

Quality of Life and Health Status of Adults With Congenital Heart Disease in Vietnam: A Cross-Sectional Study

Thanh-Huong Truong

Hanoi Medical University

Ngoc-Thanh Kim (✉ kimngocthanh@hmu.edu.vn)

Hanoi Medical University

Mai-Ngoc Thi Nguyen

Bạch Mai Hospital

Doan-Loi Do

Hanoi Medical University

Hong Thi Nguyen

Thanh Nhan Hospital

Thanh-Tung Le

Bạch Mai Hospital

Hong-An Le

School of Medicine and Pharmacy, Vietnam National University

Research Article

Keywords: quality of life, health status, congenital heart disease, adults, Vietnam

Posted Date: February 5th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-163728/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Abstract

Background: Little is known about the quality of life (QOL) and health status of adults with congenital heart disease (CHD) in developing countries. Therefore, this study aimed to describe the QOL and health status of adults with CHD and investigate the association between QOL and biological and social characteristics of these patients in Vietnam.

Methods: A cross-sectional study was performed among 109 adults with CHD, hospitalised in the Vietnam National Heart Institute, between June 2019 and December 2019. Validated instruments to assess QOL and health status describing patient-reported outcomes were used, including the EuroQOL-5 Dimensions-5 Level, Satisfaction with Life Scale and Hospital Anxiety and Depression Scale.

Results: The overall mean scores on the EuroQOL-descriptive system (EQ-DS) and the EuroQOL visual analogue scale (EQ-VAS) were 0.792 (*SD* = 0.122, 95% confidence interval, CI 0.769–0.815) and 66.3 (*SD* = 12.5, 95% CI 63.9–68.7), respectively. Symptoms of anxiety and depression were common among adults with CHD (18.7%, *n* = 20 and 11%, *n* = 12; respectively). Stratified multivariate logistic regression revealed: poor QOL using the EQ-DS, and that anxiety related to suffering from a complex CHD/ pulmonary artery hypertension (PAH) (Odds Ratio, OR = 4.55, 95% CI: 1.26–16.4, *p* = 0.021 and OR = 4.19, 95% CI 1.2–14.56, *p* = 0.024; respectively); poor QOL using the EQ-VAS, anxiety, and depression related to being unemployed/ unstable employment (OR = 4.16, 95% CI 1.64–10.56, *p* = 0.003; OR = 3.63, 95% CI 1.23–10.72, *p* = 0.02 and OR = 7.68, 95% CI 2.09–28.25, *p* = 0.002; respectively); and life dissatisfaction related to being unmarried (OR = 4.63, 95% CI 1.2–17.86, *p* = 0.026).

Conclusions: Adults with CHD in Vietnam experienced low QOL, and high levels of anxiety and depression. Poor QOL and psychological problems were related to being female, unmarried, low educational level, unemployed/ unstable employ, and complex CHD/ PAH.

Background

Congenital heart disease (CHD) is a common cardiac structural abnormality that affects one in 100 live births, globally. Many countries have made efforts towards improving the diagnostic quality and treatment of CHD, which has resulted in many children with CHD surviving well into adulthood [1-3]. Several adults with CHD continually face physical and psychosocial difficulties and experience a declined quality of life (QOL) [4-7]. Thereby, current guidelines on adults with CHD recommend comprehensive care to improve their QOL. This is useful for increasing integration opportunities in social activities and the daily lives of adults with CHD. In this context, knowledge of QOL in adults with CHD is an emerging domain and deserves investigation. However, in the long-term, many studies on QOL related to CHD have focused on children, adolescents, or their parent, despite the existence of a large gap in the knowledge regarding QOL and health status in adults with CHD, especially in developing countries [4, 8-13]. The inconsistency of the QOL status of adults with CHD in developed countries and developing countries is concerning. Previous studies conducted in developed countries showed high QOL in adults with CHD [4, 14, 15]. In contrast, the QOL of adults with CHD in developing countries seems poorer than the healthier population of the developing countries [13]. Notably, according to the World Health Organization, a high QOL is the results of a good physical health status, normal psychological state, and positive social relationships. These items depend on medical intervention, healthcare systems, financial conditions of the concerned individual, the economic conditions of the nations and the sociocultural characteristics that differ among countries; for example, these characteristics may differ between Asian and European countries, low-/middle-income countries and high-income countries, developing

and developed countries. Recently, an international study found that the effect of country specific characteristics of QOL score of adults with CHD has a great difference of 10.5 points between countries with the highest and lowest QOL [8, 16]. From the abovementioned studies, we can conclude that it is essential to conduct research on QOL in adults with CHD in developing countries. This would be the base of implementation of important health and social policies to improve the QOL of adults with CHD in developing countries.

Vietnam is a densely-populated, dynamic country in Southeast Asia, with a population of 97 million; it can be classified as a low-/ middle-income country. Apart from economic development, the Vietnamese government has also focused on improving the healthcare system. In fact, a previous study has highlighted the screening programs, diagnostic approaches, and treatment for patients with CHD throughout the country [17]. Owing to these programs, many children have received timely intervention and have survived into adulthood. However, there is a gap for management for adults with CHD in Vietnam, including programs to improving their QOL. In this context, characteristics of Vietnamese patients might be generalised for adults with CHD in developing countries. In details, certain characteristics of adults with CHD include low level of education, unmarried status, unemployment, and unrepaired defects. However, we lack information about the assessed QOL in adults with CHD and its relationship with different sociodemographic characteristics in these countries. Therefore, the present study aimed to describe the QOL and health status of adults with CHD in Vietnam and investigate the association between the QOL and the biological and social characteristics of these patients.

Methods

Study Design

We performed a cross-sectional study at the Vietnam National Heart Institute, Bach Mai Hospital (Hanoi, Vietnam)—the largest hospital for adults with CHD in North Vietnam, and the national referral cardiovascular hospital, between June 2019 and December 2019. We recruited inpatients, who were admitted for cardiac imaging, intervention or surgery for CHD. All patients included in this study provided informed consent. The protocol of the current study and ethics approval for the human study was obtained from the Science Boards and Ethics Committee of the Department of Cardiology, Hanoi Medical University (no: 6655/QD-DHYHN). All the experiment protocol for involving human data was in accordance to Declaration of Helsinki.

Inclusion criteria

The inclusion criteria were: (1) individuals with structural CHD confirmed by cardiac imaging and (2) aged ≥ 16 years. Transthoracic echocardiography was performed by experts on patients with CHD at Vietnam National Heart Institute during admission. If structural CHD on transthoracic echocardiography was doubted, we confirmed structural CHD by transoesophageal echocardiography, and/or cardiac computed tomography, and/or cardiac magnetic resonance imaging. In the study, we defined the age of attaining legal adulthood as 16 years, according to the Law on Children of Vietnam (<http://vbpl.vn/TW/Pages/vbpqen-toanvan.aspx?ItemID=11044>).

Exclusion criteria

Exclusion criteria for participants were: (1) other known cardiac diseases than CHD, (2) other known chronic diseases that require ongoing medical attention or limit activities of daily living, (3) known neuropathies, mental disorders, and syndromes affecting cognitive abilities, and (4) emotional fragility.

Sample size

The sample size was calculated using the following formula in cross-sectional studies: $N = \frac{Z_{1-\alpha/2}^2 P(1-P)}{d^2}$; where N is the sample size, Z is the statistic corresponding to the confidence level, P is the expected prevalence and d is precision. With a prevalence rate of reduced QOL in adults with CHD of 29.7% [8], the prevalence rate of psychological problems in adults with CHD is 58.7% [18], a confidence interval (CI) of 95%, and a precision of 0.1, sample size was calculated as 94. To prevent missing data, we added 15% to the sample size. Therefore, the final sample size was 109.

Outcome measures

The patients completed a survey that included items of biological and social characteristics such as age, sex, marital status, employment status, educational level, CHD type and CHD treatment. Subsequently, the following validated instruments describing patient-reported outcomes were completed to assess QOL and health status: EuroQOL-5 dimensions-5 level (EQ-5D-5L), Satisfaction with Life Scale (SWLS), Hospital Anxiety and Depression Scale (HADS). Additionally, face-to-face interviews were conducted by one well-trained nurse. This nurse answered and clarified the questions and doubts of patients during the survey. She also ensured that patients completed the survey independently.

Primary outcomes measures were self-reported QOL that was evaluated by EQ-5D-5L and SWLS, and self-reported psychosocial functioning that was evaluated by HADS. Secondary outcomes measures were socioeconomic status and the relationship between socioeconomic status and QOL and health status in adults with CHD.

Vietnamese translation scales for QOL and health status

The EQ-5D-5L is a questionnaire to assess health-related QOL and includes EQ-descriptive system (EQ-DS) and EQ visual analogue scale (EQ-VAS) (**Supplementary 1**, <https://euroqol.org/eq-5d-instruments/sample-demo/>). Here, we referred to the previous Vietnamese translation EQ-5D-5L version that was developed taking into consideration the health preferences of the general adult population of Vietnam and validated elsewhere [19]. EQ-DS defines health based on five dimensions: Mobility, Self-Care, Usual Activities, Pain/Discomfort, and Anxiety/Depression. Responses are rated on a five-point Likert-type rating scale (no problems, slight problems, moderate problems, severe problems, and extreme problems). The value set for EQ-DS was redesigned for the Vietnamese population on a scale of 0 (worst imaginable QOL) to 1 (best imaginable QOL), while on the EQ-VAS, respondents rated the overall health of the day of the interview with scores ranging from 0 to 100, representing the worst and the best imaginable health state, respectively. Notably, poor QOL was defined by EQ-DS less than 0.65 or EQ-VAS less than 65 [20].

The SWLS was a five-item instrument to measure general cognitive fundamentals of life satisfaction. Each item is rated from one (strongly disagree) to seven (strongly agree) for a total score of 5–35 (**Supplementary 2**, <http://labs.psychology.illinois.edu/~ediener/SWLS.html>). A score of 20 represents a neutral point on the scale, while scores of 31–35, 26–30, 21–25, 15–19, 10–14, and 5–9 indicate that the respondent is extremely satisfied, satisfied, slightly satisfied, slightly dissatisfied, dissatisfied, and extremely dissatisfied with life, respectively [21]. In our study, we referred to the Vietnamese translation version of the SWLS that was available (<https://eddiener.com/scales/7>).

The HADS comprises 14 items (graded as 0–3), which include seven items each for symptoms of anxiety (HADS-Anxiety subscale, HADS-A) and depression (HADS-Depression subscale, HADS-D) (**Supplementary 3**, <https://www.svri.org/sites/default/files/attachments/2016-01-13/HADS.pdf>). The total scores for depression and for anxiety range between 0 and 21. We considered a score of 8–10 to represent borderline abnormality and 11–21 to represent symptoms of anxiety or depression [22]. In this study, we referred to the Vietnamese translation version of the HADS, whose validity and reliability were confirmed in the previous studies with Cronbach's alpha as 0.80 for the HADS-D and 0.85 for the HADS-A [23, 24].

Following this, in our study, we modified the Vietnamese translation scales (EQ-5D-5L, SWLS, and HADS) above. Some Vietnamese words were retranslated to make questions and options more understandable for interviewees. The process of modifying the Vietnamese translation scales included three stages. In stage one, the EQ-5D-5L, SWLS, and HADS were independently translated from English into Vietnamese by three professionals fluent in English: one cardiologist, one fifth year student and one translator who had a medical background. In stage two, a medical expert compared all versions of the translations produced in the previous steps with the available translated version and agreed on the pre-final version. Finally, in stage three, our research team, consisting of all the members conducting in this study, discussed the pre-final version, reached consensus and produced the final Vietnamese translation versions of the EQ-5D-5L, SWLS, and HADS (**Supplementary 4**).

Statistical Analysis

Data were analysed by SPSS v22 (IBM Inc., Armonk, NY, USA). Normally-distributed continuous variables are described as mean (standard deviation [*SD*], 95% CI) and non-normally distributed continuous variables are described as median and interquartile range (IQR). Nominal variables are presented as absolute numbers (*n*) and percentages. Frequencies and percentages were calculated for nominal variables. Differences in normally distributed continuous variables were assessed using the Student's *t*-test, and differences in non-normally distributed variables were assessed using the Mann–Whitney U tests. Comparisons of nominal variables between subgroups were performed by Chi-square tests or Fisher's exact tests. The univariable and multivariable forward logistic regression model using the forward stepwise method (likelihood ratio) was performed to evaluate the associations between biological-social characteristics and poor QOL and health status of the participants. In all analyses, a two-tailed *p*-value below 0.05 was considered statistically significant.

Results

Patient characteristics

A total of 109 adults with CHD were enrolled in this study. The patients were predominantly women (*n* = 76, 69.7%). The participants' overall mean age was 37.8 years (*SD* = 12.7, 95% CI 35.4–40.2); the mean age of the male and female patients was 33.7 years (*SD* = 13.4, 95% CI 29.0–38.5) and 39.6 (*SD* = 12.0, 95% CI 36.9–42.3) years, respectively. A majority of patients (*n* = 70, 64.2%) were older than 30 years. The characteristics of patients are summarized in **Table 1**. In addition, many patients had an education level of less than high school (*n* = 49, 45%); were unmarried (never married, widowed, divorced, separated; *n* = 30, 27.5%); were unemployed or had unstable employment (*n* = 27, 24.8%); and had complex CHD or pulmonary artery hypertension (PAH) (*n* = 16, 14.7%). Notably, most patients had unrepaired CHD (*n* = 81, 74.3%), or repaired palliation (*n* = 5, 4.6%).

Characteristics of quality of life

The overall mean EQ-DS and EQ-VAS were 0.792 ($SD = 0.122$, 95% CI 0.769–0.815) and 66.3 ($SD = 12.5$, 95% CI 63.9–68.7), respectively. The overall mean EQ-DS was significantly higher than EQ-VAS ($p < 0.001$, Student t -test). A significant number of adults with CHD had poor QOL (EQ-DS < 0.65 : $n = 13$, 11.9%; EQ-VAS < 65 : $n = 45$, 41.3%).

Table 2 summarises in details the distribution of EQ-5D-5L scale. Additionally, the most common problems reported were pain/discomfort ($n = 95$, 87.2%) followed by anxiety/depression ($n = 83$, 76.1%), mobility problems ($n = 46$, 42.2%), and problems with usual activities ($n = 41$, 37.6%), whereas the least reported complaint was regarding self-care ($n = 11$, 10.1%).

Characteristics of health status

The overall mean SWLS was 25.2 ± 4.3 (95% CI 24.3–25.9). Specifically, 3.7% participants were dissatisfied, 5.5% were slightly dissatisfied, 2.8% reported neutral, 42.2% were slightly satisfied, 36.7% satisfied, and 9.2% extremely satisfied. According to the HADS, the overall mean score for anxiety was 6.9 ($SD = 4.4$, 95% CI 6.1–7.8), and the overall mean score for depression was 5.9 ($SD = 3.8$, 95% CI 5.2–6.6). The anxiety component revealed that 18.7% ($n = 20$) patients experienced significant anxiety. Whiles, 11% ($n = 12$) of patients displayed significant symptoms of depression.

Association between quality of life, health status and biological-social characteristics in adults with congenital heart disease

As shown in **Table 3**, significant differences exist among the EQ-DS subgroups that were classified according to age, education level, employment status. The mean EQ-DS in patients aged > 30 years was lower than in whom aged ≤ 30 years (0.764 [$SD = 0.125$], 95% CI 0.734–0.794 vs 0.841 [$SD = 0.097$], 95% CI 0.81–0.873, $p = 0.001$ in overall; 0.766 [$SD = 0.111$], 95% CI 0.704–0.827 vs 0.853 [$SD = 0.086$], 95% CI 0.81–0.896, $p = 0.016$ in men; 0.764 [$SD = 0.13$], 95% CI 0.729–0.799 vs 0.831 [$SD = 0.106$], 95% CI 0.782–0.879, $p = 0.039$ in women; using the Student t -test; respectively). The mean EQ-DS in patients who had an education level less than high school was lower in whom had education level of high school and more (0.754 [$SD = 0.13$], 95% CI 0.716–0.791 vs 0.827 [$SD = 0.104$], 95% CI 0.8–0.855, $p = 0.002$ in overall; 0.746 [$SD = 0.132$], 95% CI 0.652–0.841 vs 0.863 [$SD = 0.061$], 95% CI 0.835–0.891, $p = 0.002$ in men; using Student t -test; respectively). The mean EQ-DS in patients without employment or unstable employment was lower than in employed patients (0.754 [$SD = 0.136$], 95% CI 0.7–0.808 vs 0.807 [$SD = 0.114$], 95% CI 0.782–0.833, $p = 0.049$ in overall; 0.737 [$SD = 0.151$], 95% CI 0.598–0.877 vs 0.848 [$SD = 0.071$], 95% CI 0.817–0.878, $p = 0.01$ in men; using the Student t -test; respectively). Moreover, the mean EQ-DS in employed women was lower than employed men as (0.79 [$SD = 0.125$], 95% CI 0.756–0.823 vs 0.848 [$SD = 0.071$], 95% CI 0.817–0.878, $p = 0.037$; using Student t -test; respectively).

As shown in **Table 4**, there existed significant differences of the mean EQ-VAS between subgroups that were classified according to age, education level, employment status, and CHD type. The mean EQ-VAS was lower in patients aged > 30 years comparing with patients aged ≤ 30 years (64.3 [$SD = 13.1$], 95% CI: 61.2–67.4 vs 69.9 [$SD = 10.8$], 95% CI: 66.4–73.4, $p = 0.024$ in overall; 60.7 [$SD = 12.1$], 95% CI: 53.6–67.8 vs 72.2 [$SD = 10.2$], 95% CI: 67.0–77.1, $p = 0.008$ in men; using the Student t -test; respectively). The mean EQ-VAS in patients with an education level less than high school, was lower in whom had education level as high school and more (63.2 [$SD = 11.9$], 95% CI: 59.7–66.6 vs 69.5 [$SD = 12.0$], 95% CI: 66.3–72.7, $p = 0.008$ in overall; 61.0 [$SD = 13.7$], 95% CI: 51.2–70.8 vs 71.9 [$SD = 9.1$], 95% CI: 67.6–76.1, $p = 0.015$ in men; using the Student t -test; respectively). The mean EQ-VAS in unemployed patients or patients with unstable employment was lower than in employed patients (61.3 [$SD = 10.0$], 95% CI: 57.4–65.2 vs 68.4 [$SD = 12.5$], 95% CI: 65.6–71.2, $p = 0.009$ in overall; 58.6 [$SD = 13.5$], 95% CI: 46.1–71.1

vs 71.1 [$SD = 9.6$], 95% CI: 67.1–75.2, $p = 0.009$ in men; using Student t -test; respectively). The mean EQ-VAS in complex CHD/ PAH patients was lower than in simple CHD patients (60.0 [$SD = 14.1$], 95% CI: 52.5–67.5 vs 67.4 [$SD = 12.0$], 95% CI: 64.9–69.9, $p = 0.029$ in overall; 56.0 [$SD = 11.4$], 95% CI: 41.8–70.2 vs 68.8 [$SD = 12.0$], 95% CI: 64.2–73.5, $p = 0.034$ in men; using the Student t -test; respectively). Moreover, the mean EQ-DS in unmarried women was 58.5 ($SD = 16.9$, 95% CI: 48.3–68.7), which was lower than in married women as 67.6 ($SD = 11.0$, 95% CI: 64.8–70.4) with $p = 0.016$, using the Student t -test.

Figure 1 shows prevalence of poor QOL by subgroups, in adults with CHD. Notably, the prevalence of poor QOL that was defined as EQ-DS < 0.65 in complex CHD or PAH patients was higher than in simple CHD patients (31.3%, $n = 5$ vs 8.6%, $n = 8$, $p = 0.01$; using the Chi-square test; respectively). While the prevalence of poor QOL that was defined as EQ-VAS < 65 in patients aged > 30 years, was higher than in patients aged ≤ 30 years (50%, $n = 35$ vs 25.6%, $n = 10$, $p = 0.013$; using the Chi-square test; respectively), the prevalence of poor QOL that was defined as EQ-VAS < 65 in patients with an education level less than high school, was higher than in whom had an education level as high school and more (55.1%, $n = 27$ vs 28.6%, $n = 16$, $p = 0.006$; using Chi-square test; respectively) and the prevalence of poor QOL that was defined as EQ-VAS < 65 in unemployed patients or patients who had unstable employment, was higher than that of employed patients (66.7%, $n = 18$ vs 37.6%, $n = 35$, $p = 0.001$; using Chi-square test; respectively).

Figure 2 shows prevalence of dissatisfaction by subgroups in adults with CHD. Notably, the prevalence of dissatisfaction in unmarried patients was higher married patients (20%, $n = 6$ vs 5.1%, $n = 4$, $p = 0.016$; using the Fisher's exact test; respectively).

Figure 3 shows prevalence of anxiety and depression by subgroups in adults with CHD. Notably, prevalence of anxiety in unemployed patients or patients who had unstable employment was higher than in employed patients (34.6%, $n = 9$ vs 14.1%, $n = 11$, $p = 0.022$; using *Chi-square* test; respectively) and prevalence of depression in unemployed patients or patients who had unstable employment was higher than in employed patients (29.6%, $n = 8$ vs 5.1%, $n = 4$, $p = 0.002$; using the Fisher's exact test; respectively). Prevalence of anxiety in complex CHD/ PAH patients was higher than in simple CHD patients (40%, $n = 6$ vs 15.2%, $n = 14$, $p = 0.022$; using *Chi-square* test; respectively). Prevalence of depression in patients aged > 30 years was higher than in patients aged ≤ 30 years (17.1%, $n = 12$ vs 0%, $n = 0$, $p = 0.004$; using Fisher's exact test; respectively). Prevalence of depression in patients with an education level less than high school was higher than that of patients with an education level as high school and more (22.4%, $n = 0.001$ vs 1.8%, $n = 1$, $p = 0.001$; using Fisher's exact test; respectively).

The results of stratified univariable and multivariable logistic regressions in the prediction of poor QOL and health status are summarized in **Table 5**. Using multivariable logistic regression, poor QOL (EQ-DS < 0.65) was associated with being complex CHD/ PAH (OR = 4.55, 95% CI 1.26–16.4, $p = 0.021$). Poor QOL (EQ-VAS < 65) was associated with being unemployed/ unstable employment (OR = 4.16, 95% CI 1.64–10.56, $p = 0.003$). Dissatisfaction was associated with being unmarried (OR = 4.63, 95% CI 1.2–17.86, $p = 0.026$). Anxiety was associated with being unemployed/ unstable employment (OR = 3.63, 95% CI 1.23–10.72, $p = 0.02$), and having a complex CHD/ PAH (OR = 4.19, 95% CI 1.2–14.56, $p = 0.024$). Depression was associated with being unemployed/ unstable employment (OR = 7.68, 95% CI 2.09–28.25, $p = 0.002$).

Discussion

To the best of our knowledge, this study is the first of its kind providing evidence regarding QOL and health status in adults with CHD, in Vietnam; it contributes essential knowledge on these matters in Vietnam. There was a significant number of adults with CHD reporting poor QOL, anxiety, and depression. Notably, we found that poor QOL and psychological problems were well-related to biological and social characteristics including gender, age, marital status, education level, employment status, and CHD type.

Quality of life characteristics

Our findings demonstrated that the majority of adults with CHD in Vietnam had poor QOL measure by EQ-5D-5L. The participants of our study showed lower mean EQ-DS and EQ-VAS scores compared to healthy individuals from a general population study in Vietnam [25]. Overall, poor QOL are common in adults with CHD, similar to the findings from previous studies in Iran [13]. A previous systematic review and meta-analysis that enrolled 18 studies from developed countries found that QOL in young adults with CHD was comparable or better compared with health controls [4]. This result might be explained by the differences in economic factors, educational status, cultural factors, and medical quality between developing and developed countries [8]. Indeed, we found that adults with CHD had greater problems with pain/discomfort, anxiety/depression, mobility, and usual activities, which is similar to the results of a previous study [26]. CHD is a chronic condition; if it is underdiagnosed or undertreated, it can result in reduced QOL and may even be life threatening [4]. Furthermore, in our study, EQ-VAS seems more sensitively than EQ-DS score: Only 2.7% of patients had EQ-VAS \geq 80, while 50.4% of patients had EQ-DS \geq 0.8. EQ-VAS is more appropriate than EQ-DS in measuring the global health ratings [25]. Therefore, EQ-VAS seems to be a valid, reliable, and responsive tool for measuring the health status in adults with CHD.

Satisfaction with life

Satisfaction with life was common in adults with CHD in Vietnam (90.2%) with a high mean score of satisfaction of 25.2 points. This score appears to be more resilient than the report from Iran [13] but it was similar to that of 15 countries in APPROACH-IS [8]. Consistent with Vietnamese adults with other complex diseases as spinal cord injury [27], our patients with CHD also trend positive cognitive judgments about their life. Reality, satisfaction with life of one individual was influenced by specific country variables such as economic status, cultural factors, and social characteristics. Level of life satisfaction was more strongly associated with financial satisfaction in low- and middle-income countries than in high-income countries [28]. Likewise, satisfaction with life of individuals in Asian countries was strongly affected by a society's national integration [29]. It explained the trending satisfaction with life in patients living in a country with dynamic economy and culture of Asia as typical as that of Vietnam.

Anxiety and depression of adults with congenital heart disease

We noted the high prevalence of symptoms of anxiety and depression in adults with CHD. The prevalence of self-reported anxiety among adults with CHD are more than seven times higher compared to the general population in Vietnam (18.7% vs. 2.6%), while the prevalence of self-reported depression among adults with CHD is more than four times higher compared to the general population in Vietnam (11% vs 2.8%) [30]. Our findings were similar to that of a recent study, which reported that 30.7% of adults with CHD had mood disorders and 28% had anxiety disorders [18]. However, the exact prevalence of psychological disturbances, their geographical differences, and valid scales of evaluations are lacking. Based on the literature, adults with CHD constitute a high-risk group for developing emotional problems related to reduced exercise capacity, complications, and social barriers [5, 18, 31-34]. Therefore, screening for mental disorders in adults with CHD is important for early diagnosis and appropriate treatment because they require special medical attention and psychosocial interventions [35].

Notably, worrying causes patients to take positive or negative actions regarding the heart disease. At adequate levels, worrying is useful in promoting health protective behaviours and adherence to treatment. However, high levels of stress can adversely affect health outcomes [36]. Furthermore, patients with high levels of anxiety have been reported to have fewer healthy coping strategies with stressful situations, increased chance of adopting behaviours, and non-adherence to treatment [37].

Effect of biological and social characteristics to quality of life and health status

Similar to findings of previous studies, we observed that women with CHD tended to have reduced QOL scores and increased risks of psychological problems than men [7, 26, 33, 38]. Indeed, differences of QOL and psychological problems between women and men were also found in general Vietnamese population [25, 39] and in other countries [40, 41]. This may be related to a tendency of sensitivity to social environment, worrying about the vulnerability to diseases in women as compared with men [42].

The effect of older age on QOL in CHD is not consistent. Certain research found lower QOL in older patients compared to young patients but others noted increased or unchanged QOL [43]. The prior study has found that older age plays a limited role in predicting poor QOL, anxiety and depression in adults with CHD [44]. In the current study, in logistic regression, age more than 30 years was not the predictor of poor QOL and mental problems. Notably, we also found lower QOL scores in older patients compared to young patients than the general Vietnamese populations [25].

Multivariable logistic regression showed that the likelihood of depression in unmarried adults with CHD is greater as compared to married adults with CHD. EQ-VAS in unmarried women was significantly lower compared to married women. With reference to previous studies, we noted that a reduced QOL, anxiety and depression was more common in unmarried individuals than married individuals. This might be related to the disadvantages of psychological distress, socioeconomic and psychosocial resources that appear frequently in unmarried individuals compared to married individuals, especially in women [40, 45]. For example, married individuals often share financial expenses and receive sympathy from spouses while unmarried individuals do not have such support.

In this study, educational level was associated with QOL and health status. Prevalence of poor QOL, anxiety, and depression in patients with less than high school education was higher than patients with high school education and more. Although studies regarding educational level in adults with CHD in developing countries are limited, previous studies in developed countries have reported similar results between education level and QOL and mental disorders [7, 38, 46].

Our results also indicated that patients who were unemployed or had unstable employment had increased risk of poor QOL, anxiety, and depression; this is consistent with the results of previous study on adults with CHD [7]. Generally, unemployment or unstable employment have negative effects on self-assessed health [47, 48]. We believe that the impact of unemployment or unstable employment on poor QOL results from declined financial consequences, reduced self-esteem, and barriers in social relationships. Therefore, patients with CHD should be provided with stable employment, which may help them cope with their illness, encourage them to overcome the psychological barriers, and improve their social relationships and QOL.

Furthermore, we observed the negative effect of complex CHD or PAH on QOL of patients with CHD. Previous studies have reported a negative association between regular physical activity and anxiety [49, 50]. Exercise and physical activity are useful to gain self-confidence. Exercise and physical activity are also good opportunities to

meet or socialize with others that improve mood and help to cope in a healthy way. However, exercise intolerance was common in patients with complex CHD or PAH [51].

Limitations

This study had a few limitations. First, this was a cross-sectional, single-location study. Although, this study was taken at the reference hospital in Vietnam, there still exists sampling bias about representativeness. Using patient self-report results in certain biases since certain responses could be exaggerated or under-reported. Besides, because of the small sample, it was difficult to analyze and compare between subgroups, which was important to investigate the association between QOL and biological and social characteristics of the patients in Vietnam.

Conclusions

To the best of our knowledge, our study provides the first evidence on reduced QOL, anxiety and depression, in Vietnamese adults with CHD. The findings highlight that an increased prevalence of low QOL and psychological problems in the following subgroups: women, older age, unmarried, lower education level, unemployment, and complex CHD or PAH. Therefore, we recommend that health-related QOL should be screened more often, and monitored in clinical practice for adults with CHD, especially for high-risk patients.

List Of Abbreviations

CHD: Congenital Heart Disease

CI: Confidence Intervals

EQ-5D-5L: EuroQOL-5 Dimensions-5 Level

EQ-DS: EuroQOL-Descriptive System

EQ-VAS: EuroQOL Visual Analogue Scale

HADS: Hospital Anxiety and Depression Scale

HADS-A: Hospital Anxiety and Depression Scale-Anxiety subscale

HADS-D: Hospital Anxiety and Depression Scale-Depression subscale

OR: Odds Ratios

PAH: Pulmonary Artery Hypertension

QOL: Quality of Life

SWLS: Satisfaction with Life Scale

Declarations

Ethics approval and consent to participate

The Council for Science and Ethics Committee for the human study, Department of Cardiology, Hanoi Medical University (no: 6655/QD-DHYHN) of Vietnam had approved this study. All participants and legally authorized representatives of minors below 18 years of age provided written informed consent after receiving clear explanation of the study objective and procedures. Participants were allowed to withdraw from the interview at any time. All personal information was kept confidential and only anonymous data were utilized for the study. All the experiment protocol for involving human data was in accordance to Declaration of Helsinki.

Consent for publication

All participants provided their consent for publication.

Availability of data and materials

The datasets used and/or analysed in the current study will be made available by the corresponding author upon reasonable request.

Competing interests

The authors have no competing interests to declare.

Funding

No funding for provided for this study.

Authors' contributions

THT and NTK conceived the study, designed the data collection tools, monitored the data collection, analysed the data, and drafted and revised the paper. MNTN, DLD, HTN, TTL and HAL monitored data collection, analysed the data, and revised the draft of the study. All authors read and approved the final manuscript.

Acknowledgements

We are grateful to the medics and nurses from Bach Mai Hospital, residents and medical students at the Hanoi Medical University for their support in this study.

Author details

Assoc. Prof Thanh-Huong Truong, MD, PhD: Former Heads of Department of Congenital Heart Disease and Paediatric Cardiology, Vietnam National Heart Institute, Bach Mai Hospital; Senior Lecturer of Department of Cardiology, Hanoi Medical University.

References

1. Moons P, Bovijn L, Budts W, Belmans A, Gewillig M: **Temporal trends in survival to adulthood among patients born with congenital heart disease from 1970 to 1992 in Belgium.** *Circulation* 2010, **122**(22):2264-2272.
2. Zimmerman MS, Smith AGC, Sable CA, Echko MM, Wilner LB, Olsen HE, Atalay HT, Awasthi A, Bhutta ZA, Boucher JL *et al*: **Global, regional, and national burden of congenital heart disease, 1990 - 2017: a systematic**

- analysis for the Global Burden of Disease Study 2017.** *The Lancet Child & Adolescent Health* 2020, **4**(3):185-200.
3. van der Linde D, Konings EE, Slager MA, Witsenburg M, Helbing WA, Takkenberg JJ, Roos-Hesselink JW: **Birth prevalence of congenital heart disease worldwide: a systematic review and meta-analysis.** *Journal of the American College of Cardiology* 2011, **58**(21):2241-2247.
 4. Fteropoulli T, Stygall J, Cullen S, Deanfield J, Newman SP: **Quality of life of adult congenital heart disease patients: a systematic review of the literature.** *Cardiology in the young* 2013, **23**(4):473-485.
 5. Eslami B, Sundin O, Macassa G, Khankeh HR, Soares JJ: **Anxiety, depressive and somatic symptoms in adults with congenital heart disease.** *Journal of psychosomatic research* 2013, **74**(1):49-56.
 6. Benderly M, Kalter-Leibovici O, Weitzman D, Blieden L, Buber J, Dadashev A, Mazor-Dray E, Lorber A, Nir A, Yalonetsky S *et al*: **Depression and anxiety are associated with high health care utilization and mortality among adults with congenital heart disease.** *International journal of cardiology* 2019, **276**:81-86.
 7. Vigl M, Niggemeyer E, Hager A, Schwedler G, Kropf S, Bauer U: **The importance of socio-demographic factors for the quality of life of adults with congenital heart disease.** *Quality of Life Research* 2011, **20**(2):169-177.
 8. Apers S, Kovacs AH, Luyckx K, Thomet C, Budts W, Enomoto J, Sluman MA, Wang JK, Jackson JL, Khairy P *et al*: **Quality of Life of Adults With Congenital Heart Disease in 15 Countries: Evaluating Country-Specific Characteristics.** *Journal of the American College of Cardiology* 2016, **67**(19):2237-2245.
 9. Heusch A, Kahl HJ, Hensel KO, Calaminus G: **Health-related quality of life in paediatric patients with congenital heart defects: association with the type of heart defect and the surgical technique.** *Quality of Life Research* 2017, **26**(11):3111-3117.
 10. Lawoko S, Soares JJF: **Quality of life among parents of children with congenital heart disease, parents of children with other diseases and parents of healthy children.** *Quality of Life Research* 2003, **12**(6):655-666.
 11. Moons P, Luyckx K: **Quality-of-life research in adult patients with congenital heart disease: current status and the way forward.** *Acta Paediatrica* 2019, **108**(10):1765-1772.
 12. Spijkerboer AW, Utens EMWJ, De Koning WB, Bogers AJJC, Helbing WA, Verhulst FC: **Health-related Quality of Life in Children and Adolescents after Invasive Treatment for Congenital Heart Disease.** *Quality of Life Research* 2006, **15**(4):663-673.
 13. Eslami B, Macassa G, Sundin Ö, Khankeh HR, Soares JJ: **Quality of life and life satisfaction among adults with and without congenital heart disease in a developing country.** *European journal of preventive cardiology* 2015, **22**(2):169-179.
 14. Schrøder M, Boisen KA, Reimers J, Teilmann G, Brok J: **Quality of life in adolescents and young adults with CHD is not reduced: a systematic review and meta-analysis.** *Cardiology in the young* 2016, **26**(3):415-425.
 15. Eaton SL, Wang Q, Menahem S: **Determinants of quality of life in adults with CHD: an Australian cohort.** *Cardiology in the young* 2017, **27**(8):1571-1576.
 16. Apers S, Kovacs AH, Luyckx K, Alday L, Berghammer M, Budts W, Callus E, Caruana M, Chidambarathanu S, Cook SC *et al*: **Assessment of Patterns of Patient-Reported Outcomes in Adults with Congenital Heart disease - International Study (APPROACH-IS): rationale, design, and methods.** *International journal of cardiology* 2015, **179**:334-342.
 17. Phuc VM, Tin DN, Giang DTC: **Challenges in the management of congenital heart disease in Vietnam: A single center experience.** *Ann Pediatr Cardiol* 2015, **8**(1):44-46.

18. Westhoff-Bleck M, Briest J, Fraccarollo D, Hilfiker-Kleiner D, Winter L, Maske U, Busch MA, Bleich S, Bauersachs J, Kahl KG: **Mental disorders in adults with congenital heart disease: Unmet needs and impact on quality of life.** *Journal of affective disorders* 2016, **204**:180-186.
19. Mai VQ, Sun S, Minh HV, Luo N, Giang KB, Lindholm L, Sahlen KG: **An EQ-5D-5L Value Set for Vietnam.** *Quality of Life Research* 2020, **29**(7):1923-1933.
20. Barton GR, Sach TH, Avery AJ, Jenkinson C, Doherty M, Whyne DK, Muir KR: **A comparison of the performance of the EQ-5D and SF-6D for individuals aged >or= 45 years.** *Health economics* 2008, **17**(7):815-832.
21. Diener E, Emmons RA, Larsen RJ, Griffin S: **The Satisfaction With Life Scale.** *Journal of Personality Assessment* 1985, **49**(1):71-75.
22. Zigmond AS, Snaith RP: **The hospital anxiety and depression scale.** *Acta psychiatrica Scandinavica* 1983, **67**(6):361-370.
23. Do TTH, Correa-Velez I, Dunne MP: **Trauma Exposure and Mental Health Problems Among Adults in Central Vietnam: A Randomized Cross-Sectional Survey.** *Front Psychiatry* 2019, **10**:31-31.
24. Truong DV, Bui QTT, Nguyen DT, Moore J: **Anxiety Among Inpatients With Cancer: Findings From a Hospital-Based Cross-Sectional Study in Vietnam.** *Cancer Control* 2019, **26**(1):1073274819864641.
25. Nguyen LH, Tran BX, Hoang Le QN, Tran TT, Latkin CA: **Quality of life profile of general Vietnamese population using EQ-5D-5L.** *Health and quality of life outcomes* 2017, **15**(1):199.
26. Berghammer M, Karlsson J, Ekman I, Eriksson P, Dellborg M: **Self-reported health status (EQ-5D) in adults with congenital heart disease.** *International journal of cardiology* 2013, **165**(3):537-543.
27. Tasiemski T, Priebe MM, Wilski M: **Life satisfaction and life values in people with spinal cord injury living in three Asian countries: a multicultural study.** *J Spinal Cord Med* 2013, **36**(2):118-126.
28. Oishi S, Diener EF, Lucas RE, Suh EM: **Cross-Cultural Variations in Predictors of Life Satisfaction: Perspectives from Needs and Values.** *Personality and Social Psychology Bulletin* 1999, **25**(8):980-990.
29. Jagodzinski W: **Economic, Social, and Cultural Determinants of Life Satisfaction: Are there Differences Between Asia and Europe?** *Social Indicators Research* 2010, **97**(1):85-104.
30. Vuong DA, Van Ginneken E, Morris J, Ha ST, Busse R: **Mental health in Vietnam: Burden of disease and availability of services.** *Asian Journal of Psychiatry* 2011, **4**(1):65-70.
31. Eslami B: **Correlates of posttraumatic stress disorder in adults with congenital heart disease.** *Congenital heart disease* 2017, **12**(3):357-363.
32. Jackson JL, Misiti B, Bridge JA, Daniels CJ, Vannatta K: **Emotional functioning of adolescents and adults with congenital heart disease: a meta-analysis.** *Congenital heart disease* 2015, **10**(1):2-12.
33. Kovacs AH, Saidi AS, Kuhl EA, Sears SF, Silversides C, Harrison JL, Ong L, Colman J, Oechslin E, Nolan RP: **Depression and anxiety in adult congenital heart disease: predictors and prevalence.** *International journal of cardiology* 2009, **137**(2):158-164.
34. Bang JS, Jo S, Kim GB, Kwon BS, Bae EJ, Noh CI, Choi JY: **The mental health and quality of life of adult patients with congenital heart disease.** *International journal of cardiology* 2013, **170**(1):49-53.
35. Diller G-P, Bräutigam A, Kempny A, Uebing A, Alonso-Gonzalez R, Swan L, Babu-Narayan SV, Baumgartner H, Dimopoulos K, Gatzoulis MA: **Depression requiring anti-depressant drug therapy in adult congenital heart disease: prevalence, risk factors, and prognostic value.** *Eur Heart J* 2015, **37**(9):771-782.
36. Bremner JD, Campanella C, Khan Z, Shah M, Hammadah M, Wilmot K, Al Mheid I, Lima BB, Garcia EV, Nye J *et al*: **Brain Correlates of Mental Stress-Induced Myocardial Ischemia.** *Psychosomatic medicine* 2018, **80**(6):515-

525.

37. Abed MA, Kloub MI, Moser DK: **Anxiety and adverse health outcomes among cardiac patients: a biobehavioral model.** *The Journal of cardiovascular nursing* 2014, **29**(4):354-363.
38. Chen CA, Liao SC, Wang JK, Chang CI, Chiu IS, Chen YS, Lu CW, Lin MT, Chiu HH, Chiu SN *et al.*: **Quality of life in adults with congenital heart disease: biopsychosocial determinants and sex-related differences.** *Heart (British Cardiac Society)* 2011, **97**(1):38-43.
39. Nguyen T, Tran T, Tran H, Tran T, Fisher J: **The burden of clinically significant symptoms of common and severe mental disorders among adults in Vietnam: a population-based cross-sectional survey.** *BMC public health* 2019, **19**(1):1173.
40. Han KT, Park EC, Kim JH, Kim SJ, Park S: **Is marital status associated with quality of life?** *Health and quality of life outcomes* 2014, **12**:109.
41. Campos ACV, e Ferreira EF, Vargas AMD, Albala C: **Aging, Gender and Quality of Life (AGEQOL) study: factors associated with good quality of life in older Brazilian community-dwelling adults.** *Health and quality of life outcomes* 2014, **12**(1):166.
42. McLean CP, Asnaani A, Litz BT, Hofmann SG: **Gender differences in anxiety disorders: prevalence, course of illness, comorbidity and burden of illness.** *J Psychiatr Res* 2011, **45**(8):1027-1035.
43. Apers S, Luyckx K, Moons P: **Quality of life in adult congenital heart disease: what do we already know and what do we still need to know?** *Current cardiology reports* 2013, **15**(10):407.
44. Moons P, Kovacs AH, Luyckx K, Thomet C, Budts W, Enomoto J, Sluman MA, Yang HL, Jackson JL, Khairy P *et al.*: **Patient-reported outcomes in adults with congenital heart disease: Inter-country variation, standard of living and healthcare system factors.** *International journal of cardiology* 2018, **251**:34-41.
45. Bierman A, Fazio EM, Milkie MA: **A Multifaceted Approach to the Mental Health Advantage of the Married: Assessing How Explanations Vary by Outcome Measure and Unmarried Group.** *Journal of Family Issues* 2006, **27**(4):554-582.
46. Pfitzer C, Helm PC, Rosenthal LM, Walker C, Ferentzi H, Bauer UMM, Berger F, Schmitt KRL: **Educational level and employment status in adults with congenital heart disease.** *Cardiology in the young* 2018, **28**(1):32-38.
47. McKee-Ryan F, Song Z, Wanberg CR, Kinicki AJ: **Psychological and physical well-being during unemployment: a meta-analytic study.** *The Journal of applied psychology* 2005, **90**(1):53-76.
48. Norström F, Virtanen P, Hammarström A, Gustafsson PE, Janlert U: **How does unemployment affect self-assessed health? A systematic review focusing on subgroup effects.** *BMC public health* 2014, **14**:1310-1310.
49. Sareen J, Cox BJ, Clara I, Asmundson GJ: **The relationship between anxiety disorders and physical disorders in the U.S. National Comorbidity Survey.** *Depression and anxiety* 2005, **21**(4):193-202.
50. Goodwin RD: **Association between physical activity and mental disorders among adults in the United States.** *Preventive medicine* 2003, **36**(6):698-703.
51. Diller G-P, Dimopoulos K, Okonko D, Li W, Babu-Narayan SV, Broberg CS, Johansson B, Bouzas B, Mullen MJ, Poole-Wilson PA *et al.*: **Exercise Intolerance in Adult Congenital Heart Disease.** *Circulation* 2005, **112**(6):828-835.

Tables

Table 1 Demographic characteristics of adults with congenital heart disease

Characteristics	N (%)
<i>Gender</i>	
Men	33 (30.3)
Women	76 (69.7)
<i>Age groups</i>	
16-30	39 (35.8)
31-40	31 (28.4)
41-50	18 (16.5)
51-60	14 (12.8)
61+	7 (6.4)
<i>Marital status</i>	
Never married	23 (21.1)
Married/cohabiting	79 (72.5)
Window or divorce or separate	7 (6.4)
<i>Education level</i>	
Secondary school and less	49 (45.0)
High school	19 (17.4)
Undergraduate and postgraduate	37 (33.9)
Missing data	4 (3.7)
<i>Occupation</i>	
Farmer	30 (27.5)
Blue-collar	22 (20.2)
White-collar	30 (27.5)
Student	6 (5.5)
Others	21 (19.3)
<i>Employment status</i>	
Stable	59 (54.1)
Homemaker or retired	14 (12.8)
Unstable	21 (19.3)
Unemployed	6 (5.5)
Student or other works	6 (5.5)
Missing data	3 (2.8)

<i>Type of congenital heart disease</i>	
Isolated atrial septal defect	53 (48.6)
Isolated ventricular septal defect	29 (26.6)
Isolated patent ductus arteriosus	19 (17.4)
Combined ventricular septal defect and patent ductus arteriosus	1 (0.9)
Combined atrial septal defect and pulmonary stenosis	1 (0.9)
Combined ventricular septal defect and pulmonary stenosis	2 (1.8)
Tetralogy of Fallot	3 (2.8)
Pulmonary atresia with ventricular septal defect	1 (0.9)
<i>Congenital heart disease status</i>	
Simple	93 (85.3)
Complex or pulmonary artery hypertension	16 (14.7)
<i>Treatment for congenital heart disease</i>	
Interventional/surgical correction	23 (21.1)
Interventional/surgical palliation	5 (4.6)
Unrepaired	81 (74.3)

Table 2 Profiles of EQ-5D-5L in adults with congenital heart disease

Scales	Score range										
		<i>0-0.1</i>	<i>0.11-0.2</i>	<i>0.21-0.3</i>	<i>0.31-0.4</i>	<i>0.41-0.5</i>	<i>0.51-0.6</i>	<i>0.61-0.7</i>	<i>0.71-0.8</i>	<i>0.81-0.9</i>	<i>0.91-1</i>
<i>EQ-DS</i>	<i>N</i>	0	0	0	0	4	3	16	31	30	25
	<i>%</i>	0	0	0	0	3.7	2.8	14.7	28.4	27.5	22.9
<i>EQ-VAS</i>		<i>0-10</i>	<i>11-20</i>	<i>21-30</i>	<i>31-40</i>	<i>41-50</i>	<i>51-60</i>	<i>61-70</i>	<i>71-80</i>	<i>81-90</i>	<i>91-100</i>
	<i>N</i>	0	1	0	4	13	27	36	25	2	1
	<i>%</i>	0	0.9	0	3.7	11.9	24.8	33	22.9	1.8	0.9
Domains of EQ-DS	Levels										
		<i>Extreme problems</i>	<i>Severe problems</i>	<i>Moderate problems</i>	<i>Slight problems</i>	<i>No problems</i>					
<i>Mobility</i>	<i>N</i>	0	0	6	40	63					
	<i>%</i>	0%	0%	5.5%	36.7%	57.8%					
<i>Self-care</i>	<i>N</i>	0	0	0	11	98					
	<i>%</i>	0%	0%	0%	10.1%	89.9%					
<i>Usual activities</i>	<i>N</i>	0	0	4	37	68					
	<i>%</i>	0%	0%	3.7%	33.9%	62.4%					
<i>Pain/Discomfort</i>	<i>N</i>	0	1	17	77	14					
	<i>%</i>	0%	0.9%	15.6%	70.6%	12.8%					
<i>Anxiety/Depression</i>	<i>N</i>	1	5	16	61	26					
	<i>%</i>	0.9%	4.6%	14.7%	56%	23.9%					

Table 3 EQ-DS by subgroups in adults with congenital heart disease

	Total			Men			Women			<i>p-value*</i>
	<i>Mean (SD)</i>	<i>95%CI</i>	<i>p-value</i>	<i>Mean (SD)</i>	<i>95%CI</i>	<i>p-value</i>	<i>Mean (SD)</i>	<i>95%CI</i>	<i>p-value</i>	
Total	0.792 (0.121)	0.769- 0.815		0.814 (0.106)	0.776- 0.851		0.782 (0.127)	0.753- 0.811		0.22
Age groups										
16-30	0.841 (0.097)	0.81- 0.873	0.001	0.853 (0.086)	0.81- 0.896	0.016	0.831 (0.106)	0.782- 0.879	0.039	0.472
31+	0.764 (0.125)	0.734- 0.794		0.766 (0.111)	0.704- 0.827		0.764 (0.13)	0.729- 0.799		0.964
Marital status										
Married	0.795 (0.108)	0.771- 0.819	0.659	0.795 (0.106)	0.739- 0.851	0.339	0.795 (0.11)	0.767- 0.823	0.056	0.999
Unmarried	0.783 (0.152)	0.727- 0.84		0.831 (0.107)	0.776- 0.886		0.721 (0.183)	0.611- 0.832		0.049
Educational level										
High school +	0.827 (0.104)	0.8- 0.855	0.002	0.863 (0.061)	0.835- 0.891	0.002	0.808 (0.118)	0.768- 0.848	0.074	0.057
High school -	0.754 (0.13)	0.716- 0.791		0.746 (0.132)	0.652- 0.841		0.756 (0.131)	0.713- 0.798		0.842
Employment status										
Employed	0.807 (0.114)	0.782- 0.833	0.049	0.848 (0.071)	0.817- 0.878	0.01	0.79 (0.125)	0.756- 0.823	0.372	0.037
Unemployed/ unstable	0.754 (0.136)	0.7- 0.808		0.737 (0.151)	0.598- 0.877		0.76 (0.134)	0.697- 0.823		0.718
CHD type										
Simple	0.8 (0.119)	0.776- 0.825	0.08	0.829 (0.097)	0.791- 0.866	0.053	0.788 (0.126)	0.757- 0.819	0.349	0.131
Complex/ PAH	0.743 (0.129)	0.674- 0.812		0.729 (0.13)	0.568- 0.89		0.749 (0.135)	0.659- 0.84		0.786
CHD treatment										
Repaired	0.796 (0.117)	0.771- 0.821	0.501	0.819 (0.093)	0.783- 0.855	0.5	0.785 (0.126)	0.752- 0.818	0.772	0.206
Unrepaired/ palliative	0.777 (0.138)	0.717- 0.836		0.783 (0.175)	0.567- 1.0		0.775 (0.133)	0.709- 0.841		0.905
CHD: Congenital heart disease; PAH: Pulmonary artery hypertension; SD: Standard Deviation; CI: Confidence Interval; Employed status included stable employment, homemaker, retired, student or other works; * Compared between men and women.										

Table 4 EQ-VAS scores by subgroups in adults with congenital heart disease

	Total			Men			Women			<i>p-value*</i>
	<i>Mean (SD)</i>	<i>95%CI</i>	<i>p-value</i>	<i>Mean (SD)</i>	<i>95%CI</i>	<i>p-value</i>	<i>Mean (SD)</i>	<i>95%CI</i>	<i>p-value</i>	
Total	66.3 (12.5)	63.9- 68.7		66.9 (12.6)	62.4- 71.4		66.1 (12.6)	63.2- 68.9		0.754
Age groups										
16-30	69.9 (10.8)	66.4- 73.4	0.024	72.2 (10.2)	67.0- 77.1	0.008	68.1 (11.2)	63.0- 73.2	0.385	0.228
31+	64.3 (13.1)	61.2- 67.4		60.7 (12.8)	53.6- 67.8		65.3 (13.1)	61.7- 68.8		0.259
Marital status										
Married	67.0 (11.2)	64.4- 69.5	0.376	64.4 (12.1)	57.9- 70.8	0.276	67.6 (11.0)	64.8- 70.4	0.016	0.306
Unmarried	64.6 (15.5)	58.8- 70.4		69.2 (13.0)	62.5- 75.9		58.5 (16.9)	48.3- 68.7		0.058
Educational level										
High school +	69.5 (12.0)	66.3- 72.7	0.008	71.9 (9.1)	67.6- 76.1	0.015	68.2 (13.3)	63.7- 72.7	0.124	0.279
High school -	63.2 (11.9)	59.7- 66.6		61.0 (13.7)	51.2- 70.8		63.7 (11.6)	60.0- 67.5		0.526
Employment status										
Employed	68.4 (12.5)	65.6- 71.2	0.009	71.1 (9.6)	67.1- 75.2	0.009	67.2 (13.5)	63.5- 70.8	0.134	0.2
Unemployed/ unstable	61.3 (10.0)	57.4- 65.2		58.6 (13.5)	46.1- 71.0		62.3 (8.7)	58.2- 66.3		0.411
CHD type										
Simple	67.4 (12.0)	64.9- 69.9	0.029	68.8 (12.0)	64.2- 73.5	0.034	66.8 (12.0)	63.8- 69.8	0.23	0.452
Complex/ PAH	60.0 (14.1)	52.5- 67.5		56.0 (11.4)	41.8- 70.2		61.8 (15.4)	51.5- 72.2		0.465
CHD treatment										
Repaired	66.9 (12.6)	64.2- 69.6	0.352	67.4 (11.8)	62.8- 72.0	0.588	66.6 (13.1)	63.2- 70.1	0.47	0.797
Unrepaired/ palliative	64.1 (12.3)	58.8- 69.5		64.0 (18.2)	41.4- 86.6		64.2 (10.9)	58.8- 69.6		0.979
CHD: Congenital heart disease; PAH: Pulmonary artery hypertension; SD: Standard Deviation; CI: Confidence Interval; Employed status included stable employment, homemaker, retired, student or other works; * Compared between men and women.										

Table 5 Univariable and multivariable predictors of poor quality of life and health status in adults with congenital heart disease on logistic regression

Independent variables	Beta	Standard Error	p-value (Wald statistic)	OR (95%CI)
<i>Univariable logistic regression</i>				
<i>Poor quality of life (EQ-D5 < 0.65)</i>				
Women	0.964	0.799	0.228	2.62 (0.55; 12.56)
> 30 years old	0.693	0.691	0.316	2.0 (0.52; 7.75)
Unmarried	0.944	0.604	0.118	2.57 (0.79; 8.4)
Less than high school	1.073	0.637	0.092	2.93 (0.84; 10.19)
Unemployed or unstable employment	1.078	0.609	0.077	2.94 (0.89; 9.7)
Complex CHD or PAH	1.575	0.654	0.016	4.83 (1.34; 17.4)
Unrepaired CHD or repaired palliation	0.588	0.653	0.368	1.8 (0.5; 6.5)
<i>Poor quality of life (EQ-VAS < 65)</i>				
Women	0.295	0.43	0.492	1.34 (0.58; 3.12)
> 30 years old	1.065	0.438	0.015	2.9 (1.23; 6.84)
Unmarried	0.491	0.433	0.257	1.63 (0.7; 3.81)
Less than high school	1.121	0.412	0.007	3.07 (1.37; 6.88)
Unemployed or unstable employment	1.463	0.475	0.002	4.3 (1.7; 10.95)
Complex CHD or PAH	1.016	0.559	0.069	2.76 (0.92; 8.26)
Unrepaired CHD or repaired palliation	0.114	0.474	0.81	1.12 (0.44; 2.84)
<i>Dissatisfaction with life (SWLS < 20)</i>				
Women	0.014	0.724	0.984	1.01 (0.25; 4.19)
> 30 years old	-0.198	0.679	0.77	0.82 (0.22; 3.1)
Unmarried	1.545	0.687	0.024	4.69 (1.22; 18.01)
Less than high school	0.148	0.665	0.824	1.16 (0.32; 4.27)
Unemployed or unstable employment	1.213	0.677	0.073	3.36 (0.89; 12.69)
<i>Anxiety (HADS-A > 10)</i>				
Women	1.504	0.779	0.054	4.5 (0.98; 20.73)
> 30 years old	0.606	0.562	0.281	1.83 (0.61; 5.51)
Unmarried	0.74	0.521	0.155	2.1 (0.76; 5.81)
Less than high school	0.984	0.519	0.058	2.68 (0.97; 7.41)

Unemployed or unstable employment	1.171	0.525	0.026	3.23 (1.15; 9.03)
Complex CHD or PAH	1.312	0.602	0.029	3.71 (1.14; 12.08)
Unrepaired CHD or repaired palliation	0.643	0.561	0.252	1.9 (0.63; 5.71)
<i>Depression (HADS-D > 10)</i>				
Women	0.854	0.805	0.289	2.35 (0.49; 11.37)
Unmarried	1.112	0.623	0.074	3.04 (0.9; 10.32)
Less than high school	2.768	1.066	0.009	15.92 (1.97; 128.52)
Unemployed or unstable employment	2.066	0.664	0.002	7.9 (2.15; 29.01)
Complex CHD or PAH	0.767	0.73	0.293	2.15 (0.52; 9.01)
Unrepaired CHD or repaired palliation	0.719	0.664	0.279	2.05 (0.56; 7.54)
Multivariable logistic regression				
<i>Poor quality of life (EQ-DS < 65)</i>				
Complex CHD or PAH	1.514	0.655	0.021	4.55 (1.26; 16.4)
Constant	0.788	0.539	0.144	
<i>Poor quality of life (EQ-VAS < 65)</i>				
Unemployed or unstable employment	1.426	0.475	0.003	4.16 (1.64; 10.56)
Constant	-0.693	0.408	0.09	
<i>Dissatisfaction with life (SWLS < 20)</i>				
Unmarried	1.533	0.689	0.026	4.63 (1.2; 17.86)
Constant	1.344	0.458	0.003	
<i>Anxiety (HADS-A > 10)</i>				
Unemployed or unstable employment	1.29	0.552	0.02	3.63 (1.23; 10.72)
Complex CHD or PAH	1.43	0.636	0.024	4.19 (1.2; 14.56)
Constant	-0.616	0.701	0.379	
<i>Depression (HADS-D > 10)</i>				
Unemployed or unstable employment	2.039	0.664	0.002	7.68 (2.09; 28.25)
Constant	0.865	0.421	0.04	
CHD: Congenital heart disease; PAH: Pulmonary artery hypertension; OR: Odds Ratio; CI: Confidence Interval.				

Figures

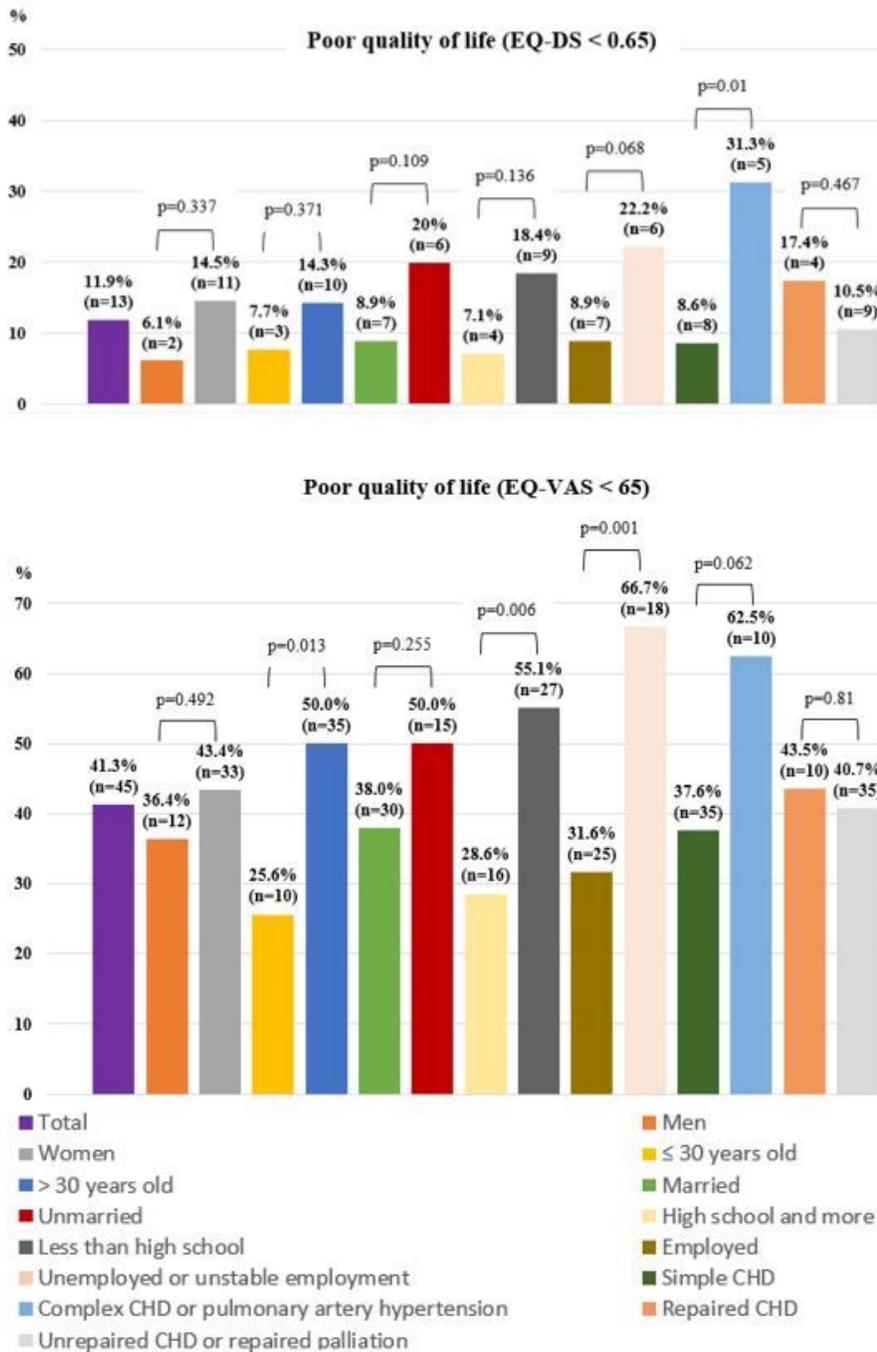


Figure 1

Poor quality of life by subgroups in adults with congenital heart disease. If poor quality of life (QOL) was defined as EuroQOL-Descriptive System (EQ-DS) < 0.65, the prevalence of poor QOL in complex congenital heart disease (CHD) or pulmonary artery hypertension (PAH) patients was higher than in simple CHD patients (31.3%, n = 5 vs 8.6%, n = 8, p = 0.01; using the Chi-square test; respectively). If poor QOL was defined as EuroQOL Visual Analogue Scale (EQ-VAS) < 65, the prevalence of poor QOL in patients aged > 30 years was higher than in patients aged ≤ 30 years (50%, n = 35 vs 25.6%, n = 10, p = 0.013; using the Chi-square test; respectively), those in patients with an

education level less than high school was higher than in patients had an education level as high school and more (55.1%, n = 27 vs 28.6%, n = 16, p = 0.006; using Chi-square test; respectively), and those in unemployed patients or patients who had unstable employment was higher than in employed patients (66.7%, n = 18 vs 37.6%, n = 35, p = 0.001; using Chi-square test; respectively).

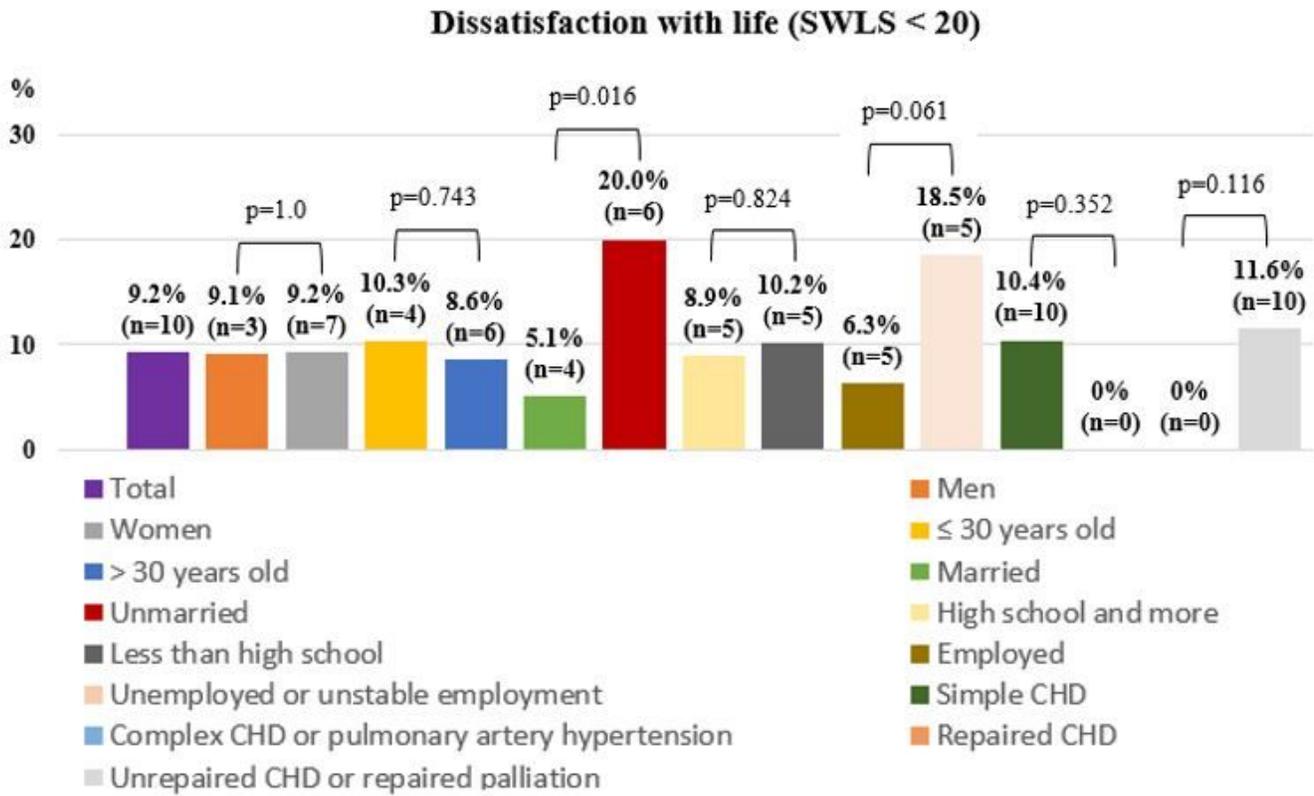


Figure 2

Dissatisfaction with life by subgroups in adults with congenital heart disease. If dissatisfaction with life was defined as Satisfaction with Life Scale (SWLS) < 20, the prevalence of dissatisfaction with life in unmarried patients was higher married patients (20%, n = 6 vs 5.1%, n = 4, p = 0.016; using the Fisher's exact test; respectively). CHD: Congenital heart disease

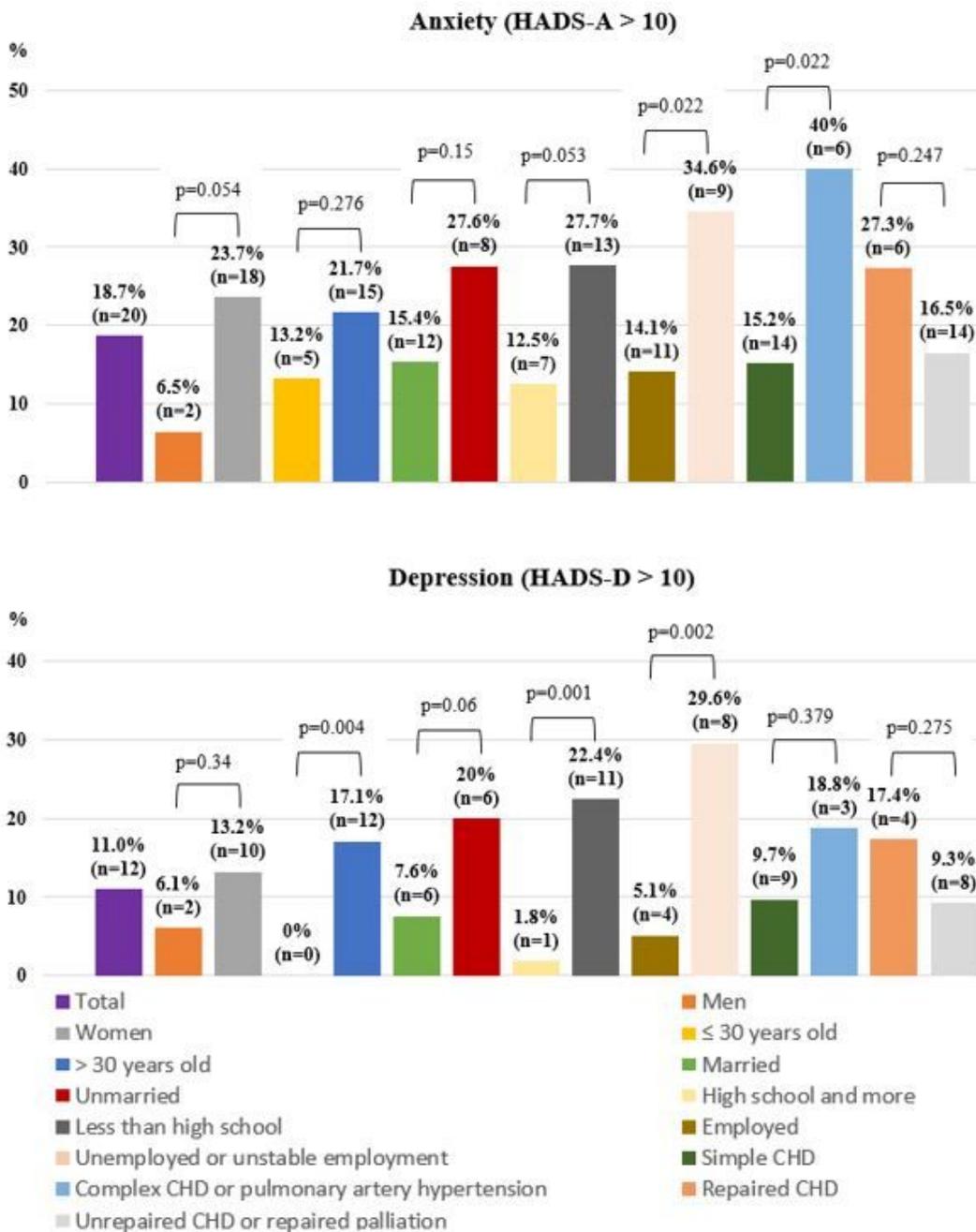


Figure 3

Symptoms of anxiety and depression by subgroups in adults with congenital heart disease. If anxiety was defined as Hospital Anxiety and Depression Scale-Anxiety subscale (HADS-A) > 10, prevalence of anxiety in unemployed patients or patients who had unstable employment was higher than in employed patients (34.6%, n = 9 vs 14.1%, n = 11, p = 0.022; using Chi-square test; respectively), those in complex congenital heart disease (CHD) or pulmonary artery hypertension (PAH) patients was higher than in simple CHD patients (40%, n = 6 vs 15.2%, n = 14, p = 0.022; using Chi-square test; respectively). If depression was defined as Hospital Anxiety and Depression Scale-Depression subscale (HADS-D) > 10, prevalence of depression in unemployed patients or patients who had unstable employment was higher than in employed patients (29.6%, n = 8 vs 5.1%, n = 4, p = 0.002; using the Fisher's exact test; respectively), those in patients aged > 30 years was higher than in patients aged ≤ 30 years

(17.1%, n = 12 vs 0%, n = 0, p = 0.004; using Fisher's exact test; respectively), and those in patients with an education level less than high school was higher than that of patients with an education level as high school and more (22.4%, n = 0.001 vs 1.8%, n = 1, p = 0.001; using Fisher's exact test; respectively).

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Supplementary1EnglishversionofEQ5D5L.docx](#)
- [Supplementary2EnglishversionofSWLS.docx](#)
- [Supplementary3EnglishversionofHADS.docx](#)
- [Supplementary4Vietnameseverions.docx](#)