

# Do children with asymptomatic ventricular preexcitation have similar quality of life as healthy children?

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DOI: 10.33963/v.phj.99291

## Received:

September 28, 2023

## Accepted:

February 1, 2024

## Early publication date:

February 22, 2024

## ABSTRACT

**Background:** To our knowledge, no studies have assessed Quality of life (QoL) in asymptomatic children with a preexcitation electrocardiogram pattern.

**Aim:** To evaluate the QoL of children with asymptomatic Wolff–Parkinson–White (WPW) syndrome.

**Methods:** This study involved QoL assessment of 31 children with asymptomatic preexcitation and 82 healthy children using the WHOQOL-BREF and the Pediatric Arrhythmia Related Score (PARS), a specific questionnaire that we have developed, which is related to patients’ feelings and observations concerning arrhythmia.

**Results:** There were no significant differences between the two groups in all the measured domains; however, there were significant differences regarding general satisfaction with their health condition ( $P = 0.01$ ). There were no differences in general satisfaction with the QoL, but WPW children more often experienced palpitations than the control group ( $P < 0.001$ ) and were more likely to feel sad ( $P = 0.046$ ) and nervous ( $P = 0.04$ ) compared to healthy children.

**Conclusions:** The children with WPW were more dissatisfied with their health compared to healthy children. Although both groups of children had similar levels of satisfaction with their QoL, some areas of physical and psychological parameters of QoL were worse in WPW children. The PARS questionnaire is a useful tool as a disease-specific QoL instrument, which supplements the general questionnaire and aids in clinical practice and decision-making.

**Key words:** pediatrics, quality of life, questionnaire, ventricular preexcitation

## INTRODUCTION

Wolff–Parkinson–White (WPW) syndrome is an abnormality of the cardiac conduction system characterized by an accessory conduction pathway between the atria and the ventricles [1, 2]. WPW diagnosis is usually based on an electrocardiogram (ECG). During sinus rhythm, the typical resting ECG pattern consists of a short PR interval, slurred upstroke (or downstroke) of the QRS complex (“delta wave”), and wide QRS complex [3–5]. The presence of an accessory pathway may lead to serious consequences ranging from supraventricular tachycardia (SVT) to sudden cardiac death (SCD) [6]. In the pediatric group, an accessory atrioventricular pathway is the most

frequent cause of SVT. Moreover, children and adolescents with accessory pathways may be “presymptomatic” as they have not had time to develop symptoms or a sentinel event [7], and SCD may occur even in asymptomatic WPW [8–10].

Reduced quality of life (QoL) is a typical consequence of chronic disease in children and adolescents, hence, children with SVT have a significantly poorer QoL than their healthy peers [11–14]. To our knowledge, no studies have assessed the QoL in children with asymptomatic WPW, and we hypothesized that the QoL of children with asymptomatic WPW is worse than in healthy individuals because of limitations and hazards resulting

## WHAT'S NEW?

Quality of life assessment in asymptomatic children with a preexcitation electrocardiogram pattern is a new clinical practice, as to the best of our knowledge, no studies have assessed the quality of life in these children. Quality of life questionnaires should be an important element in clinical practice, as they can be helpful in treatment decision-making.

from WPW diagnosis. Therefore, this study was designed to evaluate the QoL in children with asymptomatic WPW.

## METHODS

### Participants

The study group included children aged 7–18 with asymptomatic preexcitation and no organic heart disease or other chronic conditions that could interfere with the QoL. All participants lived in Poland and were patients of the Department of Pediatric Cardiology, Poznan University of Medical Sciences, Poland. All patients were approved for electrophysiology studies (EPS) and radiofrequency ablation or cryoablation by a cardiologist with expertise in electrophysiology and electrotherapy. A group of healthy children aged 7–18 with no medical conditions that could impede their QoL was enrolled as the control group by pediatricians during routine check-ups. The inclusion criteria, as in our previous studies assessing QoL [11, 15, 16], was a minimum age of 7 years. All patients and their parents provided written informed consent and each patient underwent a detailed interview and physical examination (both groups). In addition, the study group also had 12-lead resting ECG and echocardiography examinations.

The criterion for recognizing an asymptomatic patient was the lack of symptoms typical of arrhythmia, such as palpitations with abrupt onset and end, shortness of breath or chest pain, and no arrhythmia recorded during electrocardiographic diagnostics. The QoL parameters were assessed in children with preexcitation and compared to the control group. The study protocol was approved by the Bioethics Committee of the University of Medical Sciences, Poznan, Poland.

### World Health Organization Quality of Life (WHOQOL) questionnaire

The WHOQOL-BREF instrument comprises 26 items to measure the following domains: physical health (Phd), psychological health (Psd), social relationships, and the environment [17, 18]. The WHOQOL-BREF is a shorter version of the original instrument that may be more convenient for use in large research studies or clinical trials. The questions included in the questionnaire are rated on a five-point Likert scale; the points are calculated in accordance with the established code and transformed to a 4–20 scale and subsequently to a 0–100 scale. The higher the score obtained in one domain, the higher the QoL [17, 18].

WHOQOL-BREF also includes questions that are analyzed individually: question 1 concerns the individual's general perception of QoL, and question 2 concerns the individual's general perception of their health. Considering the patient's age, the question referring to sexual activity in the social domain was removed from the questionnaire.

### Pediatric Arrhythmia Related Score (PARS)

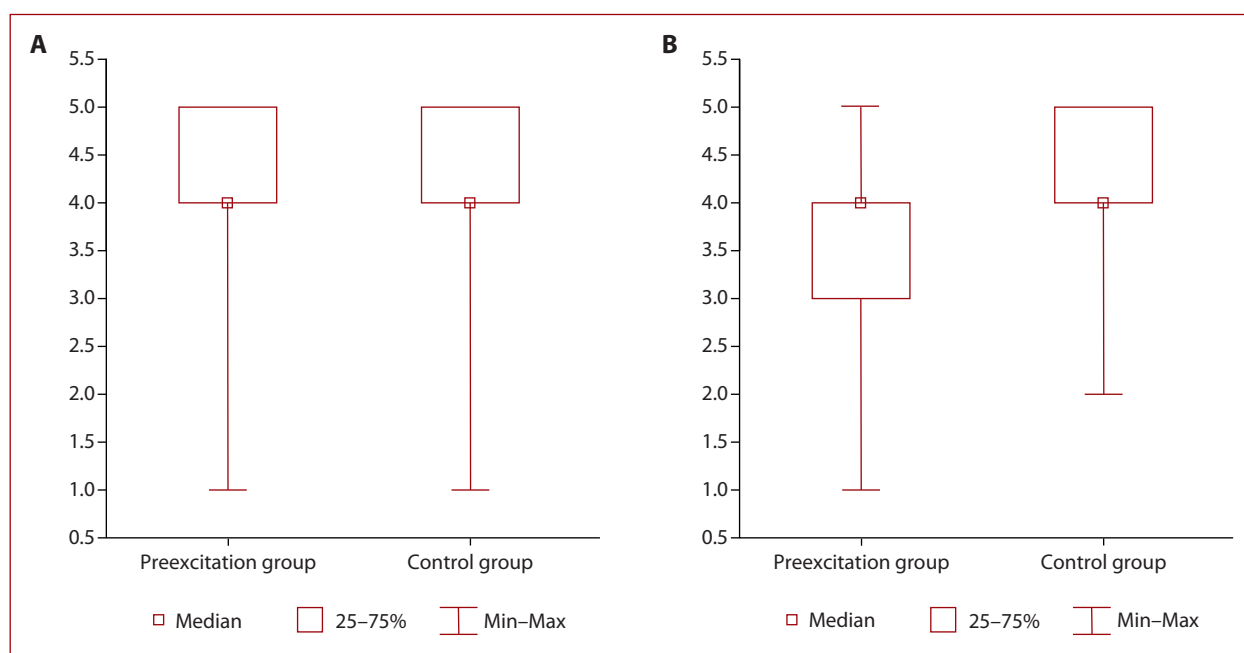
The questionnaire regarding patients' feelings and observations associated with arrhythmia (Pediatric Arrhythmia Related Score — PARS) was developed by pediatric cardiologists in collaboration with clinical psychologists and modified for arrhythmia children. This questionnaire was used in our previous studies evaluating QoL in SVT children [11, 15, 16]. The questionnaire contains 32 questions, which are grouped into 3 domains: physical, regarding the symptoms perceived as specific or likely to accompany SVT; medical satisfaction, concerning cooperation with medical care professionals; and psychological, referring to the emotional condition of the studied individuals. The answers are provided using a 1–5 point scale where "1" means "absolutely not" and "5" means "absolutely yes". Each domain is assessed on a 1–5 point scale and numeric results of individual areas are "negatively directed", i.e. the lower the numeric value, the higher the QoL. For this research, only the questions regarding physical and psychological aspects were used, assuming that the questions referring to medical satisfaction are inappropriate in a group of healthy children, who have limited or no contact with medical care professionals. Specific details regarding the PARS questionnaire are available in our previous study [11].

### Statistical analysis

Statistica 13 software by TIBCO and PQStat by PQStat Software was used for the statistical analysis with the level of significance  $\alpha = 0.05$ . The two groups were compared with regard to age, sex, education, and place of living (village/town). The normality of the distribution of variables was assessed by the Shapiro–Wilk test. The Mann–Whitney test was used to compare the variables between the two groups. The Friedman test with the Dunn–Bonferroni multiple comparison test or the Wilcoxon test were applied to test whether the evaluated domains were different. The  $\chi^2$  test of independence, Fisher's exact test, or the Fisher–Freeman–Halton test were used to test relationships between categorical variables. Since the variable "sex" could confuse the results of the univariate

**Table 1.** Patient demographics

	Preexcitation group	Healthy children	P-value
Patient No.	31	82	
Age, median (Q1–Q3)	13 (11.0–16.0)	13 (10.0–16.0)	0.95
Sex, n (%)			
Boys	24 (77.4)	38 (46.3)	0.003
Girls	7 (22.6)	44 (53.7)	
Place of living, n (%)			
Village	9 (29.0)	22 (26.8)	0.44
Town	22 (71.0)	60 (73.2)	
Background, n (%)			
1. Junior school	18 (58.1)	34 (41.5)	0.82
2. Grammar school	4 (13.0)	22 (26.8)	
3. Basic vocational school	2 (6.4)	1 (1.2)	
4. Secondary technical school	2 (6.4)	6 (7.3)	
5. High school	5 (16.1)	19 (23.2)	

**Figure 1.** General satisfaction with the quality of life (A) and with health condition (B): comparison of the preexcitation and healthy groups

analyses (the groups were not homogeneous with respect to sex), a logistic regression model was built to verify the conclusions obtained in the preliminary analyses. In this model, the dependent variable is the occurrence or not of a particular disease, and the independent variables are sex and the question analyzed. In the constructed models, the significance of the variables in the model was tested using the Wald chi-squared test, and the significance of the whole model was tested using the reliability quotient test. To assess correlations between scores in the PARS and WHOQOL-BREF, the Spearman rank correlation coefficient was used.

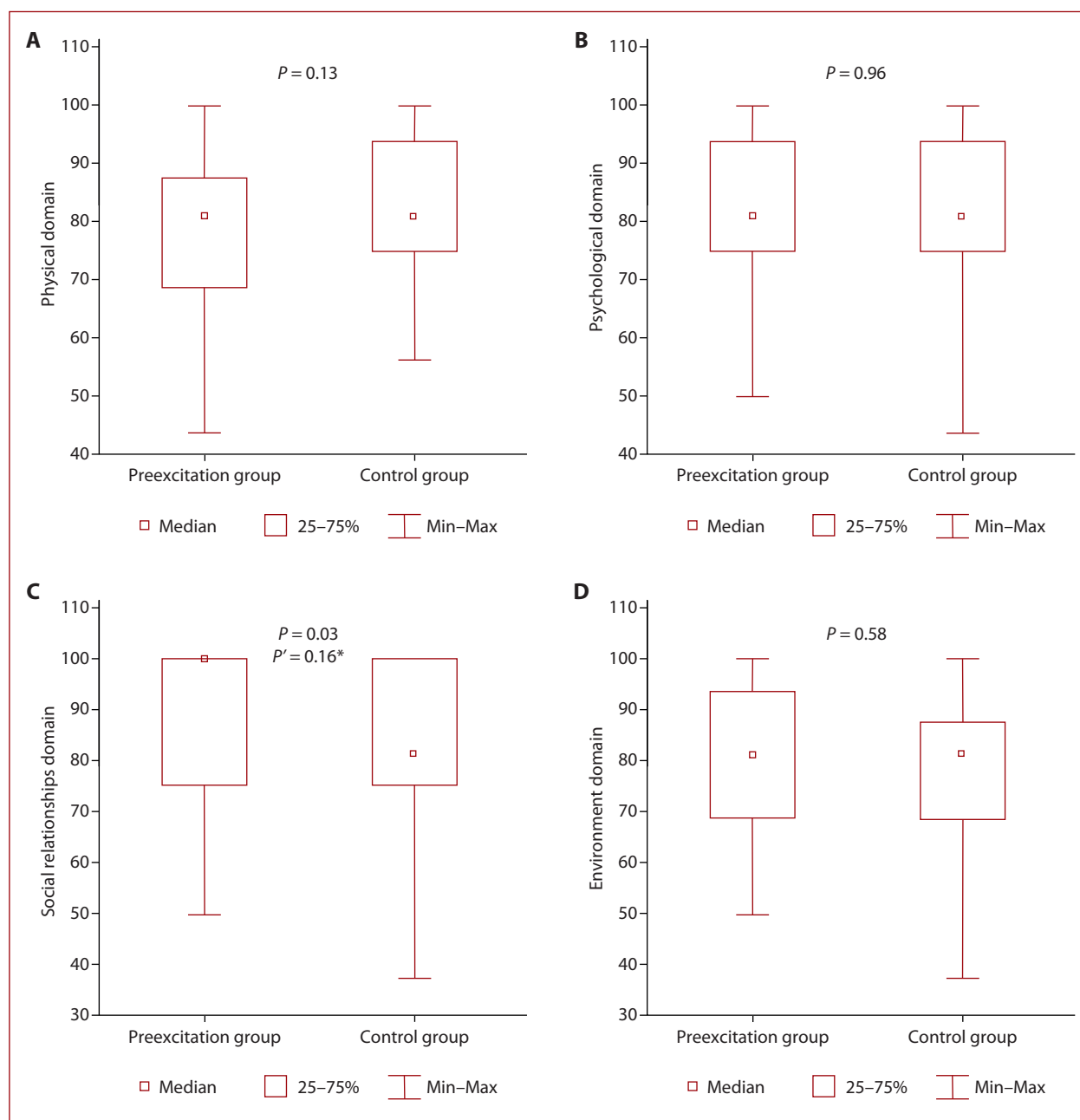
## RESULTS

Of 73 WPW patients aged 7–18 eligible for ablation treatment, 31 were asymptomatic and were included in the

study. In all cases, accessory pathways were confirmed during EPS examination. The control group included 82 healthy children. Patient demographics are shown in Table 1.

### WHOQOL-BREF

The WHOQOL-BREF analysis showed a few differences between the group of healthy children and WPW patients. Significant differences were found regarding general satisfaction with their health condition ( $P = 0.02$ ), with 67.7% of WPW children being satisfied/very satisfied with their general health compared to 87.9% of healthy children (Figure 1). There were no differences regarding general satisfaction with their QoL ( $P = 0.19$ ) (Figure 1). However, there was a statistically significant difference between the group of healthy children and the WPW children in terms of the social domain ( $P = 0.03$ ), but after adjusting for sex,



**Figure 2.** WHOQOL-BREF scores: comparison of the preexcitation and the control groups

\*P-value corrected for sex

the difference was statistically insignificant (Figure 2). There were no significant differences in physical, psychological, and environmental domains (Figure 2). When analyzing each sub-scale of WHOQOL-BREF, after considering the sex variable in the analysis, a difference was only observed in one sub-scale regarding Phd: dependency on drugs and treatment ( $P < 0.001$ ) (Table 2).

### PARS questionnaire

The PARS questionnaire analysis showed no significant differences between the domains (Figure 3), with similar Phd and Psd values for both groups. The analysis of Phd only showed that WPW children more often felt palpitations

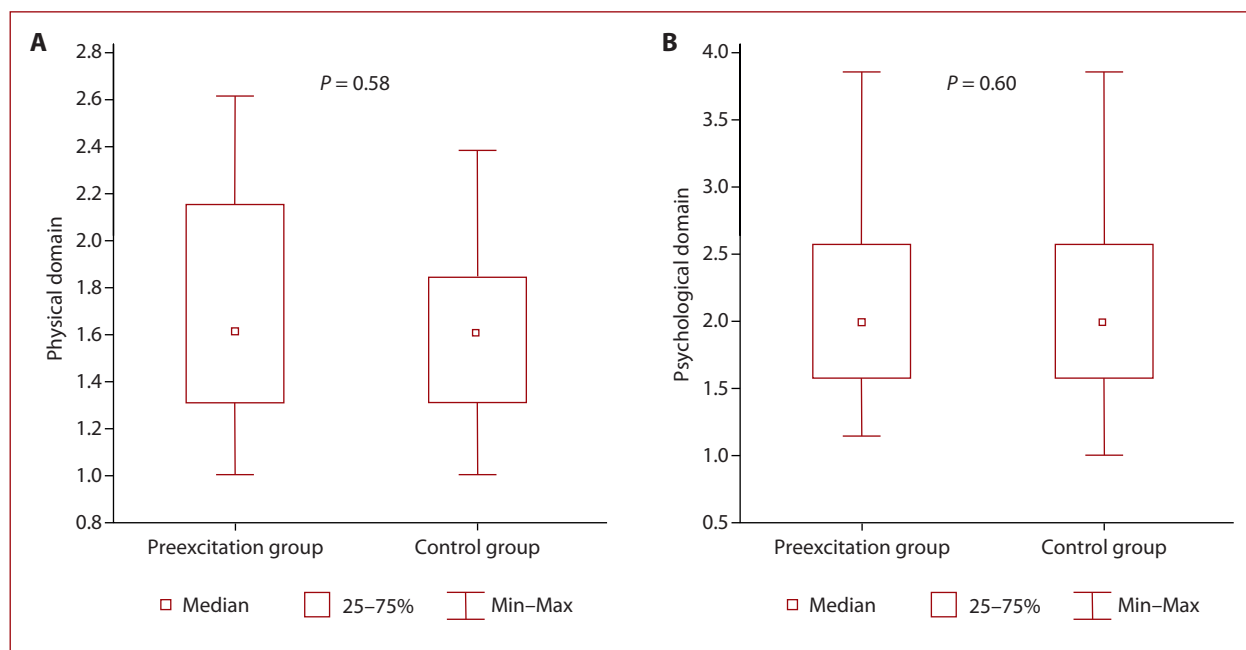
than the control group and the Psd analysis also showed that the WPW group was more likely to feel nervous compared to the healthy children (Table 3). After adjusting for sex, there was also a significant difference in the response to the question about being sad (Table 3).

### Analysis of the WPW group

In the study group, we assessed correlations between the scores obtained in the PARS questionnaire and the WHO: higher QoL regarding Phd and Psd of the PARS relates to the higher evaluation of the QoL in similar domains of WHOQOL. There was a correlation between Phd of the PARS questionnaire and Phd of the WHOQOL-BREF assessment

**Table 2.** Sub-scales of WHQOL-BREF assessment: comparison of the preexcitation and healthy groups

Sub-scales	Preexcitation group	Healthy children	P-value	P-value corrected for sex
	Median (Q1–Q3)	Median (Q1–Q3)		
<b>Physical domain</b>				
Pain and discomfort	5.0 (4.0–5.0)	5.0 (3.0–5.0)	0.22	0.35
Dependency on drugs and treatment	5.0 (3.0–5.0)	5.0 (5.0–5.0)	<b>&lt;0.001</b>	<b>&lt;0.001</b>
Mobility	4.0 (3.0–5.0)	4.0 (4.0–5.0)	0.14	0.05
Work capacity	4.0 (3.0–5.0)	4.0 (4.0–5.0)	0.32	0.29
Energy and fatigue	5.0 (4.0–5.0)	4.0 (4.0–5.0)	<b>0.049</b>	0.16
Activities of daily living	4.0 (4.0–5.0)	4.0 (4.0–5.0)	0.66	0.77
Sleep and rest	4.0 (3.0–5.0)	4.0 (4.0–5.0)	0.56	0.96
<b>Psychological domain</b>				
Self-esteem	5.0 (4.0–5.0)	4.0 (4.0–5.0)	0.59	0.84
Negative feelings	4.0 (3.0–5.0)	4.0 (4.0–5.0)	0.99	0.58
Thinking, learning, memory, concentration	4.0 (4.0–4.0)	4.0 (4.0–5.0)	0.20	0.21
Positive feelings	4.0 (4.0–5.0)	4.0 (4.0–5.0)	0.40	0.30
Bodily image and appearance	5.0 (4.0–5.0)	5.0 (4.0–5.0)	0.66	0.92
Meaning of life	5.0 (4.0–5.0)	5.0 (4.0–5.0)	0.44	0.48
<b>Social relationships domain</b>				
Personal relationships	5.0 (4.0–5.0)	4.0 (4.0–5.0)	<b>0.008</b>	0.07
Social support	5.0 (4.0–5.0)	4.0 (4.0–5.0)	0.19	0.31
<b>Environment domain</b>				
Financial resources	4.0 (3.0–5.0)	4.0 (3.0–5.0)	0.46	0.88
Freedom, physical safety, and security	5.0 (4.0–5.0)	5.0 (4.0–5.0)	0.88	0.93
Health and social care	4.0 (3.0–5.0)	3.0 (3.0–4.0)	0.08	0.13
Home environment	5.0 (4.0–5.0)	5.0 (4.0–5.0)	0.57	0.87
Opportunities for acquiring new information and skills	5.0 (4.0–5.0)	5.0 (4.0–5.0)	0.55	0.40
Opportunities for recreation/leisure activities	5.0 (4.0–5.0)	5.0 (4.0–5.0)	0.78	0.78
Physical environment (pollution/noise/traffic/climate)	4.0 (3.0–5.0)	4.0 (4.0–5.0)	0.80	0.41
Transport	4.0 (3.0–5.0)	4.0 (3.0–4.0)	0.87	0.99

**Figure 3.** PARS scores: comparison of the preexcitation group and healthy children

( $R_s = -0.37$ ;  $P = 0.04$ ). Similarly, there was a correlation between Psd of the PARS questionnaire and Psd of the WHOQOL-BREF assessment ( $R_s = -0.61$ ;  $P < 0.001$ ).

## DISCUSSION

Good physical functioning does not always correspond with psychological well-being or health perception, par-

ticularly among patients with cardiovascular disorders who are very concerned about their heart condition. Indeed, patients with cardiac conditions may suffer from depression and anxiety, thus requiring psychotherapeutic help [19–21].

This study evaluated QoL in asymptomatic children with WPW and demonstrated that the general QoL of asymptomatic WPW patients is similar to that of healthy children.

**Table 3.** PARS questions and scores: comparison of WPW and healthy children

Questions	Preexcitation group	Healthy children	P-value	P-value corrected for sex
	Median (Q1–Q3)	Median (Q1–Q3)		
Physical domain				
1. Do you have dyspnea?	1.0 (1.0–2.0)	1.0 (1.0–2.0)	0.23	0.05
2. Do you have palpitations?	2.0 (1.0–3.0)	1.0 (1.0–1.0)	<b>&lt;0.001</b>	<b>&lt;0.001</b>
3. Do you have pain behind your breastbone?	1.0 (1.0–2.0)	1.0 (1.0–1.0)	0.32	0.28
4. Do you ever faint?	1.0 (1.0–1.0)	1.0 (1.0–1.0)	0.97	0.93
5. Do you seem to pass urine more frequently than usual?	1.0 (1.0–2.0)	1.0 (1.0–2.0)	0.06	0.06
6. Do you ever have blurred vision? (e.g. scotoma)	1.0 (1.0–2.0)	2.0 (1.0–3.0)	0.27	0.30
7. Do you think you are paler than your friends or do you happen to become pale suddenly?	1.0 (1.0–2.0)	1.0 (1.0–2.0)	0.65	0.52
8. Do you experience situations in which you sweat more than your friends?	1.0 (1.0–2.0)	1.0 (1.0–2.0)	0.25	0.35
9. Do you ever feel nauseous?	1.0 (1.0–2.0)	1.0 (1.0–2.0)	0.60	0.86
10. Do you have headaches?	2.0 (1.0–3.0)	3.0 (2.0–3.0)	0.09	0.13
11. Do you have stomach aches?	2.0 (1.0–3.0)	3.0 (2.0–3.0)	0.08	0.12
12. Do you sometimes feel suddenly cold without a reason?	1.0 (1.0–3.0)	1.0 (1.0–2.0)	0.36	0.08
13. Do you think you are weaker than your peers?	1.0 (1.0–2.0)	1.0 (1.0–2.0)	0.96	0.96
Psychological domain				
1. Do you often cry?	1.0 (1.0–3.0)	2.0 (1.0–2.0)	0.78	0.41
2. Is it easy to make you cry?	2.0 (1.0–4.0)	2.0 (1.0–3.0)	0.27	0.09
3. Do you think you are more nervous than your peers?	2.0 (2.0–3.0)	2.0 (1.0–2.0)	<b>0.04</b>	<b>0.049</b>
4. Do you think you are sadder than your peers?	2.0 (1.0–3.0)	1.0 (1.0–2.0)	0.19	<b>0.046</b>
5. Do you think you are happier than your peers?	3.0 (2.0–4.0)	3.0 (2.0–4.0)	0.66	0.96
6. Do you think you are lonelier than your peers?	1.0 (1.0–2.0)	1.0 (1.0–2.0)	0.66	0.86
7. Can you count on your friends?	5.0 (4.0–5.0)	5.0 (4.0–5.0)	0.96	0.82

However, the healthy children reported significantly greater contentment regarding their general satisfaction with their health condition. Both physical and psychological parameters of the QoL were similar in both groups but some areas of physical and psychological parameters of QoL were lower in WPW children. Analyzing each question individually indicated that WPW children felt generally more dependent on treatment; they felt palpitations more often and were more likely to feel sad and nervous compared to healthy children. Although the patients were classified as asymptomatic, some of them reported palpitations based on the PARS questionnaire; this may be explained by the stress related to the diagnosis and their awareness of the resulting risks. The relationship between the described symptoms and arrhythmia was not confirmed in electrocardiographic tests for any of the patients with palpitations. Moreover, when asked about the symptoms, they denied that they were typical, (i.e., abrupt onset and end) and that they were not accompanied by other symptoms suggestive of arrhythmia.

Patients with SVT experience many negative feelings [21, 22], and the limitations resulting from the disease significantly lower the QoL of SVT children. The obligation to take medications as well as arrhythmia symptoms may have an additional negative impact on their QoL and emotional development [11, 23]. Yet, there are insufficient data related to QoL in asymptomatic WPW, so it is important to assess how the limitations related to WPW diagnosis affect the patient's physical, emotional, and social well-being. To our knowledge, this is the first study assessing the QoL in children with asymptomatic WPW.

We believe that asymptomatic WPW can also be challenging, especially in young, active people who want to

develop their interests without limitations. One of the limitations resulting from WPW diagnosis is avoidance of physical activity, especially competitive sports [24–27]. For young people, it is often a very significant limitation of their passions, interests, and life goals, which brings about the feeling of being different from their peer group. That perception is reinforced because WPW patients must be supervised and monitored, have regular check-ups, and be aware of unpredictable tachycardia episodes [24, 28, 29]. These issues may also cause QoL deterioration. Moreover, the “heart condition” diagnosis may contribute to the patient's lower QoL, and affect their sense of security or cause fear, as evidenced in our study. Our participants felt more dependent on treatment and more inclined to feel sad and nervous in comparison with healthy children.

For adult competitive/professional athletes with asymptomatic preexcitation, an EPS is recommended to evaluate the risk of SCD [5, 30]. It should be noted that in pediatric patients below 12 years, the risk of SCD is very low, therefore, a conservative approach is recommended [30]. Despite this, prophylactic ablation is advocated by some authors as it reduces the risk of sudden death [31]. According to the 2020 European Society of Cardiology guidelines on sports cardiology and exercise in patients with cardiovascular diseases, it should be emphasized that our knowledge on this subject is still insufficient [30]. Parents and children should be provided with comprehensive information about the risks and potential benefits of ablation treatment versus observation and be informed about related risks of this procedure [24, 32]. Competitive athletes with low-risk pathways identified during EPS not undergoing ablation therapy should be monitored for the

development of new symptoms [24], and the PARS may be a helpful tool to show the real clinical disease status and detect symptomatic patients.

In the previous studies [11, 15, 16], we noticed that the PARS can be particularly useful in everyday clinical practice to detect QoL deterioration, which can be difficult to observe during routine check-ups. It is also useful in deciding about EPS and ablation treatment in non-obvious cases (medical and psychological reasons). The necessity to limit sports activity and the related consequences for QoL may be important factors affecting qualification for ablation in young athletes with WPW. Joint decisions with the athletes are encouraged by the 2020 European Society of Cardiology guidelines on sports cardiology and exercise in patients with cardiovascular diseases, which emphasize the importance of respecting “the autonomy of the individual after provision of detailed information about the impact of sports and the potential risks of complications and/or adverse events” [30].

The influence of arrhythmia and its treatment on QoL is still an underestimated issue in the clinical approach. The published studies on pediatric and adult patients with arrhythmia showed the positive effects of ablation on QoL [12–15, 33]. It is known that arrhythmia, apart from worsening QoL, can also lead to heart failure and cardiomyopathy, which is why successful arrhythmia control is so important. Gardziejczyk et al. [33] show that successful catheter ablation significantly improves clinical status, left ventricular ejection fraction, and health-related QoL of patients with structural heart disease and arrhythmia-mediated cardiomyopathy. We suppose that further analysis needs to be performed to demonstrate long-term consequences of ablation therapy on QoL parameters and also in children with asymptomatic preexcitation patterns on ECG.

QoL evaluation is an important element in current clinical practice as some individuals feel ill and do not function well despite no changes in their body tissues. The Constitution of the World Health Organization defines health “as a state of complete physical, mental, and social wellbeing” [34]. QoL refers to “individuals’ perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns” [35]. Thus, QoL assessment should be a key element in assessing the patient’s health condition and making further clinical decisions, including those concerning diagnosis and treatment.

### Study limitations

We acknowledge the following limitations of the performed study.

The study group is limited to 31 patients. The small group size is related to the fact that the majority of patients admitted to the Department of Pediatric Cardiology with signs of ventricular preexcitation on ECG recordings, without electrocardiographically confirmed episodes of tachycardia, reported symptoms that could indicate arrhythmia.

Therefore, they were excluded from participation in the study. Despite the small group size, this is still the only available study that examines in detail the QoL of children with asymptomatic preexcitation.

The control group and the study group were not homogeneous and differed in terms of sex, which is a limitation of the study. The control group consisted of volunteers. Since sex could be a factor confounding the results of univariate analyses, a logistic regression model was developed to verify the conclusions obtained in preliminary analyses. In this way, we sought to eliminate possible distortions that might arise from differences in the numbers of boys and girls in individual groups.

Although the children in the study group were not on medication and had not been hospitalized for cardiac reasons by the time of completing the questionnaire, they were compared with healthy children in terms of “dependency on drugs and treatment”. We believe that this question, which is part of the WHOQOL-BREF questionnaire, allows for assessment of whether the mere diagnosis of ventricular preexcitation features, despite the absence of treatment at the time of completing the questionnaire, may give patients a sense of being limited by a scheduled future treatment (e.g., having an ablation procedure and its effects on their normal physical activity, including sports).

## CONCLUSION

In conclusion, general satisfaction with their health condition in WPW children was significantly worse in comparison with healthy children. Although both groups of children were generally satisfied with their QoL, some physical and psychological parameters of QoL were worse in WPW children. The PARS questionnaire is a useful disease-specific QoL instrument that supplements the general questionnaire and helps in clinical practice and decision-making.

### Article information

**Conflict of interest:** None declared.

**Funding:** None.

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