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Research Article

Congenital Heart Disease Surgery in Adults in KSA: A cross-sectional study

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Abstract

Background: Adults with CHD often experience long-term complications, reduced quality of life (QoL), and psychosocial challenges. In Saudi Arabia, there is limited data on the clinical, demographic, and psychosocial profiles of adults undergoing surgery for CHD. This study aims to explore these aspects, with a focus on post-surgical outcomes, quality of life, and access to specialized care.

Methodology: This cross-sectional study included adult CHD patients who underwent surgical interventions and were followed at a tertiary care center in Saudi Arabia. Data were collected through a structured questionnaire and medical records. The questionnaire included demographic information, clinical history, surgical details, postoperative complications, and psychosocial factors. Additionally, quality of life was assessed using the Short Form-36 (SF-36) health survey. Descriptive statistics were used to summarize the findings, and correlations between demographic and clinical variables and QoL outcomes were analyzed.

Results: The study sample consisted of 386 adult CHD patients, predominantly male (72%) and married (84.2%), with 83.9% having a university-level education. The most common congenital defects were ventricular septal defect (VSD) (70.2%). Most participants (78.8%) underwent catheter-based interventions, while 9.1% had multiple surgeries and 10.4% had undergone heart transplants. Postoperative complications included arrhythmias (55.8%), blood clots (38.9%), and stroke (44.2%). Nearly one-third of participants (29.3%) reported frequent anxiety or worry about their condition, while 12.4% had a formal diagnosis of anxiety or depression. The SF-36 results indicated moderate physical functioning (mean score: 71.50), with limitations in social functioning (mean score: 50.00) and emotional health.

Conclusion: The findings highlight the complex and chronic nature of CHD in adulthood, with significant postoperative complications, psychological distress, and reduced QoL. This underscores the need for comprehensive, multidisciplinary care that integrates mental health support, patient education, and long-term follow-up.

Key words: Congenital heart disease; Adults; heart surgery; Saudi Arabia.

Introduction

Congenital Heart disease (CHD) is consisted of different range of structural anomalies occurred for heart that present at birth and has a prevalence of 8-12 child per 1,000 live births globally [1–3]. Thanks to advances in pediatric cardiology, heart surgery techniques, and perioperative care, survival rates for people with CHD have greatly increased over the last few decades [4,5]. This translates into a rising number of grownups living with repaired or palliated congenital heart defects since more than 85% of children suffering from CHD now survive into adulthood [6,7]. This change calls for more focus on long-term consequences including quality of life, need for continuous medical monitoring, and late side effects risk [8,9].

Thanks to sophisticated pediatric cardiology facilities and surgical operations, Saudi Arabia has seen tremendous advances in CHD diagnosis and treatment [10]. Adults in the area who have had surgery for CHD have though not been fully examined in terms of long-term outcomes. For several of these people, including others arrhythmias, heart failure, pulmonary hypertension, and requirement for reinterventions, their health problems persist to be serious [11]. Moreover, in adult patients with less or asymptomatic defects during childhood, especially in those with milder or asymptomatic defects, some cases of CHD go undiagnosed until adulthood requiring later in life surgery [12].

Adults living with CHD in Saudi Arabia's long-term health status, quality of life, and post-surgical results are poorly documented despite their rising numbers

[8]. Research in both Western and Asian societies has shown the value of organized follow-up, multidisciplinary treatment, and patient education in improving results for this group [13]. Emphasizing the need of area-specific studies, nonetheless, cultural, healthcare system, and demographic variations might affect the experiences and difficulties faced by Saudi adults with CHD.

Including both patients treated in early life and those first diagnosed in adulthood, this research looks at the long-term results of adults having had CHD surgery in Saudi Arabia. Using a cross-sectional questionnaire-based method, this study will assess major points such clinical status, postoperative problems, medical use, and quality of life. Helping to shape healthcare policies, improve long-term care planning, and guide future legislation development to better handle adult CHD patients in Saudi Arabia by offering knowledge on the needs and issues of this population group, the results might also influence healthcare strategies. Adults in Saudi Arabia who have had surgery for congenital heart disease will be evaluated in the research for long-term health results, side effects, and quality of living. The study tries to find possible risk factors for negative results and assess how much surgery affects patients' general quality of life as well as medical use.

Methodology:

This study utilized a cross-sectional design to investigate the long-term outcomes of adults who had undergone surgery for congenital heart disease (CHD) in Saudi Arabia. Data were collected through a questionnaire-based survey, which facilitated the assessment of clinical status, postoperative complications, healthcare utilization, and quality of life. This design was appropriate for examining associations between variables at a single point in time and provided valuable insights into the long-term impact of CHD surgery.

The study was conducted at major hospitals and cardiology centers across Saudi Arabia that specialize in the surgical treatment and follow-up care of adult CHD patients. These institutions were selected based on their recognized expertise in managing CHD and their ability to grant access to eligible patients. Recruitment was carried out using hospital records, outpatient clinics, and cardiology departments to ensure a representative sample of the adult CHD population in Saudi Arabia.

The target population for this study included adults aged 18 years and older who had undergone surgical intervention for CHD, including both those treated during childhood and those diagnosed and operated on in adulthood. Participants were required to meet specific inclusion criteria, which included having a documented history of CHD surgery, attending follow-up care at the participating hospitals, and providing informed consent. Patients with incomplete medical records related to CHD surgery, severe cognitive impairment that impaired their ability to complete the questionnaire, a history of heart transplantation, or those who declined to participate or withdrew consent were excluded from the study.

The sample size was determined through statistical power analysis, taking into account the estimated prevalence of CHD among adults and the anticipated differences in long-term outcomes between subgroups. The calculation was performed using a 5% margin of error and a 95% confidence level to ensure that the study had sufficient statistical power to detect significant differences.

A purposive sampling technique was employed to recruit participants who met the eligibility criteria. This non-probability sampling method was deemed appropriate for targeting a specific population, namely adults with a history of CHD surgery, and helped enhance the representativeness of the sample. Eligible participants were identified from hospital records and outpatient clinic registries.

Data were collected using a structured and validated questionnaire, which was administered during in-person hospital visits and, where applicable, through online platforms. The questionnaire gathered information on various aspects, including demographic data (age, gender, marital status, education level, and employment status), medical history (type of CHD, age at diagnosis, type and timing of surgical interventions, history of reoperations, and comorbidities), postoperative complications (such as arrhythmias, heart failure, and pulmonary hypertension), healthcare utilization (frequency of hospital visits, admissions, medications, and ongoing treatments), and quality of life (physical, psychological, and social well-being). Quality of life was assessed using validated scales, such as the SF-36, to provide a comprehensive understanding of participants' overall well-being.

The collected data were analyzed using Statistical Package for the Social Sciences (SPSS) software. Descriptive statistics summarized patient characteristics, clinical outcomes, and quality-of-life measures. Continuous variables were presented as means and standard deviations, while categorical variables were reported as frequencies and percentages. Comparative analyses were conducted using chi-square tests for categorical variables, independent t-tests or Mann-Whitney U tests for continuous variables, and multivariate regression analysis to identify predictors of adverse long-term outcomes. A p-value of less than 0.05 was considered statistically significant.

Ethical approval for the study was obtained from the Institutional Review Board (IRB) of the participating hospitals. Informed consent was obtained from all participants after they were briefed on the study objectives and agreed to participate voluntarily. Confidentiality was strictly maintained by anonymizing all responses and securely storing the collected data. Ethical principles, including beneficence, non-maleficence, and respect for autonomy, were upheld throughout the study to safeguard participants' rights and well-being.

Results:

The demographic profile of the participants showed a male predominance, with 278 (72.0%) male respondents and 108 (28.0%) females. The marital status distribution revealed that the majority were married, accounting for 325 (84.2%) of the participants, followed by 38 (9.8%) who were single, 14 (3.6%) who were divorced, and 9 (2.3%) who were widowed. In terms of educational attainment, 324 (83.9%) had a university degree, while 16 (4.1%) pursued postgraduate education. Participants with secondary school education constituted 34 (8.8%), primary school graduates were 8 (2.1%), and 4 (1.0%) had no formal education. Employment status data indicated that 230 (59.6%) of participants were employed full-time, while 89 (23.1%) were retired, 31 (8.0%) were unemployed, 23 (6.0%) were students, and 13 (3.4%) were employed part-time. Regarding income distribution, most participants (59.3%) reported earning more than 10,000 SAR per month, followed by 88 (22.8%) earning less than 3,000 SAR, 37 (9.6%) in the 3,000–6,000 SAR bracket, and 32 (8.3%) earning 6,001–10,000 SAR (Table 1).

Table 1: Demographic factors of the participants

		Count	Column N %
Gender	Male	278	72.0%
	Female	108	28.0%
Marital status	Single	38	9.8%
	Married	325	84.2%
	Divorced	14	3.6%
	Widow	9	2.3%
Level of education	No formal education	4	1.0%
	Primary school	8	2.1%
	Secondary school	34	8.8%
	University degree	324	83.9%
	Postgraduate degree	16	4.1%
Employment status	Employed (full-time)	230	59.6%
	Employed (part-time)	13	3.4%
	Unemployed	31	8.0%
	Retired	89	23.1%
	Student	23	6.0%
Monthly income	Less than 3,000 SAR	88	22.8%
	3,000 - 6,000 SAR	37	9.6%
	6,001 - 10,000 SAR	32	8.3%
	More than 10,000 SAR	229	59.3%

The majority of participants were diagnosed with Ventricular Septal Defect (VSD), comprising 271 (70.2%) of the sample, followed by Atrial Septal Defect (ASD) and Tetralogy of Fallot (TOF), each affecting 35 (9.1%) participants. Fewer cases were diagnosed with Coarctation of the Aorta (19, 4.9%) and Transposition of the Great Arteries (TGA) (17, 4.4%), while 9 (2.3%) had other congenital heart diseases (CHDs).

When examining the types of surgical interventions, catheter-based interventions were the most common, reported by 304 (78.8%) participants, compared to 82 (21.2%) who underwent open-heart surgery. A small proportion of participants (9.1%) had undergone more than one surgery for CHD, while 90.9% had only one surgery. Regarding heart transplants, 40 (10.4%) had undergone the procedure. CHD-related complications necessitated additional procedures or hospitalizations for 124 (32.1%) participants, while 262 (67.9%) had no such history. Medication use for heart-related conditions was low, with 30 (7.8%) participants on medication. Follow-up frequency varied, with 96 (24.9%) attending cardiology appointments every three months, 67 (17.4%) every six months, 84 (21.8%) annually, and 139 (36.0%) attending less than once a year. Hospital admissions for heart-related issues in the past five years were reported by 46 (11.9%) participants. Among those admitted, 20 (43.5%) were hospitalized three times, 18 (39.1%) twice, 7 (15.2%) once, and 1 (2.2%) four times. Most participants (78.8%) had access to specialized adult congenital heart disease (ACHD) care, while 10.9% did not, and 10.4% were uncertain (Table 2).

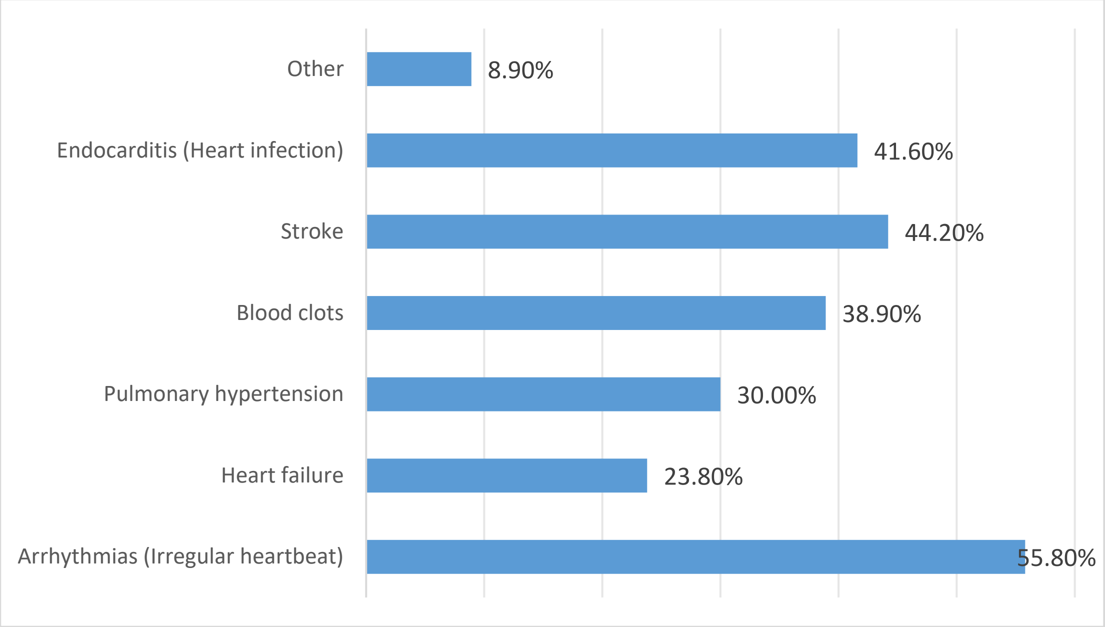
Table 2: Clinical Characteristics and Medical History of Participants

		Count	Column N %
What type of congenital heart disease (CHD) were you diagnosed with?	Atrial Septal Defect (ASD)	35	9.1%
	Ventricular Septal Defect (VSD)	271	70.2%
	Tetralogy of Fallot (TOF)	35	9.1%
	Coarctation of the Aorta	19	4.9%
	Transposition of the Great Arteries (TGA)	17	4.4%
	other	9	2.3%
What type of surgery did you undergo?	Open-heart surgery	82	21.2%
	Catheter-based intervention	304	78.8%
Have you had more than one surgery for CHD?	No	351	90.9%
	Yes	35	9.1%
Have you undergone a heart transplant?	No	346	89.6%
	Yes	40	10.4%
Have you required additional medical procedures or hospitalizations due to CHD-related complications?	No	262	67.9%
	Yes	124	32.1%
Are you currently on any medications for heart-related conditions?	No	356	92.2%
	Yes	30	7.8%
How often do you visit a cardiologist for follow-up?	Every 3 months	96	24.9%
	Every 6 months	67	17.4%
	Once a year	84	21.8%
	Less than once a year	139	36.0%
Have you been admitted to the hospital for heart-related issues in the past 5 years?	No	340	88.1%
	Yes	46	11.9%
If yes, How many times?	1	7	15.2%
	2	18	39.1%
	3	20	43.5%
	4	1	2.2%
Do you have access to specialized adult congenital heart disease (ACHD) care in your region?	No	42	10.9%
	Yes	304	78.8%
	Not sure	40	10.4%

The most frequently reported post-surgical complication was arrhythmias (irregular heartbeat), affecting 169 (55.8%) participants. Other complications included stroke (44.2%), blood clots (38.9%), endocarditis (41.6%), pulmonary hypertension (30.0%), and heart failure (23.8%). A smaller proportion, 8.9%, reported experiencing other complications (FIgure 1).

Regarding lifestyle modifications, 127 (23.6%) participants reported engaging in regular physical activity, 122 (22.7%) practiced stress management, 108 (20.1%) adopted dietary modifications, and 37 (6.9%) quit smoking. However, 144 (26.8%) reported no lifestyle changes despite recommendations from healthcare providers (Figure 2).

Figure 1:Have you experienced any of the following complications after your surgery?



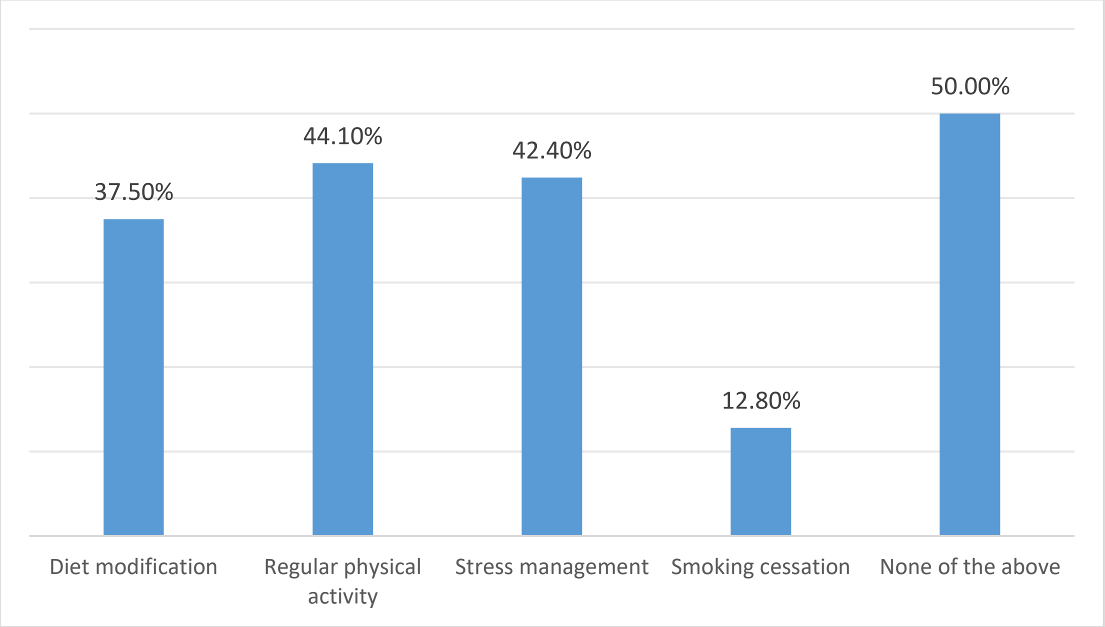


Figure 2: Have you undergone any lifestyle changes recommended by your healthcare provider?

A significant proportion of participants (45.6%) reported that they did not feel anxious or worried about their heart condition, while 113 (29.3%) felt very often anxious, and 97 (25.1%) experienced occasional anxiety. Regarding mental health diagnoses, 48 (12.4%) had been diagnosed with depression or anxiety related to their heart condition. However, only 48 (12.4%) reported receiving psychological or emotional support, while the majority (79.3%) did not. In terms of satisfaction with medical care, 194 (50.3%) participants were satisfied, and 112 (29.0%) were very satisfied. However, 48 (12.4%) were neutral, and 16 (4.1%) each were dissatisfied or very dissatisfied. While 258 (66.8%) participants felt they had adequate information about their condition, 63 (16.3%) felt otherwise, and 65 (16.8%) were unsure. A majority (91.7%) expressed interest in receiving more education on managing their condition (Table 3).

Table 3: Psychological and Emotional Well-being

		Count	Column N %
20. Do you feel anxious or worried about your heart condition?	Yes, very often	113	29.3%
	Yes, sometimes	97	25.1%
	No, not at all	176	45.6%
20. Have you ever been diagnosed with depression or anxiety related to your heart condition?	Yes	48	12.4%
	No	338	87.6%
20. Do you receive psychological or emotional support for your condition?	Yes	48	12.4%
	No	306	79.3%
	3	32	8.3%
20. How satisfied are you with the medical care you receive for your CHD?	Very satisfied	112	29.0%
	Satisfied	194	50.3%
	Neutral	48	12.4%
	Dissatisfied	16	4.1%
	Very dissatisfied	16	4.1%
Do you feel you have enough information about your heart condition and how to manage it?	Yes	258	66.8%
	No	63	16.3%
	Not sure	65	16.8%
26.Would you like to receive more education on managing your condition?	Yes	354	91.7%
	No	32	8.3%

The mean score for physical functioning was 71.50 (SD = 11.79), indicating moderate physical health. Role limitations due to physical health (M = 61.08, SD = 43.94) and emotional problems (M = 62.44, SD = 47.41) also reflected moderate functioning. Energy/fatigue (M = 50.89, SD = 1.92) and emotional well-being (M = 51.04, SD = 5.94) were average, while social functioning scored exactly at the midpoint (M = 50.00, SD = 0.00). Pain (M = 51.63, SD = 32.59) and general health (M = 50.56, SD = 7.25) showed similar patterns, reflecting moderate to average outcomes.

Correlation analysis showed minimal or weak associations between demographic factors and SF-36 scores. Age and gender had negligible correlations with physical functioning, emotional well-being, and other SF-36 domains. Marital status was weakly but significantly associated with role limitations due to emotional problems (r = -0.106, p = 0.037). Other variables, including educational level, employment status, and monthly income, did not show statistically significant correlations with any SF-36 subscales. Additionally, CHD type, surgical type, and follow-up frequency were not meaningfully correlated with participants' quality of life scores (Figure 4).

Discussion

This study provides important insights into the demographic characteristics, clinical profiles, surgical interventions, and psychosocial aspects of adults with congenital heart disease (CHD) in Saudi Arabia. By analyzing the data of CHD patients, we aimed to explore their post-surgical outcomes, quality of life, and the challenges they encounter in managing their condition.

The demographic profile revealed that the majority of participants were male (72%), married (84.2%), and held university-level education (83.9%). The male predominance in the sample aligns with previously reported gender patterns in congenital heart disease (CHD) populations, where certain CHD subtypes, such as tetralogy of Fallot (TOF) and transposition of the great arteries (TGA), are more frequently observed in males [14]. Additionally, the male predominance in this study may reflect gender-based differences in health outcomes and survival patterns among adults with CHD, as women with complex congenital defects are often at increased risk of complications related to pregnancy and may receive different follow-up care [15].

The most common congenital defect was ventricular septal defect (VSD) (70.2%), followed by atrial septal defect (ASD) and tetralogy of Fallot (TOF), which is consistent with global epidemiological data showing that septal defects account for the majority of CHD cases [3,16,17]. Additionally, most participants (78.8%) underwent catheter-based interventions rather than open-heart surgery. This aligns with the growing trend toward minimally invasive procedures due to their lower risk profiles, reduced recovery time, and fewer complications [18,19].

A notable finding is that 9.1% of participants underwent more than one surgery, indicating the complex nature of their heart defects and the potential for recurring complications. Previous research has shown that patients with more severe forms of CHD, such as TOF or transposition of the great arteries (TGA), often require multiple surgeries throughout their lifetime [20]. Furthermore, 10.4% of participants had undergone heart transplants, emphasizing the long-term impact and severity of CHD in certain cases.

Postoperative complications were reported by a substantial proportion of participants. Arrhythmias (55.8%), blood clots (38.9%), and stroke (44.2%) were among the most frequently reported issues. These findings are consistent with previous studies that identify arrhythmias as one of the most common long-term complications in adults with CHD, particularly following surgical correction of septal defects and TOF [21-23]. Additionally, the incidence of thromboembolic events, including blood clots and stroke, highlights the need for ongoing anticoagulation therapy and regular monitoring [21].

Table 4: Correlation between SF-36 results and demographic factors

		Physical functioning	Role limitations due to physical health	Role limitations due to emotional problems	Energy/fatigue	Emotional well-being	Social functioning	Pain	General health
Age	Pearson Correlation	.002	-.011	-.012	.001	-.004	.[b]	.003	.051
	Sig. (2-tailed)	.971	.837	.807	.980	.930	.	.951	.322
Gender	Pearson Correlation	.028	.004	.035	-.035	-.014	.[b]	-.010	.052
	Sig. (2-tailed)	.579	.941	.488	.496	.783	.	.852	.311
Marital status	Pearson Correlation	.043	-.072	-.106*	.015	-.002	.[b]	.013	.006
	Sig. (2-tailed)	.396	.157	.037	.766	.975	.	.794	.903
Level of education	Pearson Correlation	.006	.058	.055	.040	.024	.[b]	.016	-.049
	Sig. (2-tailed)	.910	.252	.285	.429	.635	.	.756	.334
Employment status	Pearson Correlation	-.003	.026	.036	.030	-.032	.[b]	.043	.044
	Sig. (2-tailed)	.960	.609	.475	.559	.525	.	.404	.391
Monthly income	Pearson Correlation	.009	-.002	-.010	-.021	.042	.[b]	-.042	-.062
	Sig. (2-tailed)	.862	.962	.844	.686	.411	.	.406	.225
What type of congenital heart disease (CHD) were you diagnosed with?	Pearson Correlation	-.009	.023	.018	.024	-.004	.[b]	.034	.033
	Sig. (2-tailed)	.857	.658	.730	.635	.945	.	.510	.513
What type of surgery did you undergo?	Pearson Correlation	-.044	.019	.025	.077	.006	.[b]	.038	.022
	Sig. (2-tailed)	.389	.707	.625	.131	.910	.	.454	.660

Approximately 11.9% of participants had been admitted to the hospital for heart-related issues in the past five years, with most hospitalizations occurring two to three times. This underscores the chronic and potentially progressive nature of CHD in adulthood, necessitating continuous follow-up care to prevent acute exacerbations [22].

Our findings also shed light on the psychosocial impact of living with CHD. Nearly one-third of participants (29.3%) reported feeling anxious or worried about their heart condition "very often," and 12.4% had been diagnosed with anxiety or depression related to their condition. This is consistent with existing research showing that individuals with CHD are at an increased risk of psychological distress, partly due to the uncertainty surrounding their health and the impact of their condition on daily life [24,25]. Despite this, only 12.4% of participants reported receiving psychological or emotional support, suggesting a potential gap in mental health services for CHD patients.

The results from the SF-36 survey indicate that physical functioning (mean score: 71.50) and social functioning (mean score: 50.00) were moderately preserved, while role limitations due to physical and emotional health were lower (mean scores: 61.08 and 62.44, respectively). This aligns with prior studies that highlight reduced quality of life (QoL) in adults with CHD, particularly in domains related to physical and emotional health [26,27]. Factors such as fatigue, recurrent hospitalizations, and limitations in physical activity are known contributors to lower QoL scores [27].

Access to specialized adult congenital heart disease (ACHD) care was reported by 78.8% of participants, reflecting progress in the availability of ACHD services in Saudi Arabia. However, 16.3% of participants felt they lacked adequate information about their condition, and 91.7% expressed a desire for more education on managing CHD. This emphasizes the critical role of patient education in empowering individuals to take an active role in their care. Research has shown that tailored educational interventions can significantly improve self-management behaviors and health outcomes in chronic disease populations [28].

The findings of this study have several implications for clinical practice and public health. First, the high prevalence of postoperative complications and hospitalizations underscores the importance of long-term follow-up care, including regular cardiology assessments, medication management, and screening for arrhythmias and thromboembolic events. Second, the psychosocial burden associated with CHD highlights the need for integrating mental health services into routine care for CHD patients. Third, enhancing patient education and promoting health literacy could empower patients to better manage their condition and improve their quality of life.

This study has several limitations that should be acknowledged. The cross-sectional design limits our ability to establish causal relationships between demographic factors, clinical variables, and QoL outcomes. Additionally, the reliance on self-reported data may introduce recall bias. Future research should consider longitudinal designs to better understand the long-term trajectories of CHD patients and the factors that influence their outcomes.

Conclusion

In conclusion, this study provides valuable insights into the demographic, clinical, and psychosocial profiles of adults with CHD in Saudi Arabia. The findings highlight the importance of comprehensive, multidisciplinary care that addresses not only the physical but also the psychological and educational needs of CHD patients. Efforts to enhance patient education, improve access to specialized care, and integrate mental health support are critical for improving the overall well-being and quality of life of this population.

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