower anxiety scores ($\beta = -3.8$, 95% CI: -5.8 to -1.9; $p < 0.001$), and higher HRQoL scores ($\beta = 8.9$, 95% CI: 3.9–14.0; $p < 0.001$). NYHA class II-IV was associated with higher depression scores ($\beta = 3.1$, 95% CI: 1.3–4.8; $p < 0.001$). Higher depression ($\beta = -2.0$, 95% CI: -2.7 to -1.4; $p < 0.001$) and anxiety scores ($\beta = -0.83$, 95% CI: -1.4 to -0.25; $p = 0.005$) were independently associated with poorer HRQoL.

Conclusions:

Most adolescents with chronic heart disease reported minimal psychological distress and good HRQoL. Regular school attendance was consistently associated with better psychological outcomes and higher HRQoL, while depressive and anxiety symptoms were important determinants of reduced HRQoL.

Routine psychosocial screening and interventions that promote school engagement may improve overall well-being among adolescents with chronic heart disease.

Background

Globally, heart disease, including congenital and acquired cardiac conditions, represents a significant source of chronic morbidity among adolescents. Congenital heart disease (CHD), the most common congenital anomaly, affected an estimated 11.99 (95% UI 10,958,658–13,123,888) million people globally in 2017, reflecting an 18.7% increase in the number of individuals living with the condition during the periods 1990 and 2017 [1]. Improvements in diagnostic techniques, medical management, and surgical interventions have substantially enhanced survival rates, resulting in a growing population of adolescents living with chronic cardiac conditions and their long-term physical, psychosocial, and health-related consequences [1, 2].

Adolescence is a critical developmental period marked by profound physical, emotional, and social changes. Globally, approximately 1.3 billion individuals are aged 10–19 years, accounting for nearly 16% of the world's population [3]. Mental health disorders are among the leading causes of illness and disability in this age group, affecting approximately one in seven adolescents worldwide [4]. In Saudi Arabia, mental health concerns among young people are highly prevalent, with nearly two in five individuals estimated to meet the criteria for a mental health disorder at some point during their lifetime [5, 6].

Beyond their physical manifestations, chronic cardiac conditions adversely affect psychological well-being and health-related quality of life (HRQoL). Adolescents with heart disease frequently experience repeated healthcare encounters, invasive procedures, activity restrictions, uncertainty regarding future health status, and challenges related to social participation and peer relationships. These factors may increase vulnerability to anxiety, depression, social isolation, and impaired quality of life. Previous studies have reported elevated levels of psychological distress among young people with CHD, with the prevalence of psychopathology estimated at approximately 18.7% [7].

Despite growing recognition of the psychological burden associated with chronic heart disease, important gaps remain in literature. Existing research has primarily focused on clinical outcomes, while comparatively less attention has been given to psychological well-being and health-related quality of life during adolescence stage marred with many challenges [8]. Furthermore, few studies have explored whether the complexity and severity of cardiac disease influence psychological outcomes, and evidence from Middle Eastern populations remains limited [9]. Therefore, this study aimed to assess depression, anxiety, and health-related quality of life among adolescents with chronic heart disease in the Qassim Region of Saudi Arabia. In addition, the study examined the association between cardiac disease severity and psychological outcomes to provide a more comprehensive understanding of the impact of chronic heart disease on adolescent well-being. The findings will contribute to the limited evidence base from Saudi Arabia and provide culturally relevant insights into the psychological experiences of

adolescents living with chronic heart disease. Ultimately, this study may inform the development of evidence-based psychosocial interventions and support the integration of routine mental health assessment into pediatric cardiology services in Saudi Arabia.

Methods

Study Design

This was a cross-sectional study conducted among adolescents with chronic heart disease attending follow-up care at Prince Sultan Cardiac Center-Qassim (PSCCQ), Saudi Arabia between the period July 2025 and May 2026.

Study Setting

The study was conducted at Prince Sultan Cardiac Center-Qassim (PSCCQ), a tertiary referral cardiac center in the Qassim Region, Saudi Arabia. The center provides specialized pediatric and adult cardiology services and serves as a major referral facility for patients with congenital and acquired heart diseases. Participants were recruited from pediatric cardiology clinics during routine follow-up visits.

Study Population, sampling and sample size

All adolescents aged 13–18 years with diagnosis of congenital or acquired heart conditions and were receiving care at PSCCQ were eligible to participate in the study. Adolescents with known psychiatric disorders unrelated to their cardiac condition, those with major extracardiac malformations or genetic syndromes, and those whose parents/guardians declined consent or who declined assent to participate in the study were excluded. There was no formal Sample Size calculation performed for the study. Instead, all eligible assenting adolescents together with the parents providing consent during the study period were invited to participate in the study.

Study Procedure and quality control

The data were collected using self-administered questionnaire available in Arabic with support of trained researcher's assistants who were conversant with English and Arabic languages. The trained research assistant explained the study objectives and procedures to eligible participants and their parents or legal guardians. Written informed consent was obtained from the parents or legal guardians and written assent from adolescents before the start of data collection. Participants completed the paper-based survey in a private setting during their clinic visit. Quality measures were put in place to ensure accuracy in completing the questionnaires before the participant left the clinic. Data were subsequently entered into Microsoft Excel database, followed by logical verifications of random procedures, including random checks against source documents.

Data Collection measures

Structured questionnaire was used to collect information on sociodemographic characteristics, family support, coping mechanisms, and relevant clinical history. Items were adapted from a previous study on investigating psychosocial outcomes among adolescents with chronic illness [10].

The PedsQL 3.0 Cardiac module-Arabic version was self-administered to evaluate health-related quality of life (HRQoL) [11, 12] The instrument comprises of six different domains: Heart problems and treatment (7 items), Treatment II (5 items for patient on pharmacologic treatment), Perceived physical appearance (3 items), Treatment Anxiety (4 items), Cognitive problems (5 items) and Communication (3 items).

The self-reported questionnaire was administered to adolescents (13–18 years of age). Items are measured on a 5-point Likert scale from 0 = never to 4 = almost always. Items are reverse scored and linearly transformed to a 0–100 scale where 0 = 100, 1 = 75, 2 = 50, 3 = 25 and 4 = 0.

Anxiety symptoms were assessed using the Generalized Anxiety Disorder Scale (GAD-7) [13]. Participants reported how often in the last two weeks they have experienced anxiety symptoms. The questionnaire measured anxiety symptoms using seven items each with a four-point response ranging from 0 (“not at all”) to 3 (“nearly every day”). Total scores range from 0 to 21, with scores of: 5–9 indicating mild anxiety, 10–14 indicating moderate anxiety, and 15–21 indicating severe anxiety.

Depressive symptoms was assessed using Patient Health Questionnaire (PHQ-9) [14, 15]. Participants reported the frequency of nine depressive symptoms experienced during the previous two weeks on a four-point ranging from 0 (“not at all”) to 3 (“nearly every day”). The PHQ-9 is a short but highly effective self-assessment tool for depressive symptoms. The symptom severity scores were categorized into 5–9 for *Mild*, 10–14 for *Moderate*, and 15–27 for *Severe*.

The severity of heart conditions among adolescents was classified based on information obtained from clinical records, including diagnostic classification, cardiac imaging findings, hemodynamic assessment, and treatment history. Severity categories were determined based on established guidelines and published literature to provide a comprehensive assessment of disease severity [16–18].

Congenital heart disease (CHD) was defined as structural abnormality of the heart or great vessels arising during fetal development period [7]

Data Analysis

The demographic and clinical Characteristics were summarized descriptively using frequency and percentages for categorical variables and median (IQR) or mean (SD), as appropriate for continuous variables. The approach was used for the Psychological Outcomes of depression, anxiety and quality of life as well.

Three linear regression models were fitted with 1) depression, 2) anxiety, and 3) quality of life scores as the respective outcome variables. Linear regression assumptions were assessed using residual plots, Shapiro-Wilk tests, Breusch-Pagan tests, and variance inflation factors. Diagnostic testing indicated acceptable model fit and no evidence of problematic multicollinearity and adjusted R-squared values were reported to evaluate each of the model fit. All analysis were performed using RStudio version 4.5.1(2025-06-13 ucrt) and p-value < 0.05 set as the level of significance for all analyses.

Results

Baseline characteristics of participants

Table 1 summarizes the sociodemographic and clinical characteristics of the study participants (N = 158). The median age was 13 years (IQR: 12–16), and 51.9% were male. Most participants reported low school absenteeism, with 82.3% missing less than one day of school per week, and 89.2% lived with both parents. Most of the participants were classified as NYHA class I (81.0%), while 57.6% were categorized as Group C according to the simple CHD severity classification. The median CHD severity score was 2 (IQR: 1–6). Surgical and catheter-based interventions were performed in 28.5% and 46.8% of participants, respectively. Residual lesions were present in 20.3%, while 8.2% had documented complications.

Table 1
Sociodemographic and Clinical Characteristics of Adolescents with Chronic Heart Disease

Characteristic	N = 158
Age, Median (Q1–Q3)	13 (12.0–16)
Gender, n (%)	
Female	76 (48.1)
Male	82 (51.9)
BMI, Median (Q1–Q3)	20 (17.3–24)
Educational Level, n (%)	
Elementary	46 (29.1)
High School	40 (25.3)
Intermediate	69 (43.7)
None	3 (1.9)
Absent Days, n (%)	
2–3 days/week	24 (15.2)
Less than 1 day/week	130 (82.3)
More than 4 days/week	4 (2.5)
Monthly Income, n (%)	
5,000–10,000 SAR	61 (38.6)
Less than 5,000 SAR	47 (29.7)
More than 10,000 SAR	50 (31.6)
Government Support, n (%)	57 (36.1)
Family Situation, n (%)	
With both parents	141 (89.2)
With mother, father, or others	17 (10.8)
The simple CHD severity classification, n (%)	
group A	18 (11.4)
group B	49 (31.0)
group C	91 (57.6)

Characteristic	N = 158
The simple CHD severity scoring system, Median (Q1–Q3)	2 (1.0–6)
The proposed adapted NYHA-CHD classification for children with congenital heart disease., n (%)	
NYHA I	128 (81.0)
NYHA II A	20 (12.7)
NYHA II B	8 (5.1)
NYHA III	1 (0.6)
NYHA IV	1 (0.6)
Surgical based interventions, n (%)	45 (28.5)
Surgical intervention group, n (%)	
0	113 (71.5)
1	24 (15.2)
> 1	21 (13.3)
Catheter-based interventions, n (%)	74 (46.8)
Catheter intervention group, n (%)	
0	85 (53.8)
1	60 (38.0)
> 1	14 (8.2)
Residual lesion, n (%)	32 (20.3)
Complication, n (%)	13 (8.2)
Medication used, n (%)	
0	137 (86.7)
1	12 (7.6)
> 1	9 (5.7)

Prevalence of congenital heart diseases

Among the 158 participants, bicuspid aortic valve (BAV) was the most prevalent congenital heart disease diagnosis, identified in 47 patients (29.7%). Atrial septal defect (ASD) was present in 28 patients (17.7%), while ventricular septal defect (VSD) and aortic stenosis (AS) were observed in 22 patients (13.9%). Patent ductus arteriosus (PDA), pulmonary stenosis (PS), and mitral regurgitation (MR) were

found in 19 patients each (12.0%), whereas coarctation of the aorta (COA) was present in 16 patients (10.1%). Aortic insufficiency (AI) was identified in 12 patients (7.6%), and mitral valve prolapse (MVP) in nine patients (5.7%). Tetralogy of Fallot (TOF), double-outlet right ventricle (DORV), and tricuspid regurgitation (TR) were each observed in four patients (2.5%). Atrioventricular septal defect (AVSD), patent foramen ovale (PFO), left pulmonary artery stenosis, mitral stenosis (MS), and double-inlet left ventricle (DILV) were each present in three patients (1.9%). Pulmonary atresia (PA), transposition of the great arteries (TGA), cardiomyopathy, and vascular ring were each identified in two patients (1.3%). Partial anomalous pulmonary venous return (PAPVR), total anomalous pulmonary venous return (TAPVR), tricuspid atresia, Ebstein anomaly, and Scimitar syndrome were each observed in one patient (0.6%) (Fig. 1).

Psychological outcomes

Table 2 presents the psychological distress, coping strategies, and quality-of-life characteristics of the study participants. Median PHQ-9 was 1 (IQR:0–6), while the median for GAD-7 was 2 (IQR: 0–7). Most participants report minimal depressive symptoms (68.4%) and minimal anxiety symptoms (63.9%), with relatively few participants experiencing moderate-to-severe levels of psychological distress. Among coping strategies, social support was the most frequently reported by 28.3% of the participants, followed by avoidance at 19.6% and social media use among 19.0% of the participants.

Quality-of-life outcomes were generally favorable, with approximately two-thirds of participants reporting good physical (66.5%), emotional functioning (65.2%), school functioning (67.1%), and overall quality of life (67.1%), while social functioning had the highest ratings, with 79.7% of the participants reporting good social functioning.

Table 2
Psychological Distress, Coping Strategies and Quality of Life

Characteristic	N = 158
GAD7_Score, Median (IQR)	2.0 (0.0–7.0)
GAD-7 Anxiety Severity, n (%)	
Minimal	101 (63.9%)
Mild	30 (19.0%)
Moderate	22 (13.9%)
Severe	5 (3.2%)
PHQ9_Score, Median (IQR)	1.0 (0.0–6.0)
PHQ-9 Depression Severity, n (%)	
Minimal	108 (68.4%)
Mild	30 (19.0%)
Moderate	15 (9.5%)
Moderately Severe	4 (2.5%)
Severe	1 (0.6%)
Primary Coping Strategy, n (%)	
Social support	43 (27.2%)
Social media	30 (19.0%)
Physical activity	18 (11.4%)
Rest/sleep	22 (13.9%)
Avoidance	31 (19.6%)
Eating/appetite changes	3 (1.9%)
Religious/spiritual	2 (1.3%)
No psychological stress	3 (1.9%)
Multiple strategies	1 (0.6%)
Other	5 (3.2%)
PedsQL Physical Functioning, n (%)	
Poor (< 60)	32 (20.3%)

Characteristic	N = 158
Moderate (60–79)	21 (13.3%)
Good (80–100)	105 (66.5%)
PedsQL Emotional Functioning, n (%)	
Poor (< 60)	32 (20.3%)
Moderate (60–79)	23 (14.6%)
Good (80–100)	103 (65.2%)
PedsQL Social Functioning, n (%)	
Poor (< 60)	20 (12.7%)
Moderate (60–79)	12 (7.6%)
Good (80–100)	126 (79.7%)
PedsQL School Functioning, n (%)	
Poor (< 60)	24 (15.2%)
Moderate (60–79)	28 (17.7%)
Good (80–100)	106 (67.1%)
PedsQL Total Score, n (%)	
Poor (< 60)	20 (12.7%)
Moderate (60–79)	32 (20.3%)
Good (80–100)	106 (67.1%)
Total_Score, Median (IQR)	93 (75–99)

Depression

Table 3 presents the factors associated with depression scores among adolescents with chronic heart disease. In the adjusted model, adolescents who reported less than one day of school absence per week had significantly lower PHQ-9 scores ($\beta = -3.5$, 95% CI: -5.3 to -1.6 , $p < 0.001$), while NYHA class II-IV was associated with higher depression scores compared with NYHA class I ($\beta = 3.1$, 95% CI: 1.3 – 4.8 , $p < 0.001$). Other variables included in the adjusted model did not show significant associations with PHQ-9 scores, including CHD severity classification, residual lesions, and complications. The final model explained 19.6% of the variance in depression scores (adjusted $R^2 = 0.196$).

Table 3
Factors Associated with Depression Scores (PHQ-9)

Characteristic	Crude β			Adjusted β	
	N	Beta (95% CI)	p-value	Beta (95% CI)	p-value
Age	158	-0.01 (-0.11 to 0.10)	0.88	-0.02 (-0.12 to 0.08)	0.69
Gender	158				
Female		—		—	
Male		-1.0 (-2.5 to 0.43)	0.17	-0.85 (-2.2 to 0.49)	0.21
BMI	158	0.02 (-0.08 to 0.11)	0.72	0.01 (-0.08 to 0.10)	0.82
Monthly Income	158				
5,000–10,000 SAR		—		—	
Less than 5,000 SAR		0.87 (-0.87 to 2.6)	0.33	0.51 (-1.1 to 2.1)	0.53
More than 10,000 SAR		-1.7 (-3.4 to 0.06)	0.059	-1.1 (-2.7 to 0.51)	0.18
Absent Days	158				
2–3 days/week		—		—	
Less than 1 day/week		-4.5 (-6.3 to -2.7)	< 0.001	-3.5 (-5.3 to -1.6)	< 0.001
NYHA_group	158				
NYHA I		—		—	
NYHA II-IV		3.7 (1.9 to 5.4)	< 0.001	3.1 (1.3 to 4.8)	< 0.001
Residual lesion	158				
No		—		—	
Yes		-1.3 (-3.1 to 0.52)	0.16	-0.93 (-2.8 to 0.89)	0.31
Complication	158				
No		—		—	
NYHA_group was categorized as NYHA I versus NYHA II-IV. Adjusted model fit: N = 158, R ² = 0.252, Adjusted R ² = 0.196, Residual SD = 4.16, F = 4.47, p = 8.4e-06.					

Characteristic	Crude β			Adjusted β	
	N	Beta (95% CI)	p-value	Beta (95% CI)	p-value
Yes		-0.56 (-3.2 to 2.1)	0.68	-0.24 (-2.7 to 2.2)	0.85
The simple CHD severity classification	158				
group A		—		—	
group B		-1.0 (-3.5 to 1.5)	0.42	-0.34 (-2.7 to 2.0)	0.78
group C		0.32 (-2.0 to 2.7)	0.79	0.65 (-1.6 to 2.9)	0.58
Abbreviation: CI = Confidence Interval					
NYHA_group was categorized as NYHA I versus NYHA II-IV. Adjusted model fit: N = 158, R ² = 0.252, Adjusted R ² = 0.196, Residual SD = 4.16, F = 4.47, p = 8.4e-06.					

Anxiety

Table 4 presents the factors associated with anxiety symptoms among adolescents with chronic heart disease. After adjustment, adolescents who reported less than one day of school absence per week had significantly lower GAD-7 scores than those absent 2–3 days per week ($\beta = -3.8$, 95% CI: -5.8 to -1.9 , $p < 0.001$). Adolescents from households with a monthly income of less than 5,000 SAR had higher anxiety scores than those from households earning 5,000–10,000 SAR; however, this association was not statistically significant ($\beta = 1.4$, 95% CI: -0.29 to 3.1 , $p = 0.10$). The association between NYHA class II-IV and anxiety observed in the crude analysis was attenuated after adjustment and was no longer statistically significant ($\beta = 1.2$, 95% CI: -0.62 to 3.1 , $p = 0.19$). Other variables included in the adjusted model, including CHD severity classification, residual lesions, and complications, were not significantly associated with anxiety scores. The final model explained 14.8% of the variance in anxiety scores (adjusted $R^2 = 0.148$).

Table 4
Factors Associated with Anxiety Scores (GAD-7)

Characteristic	Crude β			Adjusted β	
	N	Beta (95% CI)	p-value	Beta (95% CI)	p-value
Age	158	-0.03 (-0.13 to 0.08)	0.64	-0.02 (-0.12 to 0.08)	0.72
Gender	158				
Female		—		—	
Male		-0.79 (-2.3 to 0.71)	0.30	-0.66 (-2.1 to 0.77)	0.36
BMI	158	-0.05 (-0.14 to 0.05)	0.33	-0.06 (-0.15 to 0.03)	0.18
Monthly Income	158				
5,000–10,000 SAR		—		—	
Less than 5,000 SAR		1.7 (-0.10 to 3.5)	0.064	1.4 (-0.29 to 3.1)	0.10
More than 10,000 SAR		-1.6 (-3.3 to 0.16)	0.075	-0.97 (-2.7 to 0.75)	0.27
Absent Days	158				
2–3 days/week		—		—	
Less than 1 day/week		-4.3 (-6.2 to -2.5)	< 0.001	-3.8 (-5.8 to -1.9)	< 0.001
NYHA_group	158				
NYHA I		—		—	
NYHA II-IV		2.1 (0.16 to 4.0)	0.033	1.2 (-0.62 to 3.1)	0.19
Residual lesion	158				
No		—		—	
Yes		-0.75 (-2.6 to 1.1)	0.43	-0.08 (-2.0 to 1.9)	0.93
Complication	158				
No		—		—	
NYHA_group was categorized as NYHA I versus NYHA II-IV. Adjusted model fit: N = 158, R ² = 0.208, Adjusted R ² = 0.148, Residual SD = 4.42, F = 3.48, p = 0.000247.					

Characteristic	Crude β			Adjusted β	
	N	Beta (95% CI)	p-value	Beta (95% CI)	p-value
Yes		0.18 (-2.6 to 2.9)	0.90	0.29 (-2.3 to 2.9)	0.83
The simple CHD severity classification	158				
group A		—		—	
group B		-1.1 (-3.7 to 1.5)	0.41	-0.27 (-2.7 to 2.2)	0.83
group C		0.50 (-1.9 to 2.9)	0.68	1.0 (-1.4 to 3.4)	0.42
Abbreviation: CI = Confidence Interval					
NYHA_group was categorized as NYHA I versus NYHA II-IV. Adjusted model fit: N = 158, $R^2 = 0.208$, Adjusted $R^2 = 0.148$, Residual SD = 4.42, F = 3.48, p = 0.000247.					

Adolescent quality of life

Table 5 presents factors associated with quality of life among adolescents with chronic heart disease. After adjustment, adolescents who reported less than one day of school absence per week had significantly higher PedsQL total scores than those who were absent 2–3 days per week ($\beta = 8.9$, 95% CI: 3.9 to 14.0, $p < 0.001$). Higher depressive symptom scores were independently associated with lower quality-of-life scores ($\beta = -2.0$, 95% CI: -2.7 to -1.4, $p < 0.001$), as were higher anxiety scores ($\beta = -0.83$, 95% CI: -1.4 to -0.25, $p = 0.005$). The strong association observed between NYHA class II–IV and quality of life in the crude analysis was no longer statistically significant after adjustment ($\beta = -1.6$, 95% CI: -6.3 to 3.1, $p = 0.50$). Other clinical factors, including CHD severity classification, residual lesions, and complications, were not significantly associated with quality-of-life scores. The final model explained 67.5% of the variance in quality-of-life scores (adjusted $R^2 = 0.675$), suggesting that psychological distress and school attendance were important determinants of quality of life in this cohort.

Table 5
Factors Associated with Quality of Life (PedsQL Total Score)

Characteristic	Crude β			Adjusted β	
	N	Beta (95% CI)	p-value	Beta (95% CI)	p-value
Age	158	0.19 (-0.23 to 0.61)	0.37	0.16 (-0.09 to 0.40)	0.21
Gender	158				
Female		—		—	
Male		2.5 (-3.3 to 8.3)	0.40	-0.02 (-3.5 to 3.4)	> 0.99
BMI	158	-0.11 (-0.47 to 0.26)	0.57	-0.09 (-0.31 to 0.13)	0.42
Monthly Income	158				
5,000–10,000 SAR		—		—	
Less than 5,000 SAR		-7.6 (-14 to -0.89)	0.027	-3.8 (-7.9 to 0.35)	0.073
More than 10,000 SAR		8.5 (1.9 to 15)	0.011	2.8 (-1.3 to 6.9)	0.19
Absent Days	158				
2–3 days/week		—		—	
Less than 1 day/week		23 (16 to 30)	< 0.001	8.9 (3.9 to 14)	< 0.001
NYHA_group	158				
NYHA I		—		—	
NYHA II-IV		-13 (-20 to -6.0)	< 0.001	-1.6 (-6.3 to 3.1)	0.50
Residual lesion	158				
No		—		—	
Yes		0.91 (-6.4 to 8.2)	0.81	-2.9 (-7.6 to 1.8)	0.22
Complication	158				
No		—		—	
Abbreviation: CI = Confidence Interval					

Characteristic	Crude β			Adjusted β	
	N	Beta (95% CI)	p-value	Beta (95% CI)	p-value
Yes		-0.20 (-11 to 10)	0.97	-0.19 (-6.5 to 6.1)	0.95
The simple CHD severity classification	158				
group A		—		—	
group B		5.5 (-4.6 to 16)	0.29	0.47 (-5.5 to 6.4)	0.88
group C		1.6 (-7.9 to 11)	0.75	0.33 (-5.5 to 6.2)	0.91
PHQ9_Score	158	-3.1 (-3.5 to -2.7)	< 0.001	-2.0 (-2.7 to -1.4)	< 0.001
GAD7_Score	158	-2.8 (-3.2 to -2.3)	< 0.001	-0.83 (-1.4 to -0.25)	0.005
Abbreviation: CI = Confidence Interval					

NYHA_group was categorized as NYHA I versus NYHA II-IV. Adjusted model fit: N = 158, $R^2 = 0.702$, Adjusted $R^2 = 0.675$, Residual SD = 10.55, $F(13, 144) = 26.13$, $p = < 2e-16$.

Discussion

This study assessed depression, anxiety, and health-related quality of life (HRQoL), as well as their associations with sociodemographic and clinical characteristics, among adolescents with chronic heart disease. Overall, the findings suggest a favorable psychological profile in this cohort, with most participants reporting minimal depressive and anxiety symptoms and good HRQoL across multiple domains. These findings may reflect the relatively stable clinical status of the study population, as most participants were classified as NYHA class I and reported low levels of school absenteeism.

Depressive symptoms were significantly associated with both school attendance and functional status. Adolescents who reported missing less than one day of school per week had significantly lower PHQ-9 scores than those with more frequent absenteeism. The finding is consistent with findings from a large population-based study by Askeland et al., which demonstrated a significant association between depressive symptoms and school absence among adolescents [19]. The observed relationship is further supported by a systematic review and meta-analysis by Finning et al., which reported consistent associations between depression and poor school attendance across multiple settings. The adolescents with higher levels of depression were more likely to experience absenteeism and truancy, emphasizing the importance of attendance as a potential indicator of psychological distress [20]. The relationship

between school absenteeism and depression is further described in a longitudinal where Liu and Hung found that depressive symptoms predicted future school absenteeism among economically disadvantaged adolescents, indicating that depression itself may contribute to school disengagement through mechanisms such as reduced motivation, fatigue, and social withdrawal [21].

The study in addition found that adolescents classified as NYHA class II-IV had significantly higher depression scores than those in NYHA class I, highlighting the potential impact of functional limitations on mental health. Reduced physical capacity, limitations in daily activities, and increased disease burden may contribute to greater emotional distress among adolescents with more severe disease. Similar findings have been reported in studies of congenital heart disease across the lifespan. Carazo et al. found that patients with depression were more likely to have impaired functional status (NYHA class II or higher), supporting the relationship between physical limitations and psychological well-being [22].

Lower levels of school absenteeism were found to be the only variable associated with anxiety levels. Adolescents with lower levels of school absenteeism reported significantly lower GAD-7 scores, suggesting that regular school attendance may have a protective association with psychological well-being. Anxiety may contribute to school avoidance through fear of social interactions, academic pressures, or separation-related concerns, leading adolescents to miss school as a means of reducing distress. Our findings are consistent with those of Halidu and Kotera, who reported that social anxiety was associated with school absenteeism among Norwegian adolescents. Adolescents with anxiety may engage in school avoidance behaviors and experience reduced school satisfaction, further contributing to absenteeism [23].

HRQoL was strongly associated with both school attendance and psychological well-being. Adolescents who missed less than one day of school per week reported significantly higher PedsQL total scores than those with more frequent absences. This finding is consistent with evidence indicating that regular school attendance is an important component of adolescent functioning and well-being. School participation facilitates academic engagement, social interaction, and emotional development, whereas persistent absenteeism has been linked to poorer psychosocial outcomes and reduced quality of life. Given that the PedsQL incorporates school functioning as a core dimension of health-related quality of life, continued engagement in school may reflect broader physical, emotional, and social well-being [24].

Furthermore, higher depression and anxiety scores were independently associated with lower HRQoL, demonstrating the substantial impact of psychological distress on adolescents' perceptions of their health and functioning. This finding is consistent with previous studies among children and adolescents with congenital heart disease showing that psychological difficulties are closely associated with poorer HRQoL. Liu et al. reported that psychological status and depressive symptoms were important determinants of HRQoL among children and adolescents with congenital heart disease, particularly among those with more complex conditions. Similarly, reviews of the congenital heart disease literature have highlighted depression and anxiety as important contributors to psychosocial adjustment and quality of life outcomes [25, 26]

Study strengths and limitations

This study provides important insights into the psychological well-being and quality of life of adolescents with chronic heart disease using validated measures of depression, anxiety, and HRQoL. However, several limitations should be considered. First, the cross-sectional design precludes conclusions regarding causality between psychological distress, school absenteeism, and quality of life. Second, the study was conducted at a single tertiary care center, which may limit the generalizability of the findings to other settings and populations. Third, psychological distress and quality-of-life outcomes were assessed using self-reported measures and may therefore be subject to recall and reporting bias. Despite these limitations, the study adds to the limited evidence regarding psychological well-being and HRQoL among adolescents with chronic heart disease and identifies potentially modifiable factors associated with these outcomes.

Conclusions

Most adolescents with chronic heart disease reported minimal symptoms of depression and anxiety and good HRQoL. Lower school absenteeism was consistently associated with better psychological outcomes and higher quality of life, while poorer functional status was associated with increased depressive symptoms. Depression and anxiety were important independent predictors of HRQoL, underscoring the importance of incorporating routine psychosocial assessment and support into the comprehensive care of adolescents with chronic heart disease. Interventions aimed at promoting school engagement and facilitating the early identification and management of depression and anxiety may contribute to improved well-being and quality of life in this population. Future longitudinal studies are needed to clarify the direction of these associations and identify effective strategies for supporting psychosocial health among adolescents living with chronic heart disease.

Abbreviations

CHD: Congenital Heart Disease; CI: Confidence Interval; GAD-7: Generalized Anxiety Disorder-7; HRQoL: Health-Related Quality of Life; IQR: Interquartile Range; NYHA: New York Heart Association; PedsQL: Pediatric Quality of Life Inventory; PHQ-9: Patient Health Questionnaire-9; PSCCQ: Prince Sultan Cardiac Center-Qassim; SD: Standard Deviation.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Regional Research Ethics Committee, Qassim Province, Qassim Health Cluster, Ministry of health, Kingdom of Saudi Arabia (NCBE Registration No. H-04-Q-001). Written informed consent was obtained from parents or legal guardians, and written assent was obtained from all adolescent participants prior to data collection. All data were anonymized and securely stored to

ensure confidentiality. Adolescents identified as experiencing psychological distress were referred for further assessment and care according to Ministry of Health guidelines. Participation was voluntary, and participants could withdraw at any time without affecting their medical care. The study was conducted in accordance with the Declaration of Helsinki.

Consent for publication

Not applicable.

Availability of data and materials

The data used in this study are available upon request from the lead and corresponding author upon completing the data user agreement form sent to zainab@gmail.com

Competing Interests

The authors have no conflicts of interest to declare.

Funding

No funding was received for this study.

Authors' contributions

Z.H.A. and J.O. wrote the main manuscript text, collected the data, and assisted with formal data analysis. **A.K.A. and N.H.A.** were involved in the conceptualization of the study and development of the methodology. All authors reviewed and approved the final manuscript.

Acknowledgement

The authors would like to thank all adolescents and their families who participated in this study. We also express our gratitude to the management and staff of Prince Sultan Cardiac Center-Qassim for their support and facilitation of data collection. We acknowledge the research assistants who contributed to participant recruitment and data management.

References

1. Zimmerman MS, Smith AGC, Sable CA, Echko MM, Wilner LB, Olsen HE, Atalay HT, Awasthi A, Bhutta ZA, Boucher JL. Global, regional, and national burden of congenital heart disease, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet Child Adolesc Health*. 2020;4(3):185–200.
2. McSharry B, Straney L, Alexander J, Gentles T, Winlaw D, Beca J, Millar J, Shann F, Wilkins B, Numa A. RACHS-ANZ: A modified risk adjustment in congenital heart surgery model for outcome surveillance in Australia and new Zealand. *J Am Heart Association*. 2019;8(9):e011390.

3. Unicef. Investing in a safe, healthy and productive transition from childhood to adulthood is critical. *Adolescents overview* 2019.
4. Organization WH. Mental health of adolescents <https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health> (2024). In.: Accessed; 2025.
5. Altwaijri YA, Al-Subaie AS, Al-Habeeb A, Bilal L, Al-Desouki M, Aradati M, King AJ, Sampson NA, Kessler RC. Lifetime prevalence and age-of-onset distributions of mental disorders in the Saudi National Mental Health Survey. *Int J Methods Psychiatr Res.* 2020;29(3):e1836.
6. Yaghmour S, Bamatraf A, Alghanmi L, Alnafisi T. Prevalence of Mental Illness Among Middle Adolescents in Jeddah, Saudi Arabia. *J PsychoSoc Nurs Ment Health Serv.* 2025;63(4):28–33.
7. Areias MEG, Pinto CI, Vieira PF, Teixeira F, Coelho R, Freitas I, Matos S, Castro M, Sarmiento S, Viana V. Long term psychosocial outcomes of congenital heart disease (CHD) in adolescents and young adults. *Translational Pediatr.* 2013;2(3):90.
8. Hoffman JI, Kaplan S. The incidence of congenital heart disease. *J Am Coll Cardiol.* 2002;39(12):1890–900.
9. Azhar AS, AlShammasi ZH, Higgi RE. The impact of congenital heart diseases on the quality of life of patients and their families in Saudi Arabia: Biological, psychological, and social dimensions. *Saudi Med J.* 2016;37(4):392.
10. Carver CS. You want to measure coping but your protocol's too long: Consider the brief cope. *Int J Behav Med.* 1997;4(1):92–100.
11. Varni JW, Seid M, Kurtin PS. PedsQL™ 4.0: Reliability and validity of the Pediatric Quality of Life Inventory™ Version 4.0 Generic Core Scales in healthy and patient populations. *Med Care.* 2001;39(8):800–12.
12. Bastiaansen D, Koot H, Bongers I, Varni J, Verhulst F. Measuring quality of life in children referred for psychiatric problems: Psychometric properties of the PedsQL™ 4.0 generic core scales. *Qual Life Res.* 2004;13(2):489–95.
13. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med.* 2006;166(10):1092–7.
14. AlHadi AN, AlAteeq DA, Al-Sharif E, Bawazeer HM, Alanazi H, AlShomrani AT, Shuqdar RM, AlOwaybil R. An arabic translation, reliability, and validation of Patient Health Questionnaire in a Saudi sample. *Ann Gen Psychiatry.* 2017;16(1):32.
15. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med.* 2001;16(9):606–13.
16. Stout KK, Daniels CJ, Aboulhosn JA, Bozkurt B, Broberg CS, Colman JM, Crumb SR, Dearani JA, Fuller S, Gurvitz M. 2018 AHA/ACC guideline for the management of adults with congenital heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation.* 2019;139(14):e698–800.
17. O'Malley BR, Raja N, Blue GM, Winlaw DS, Sholler GF, Group CHDSS. The CHD severity classification system: development of a tool to assist with disease stratification for CHD research. *Cardiol Young.*

2024;34(10):2213–8.

18. Kovacs AH, Brouillette J, Ibeziako P, Jackson JL, Kasparian NA, Kim YY, Livecchi T, Sillman C, Kochilas LK, Disease AHACLCH, et al. Psychological outcomes and interventions for individuals with congenital heart disease: a scientific statement from the American Heart Association. *Circulation: Cardiovasc Qual Outcomes*. 2022;15(8):e000110.
19. Askeland KG, Bøe T, Lundervold AJ, Stormark KM, Hysing M. The association between symptoms of depression and school absence in a population-based study of late adolescents. *Front Psychol*. 2020;11:1268.
20. Finning K, Ukoumunne OC, Ford T, Danielsson-Waters E, Shaw L, De Jager IR, Stentiford L, Moore DA. The association between child and adolescent depression and poor attendance at school: A systematic review and meta-analysis. *J Affect Disord*. 2019;245:928–38.
21. Liu I, Hung W-H. A longitudinal, cross-lagged panel analysis of school absenteeism and symptoms of depression among economically disadvantaged adolescents. *Int J Adolescence Youth*. 2025;30(1):2517094.
22. Carazo MR, Kolodziej MS, DeWitt ES, Kasparian NA, Newburger JW, Duarte VE, Singh MN, Opotowsky AR. Prevalence and prognostic association of a clinical diagnosis of depression in adult congenital heart disease: results of the Boston Adult Congenital Heart Disease Biobank. *J Am Heart Association*. 2020;9(9):e014820.
23. Halidu MD, Kotera Y. Adolescent social Anxiety, school Satisfaction, family emotional Support, and school absenteeism: findings from Young-HUNT3 and Norwegian National education data. *J Clin Med*. 2024;13(9):2547.
24. Kearney CA, Heyne D, González C. School attendance and problematic school absenteeism in youth. In., vol. 11: *Frontiers Media SA*; 2020: 602242.
25. Liu H-C, Chaou C-H, Lo C-W, Chung H-T, Hwang M-S. Factors affecting psychological and health-related quality-of-life status in children and adolescents with congenital heart diseases. *Children*. 2022;9(4):578.
26. Kim GB. Psychosocial adjustment and quality of life of adolescents and adults with congenital heart disease. *Korean J Pediatr*. 2014;57(6):257.

Figures

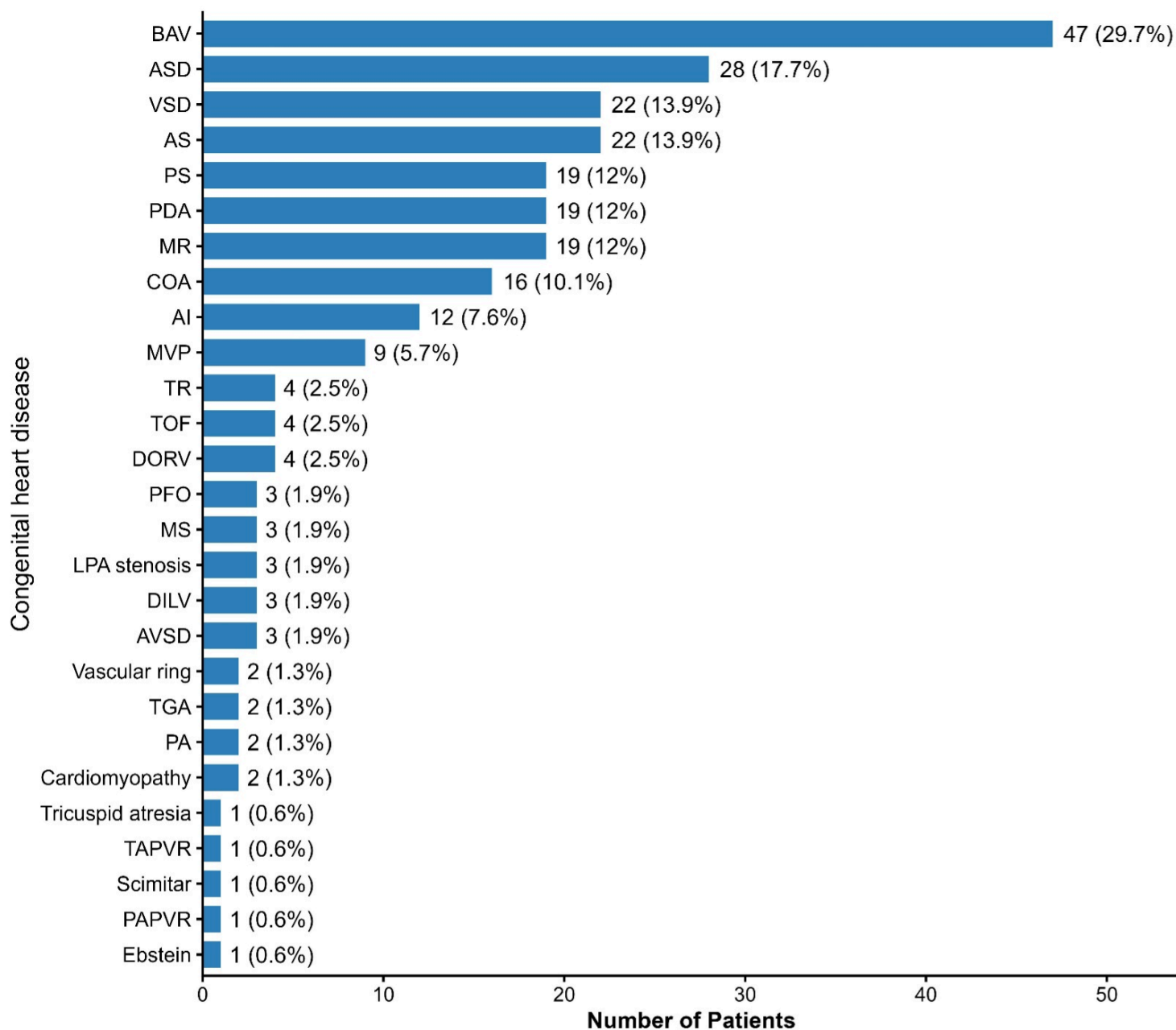


Figure 1

Distribution of congenital heart disease diagnoses among the study population (N = 158)