



Development of a knowledge, attitude, and practice scale for cardiac rehabilitation for parents of children with heart disease

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ABSTRACT

Purpose: We aimed to (i) develop a Cardiac Rehabilitation Knowledge, Attitude, and Practice Scale for parents of children with heart disease and (ii) test its reliability and validity.

Methods: Based on the theory of knowledge, attitude, and practice, an item pool was constructed through literature review, and 200 parents of children with heart disease were surveyed to test the reliability and validity of the scale.

Results: The finalized Knowledge, Attitude, and Practice Scale contains three parts, i.e., knowledge, attitude, and practice, with a total of 34 items. The Cronbach alpha coefficient of the total scale was 0.731, the split-half reliability was 0.730, the content validity was 0.956, and the content validity of each item was 0.917–1.

Conclusion: The Knowledge, Attitude, and Practice Scale of Cardiac Rehabilitation for Parents of Children with Heart Disease has good reliability and validity, and it can be used as a tool to evaluate the knowledge, attitudes, and practices of parents of children with heart disease participating in cardiac rehabilitation.

Practice implications: The development of the Cardiac Rehabilitation Knowledge, Attitude, and Practice Scale for parents of children with heart disease is of great significance for carrying out targeted education programs in the future to improve the compliance of children with heart disease with cardiac rehabilitation programs.

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Background

Due to complex physiological and abnormal structures and cardiac insufficiency, children with heart disease often face problems such as developmental delay, low cardiopulmonary function, and low physical activity in life, which seriously affect their quality of life (Howell et al., 2019; Schaan et al., 2019; Villasaca-Rojas et al., 2022). In order to promote the recovery of cardiopulmonary function in children with heart disease, increase physical activity, enhance their self-care ability, and facilitate their return to daily life, the concept of cardiac rehabilitation is gradually emerging (Callaghan et al., 2021). Studies have shown (Kroll et al., 2021; Taylor et al., 2018) that family-centered cardiac rehabilitation for children with heart disease can improve the quality of life of children with heart disease. In cardiac rehabilitation, parents, as direct caregivers of children with heart disease, play a key role in the compliance of children (Khouri et al., 2020).

Using knowledge, attitude, and practice theory, patients' enthusiasm for participating in cardiac rehabilitation can be improved by increasing their knowledge of cardiac rehabilitation and helping them establish positive attitudes about cardiac rehabilitation (Wang et al., 2020). At the same time, some studies have shown that increasing the enthusiasm of parents of children with congenital heart disease in cardiac rehabilitation programs can help improve children's participation rate and compliance (Ghisi et al., 2021). The theory of knowledge, attitude, and practice (Gumucio et al., 2011) is widely used to change the health-related behavior of a certain group, and it proposes that knowledge is the basis of behavior change, and attitude and practice are the driving force of behavior change. In order to improve the compliance of children, we need to improve parents' awareness, attitude, and practice. However, there are currently no research tools to assess the knowledge, attitudes, and practices of parents of children with heart disease about cardiac rehabilitation. Therefore, it is very important to develop a knowledge, attitude, and practice scale for these parents. Therefore, based on the theoretical framework of knowledge, attitude, and practice, in the present study, we developed the Cardiac Rehabilitation Knowledge, Attitude, and Practice Scale for parents of children with heart disease to (i) evaluate the parents' awareness of and attitude

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towards cardiac rehabilitation and (ii) formulate individualized guidance plans for the improvement of children's cardiac rehabilitation.

Research methods

The development of the Cardiac Rehabilitation Knowledge, Attitude, and Practice Scale for parents of children with heart disease consisted of two phases: (1) development of the scale, including reviewing the relevant literature to construct an item pool to form the initial scale, and (2) evaluation of the scale's psychometric properties, including verifying the content validity of the scale through expert consultation and conducting a questionnaire survey, and the scale was further improved through the results of exploratory factor analysis (EFA) to verify the reliability and validity of the scale.

Phase 1 Development of the scale

Preparation of the initial scale

In the previous study, the high incidence of health problems in children with congenital heart disease after surgery was sorted out by category based on the International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY). Then Luo (Luo et al., 2022) have done further research and revealed that in children with heart disease, the problems of growth, nutrition, immunity, medication management, and psychological and emotional problems are most prominent. Therefore, "medication management," "psycho-emotional," and "physical activity" were used as keywords when we searched for articles published between January 2018 and January 2022 in the Wanfang, CNKI, VIP, EMBASE, PUBMED, and Web of Science databases. Finally, according to the search results, the initial scale to quantify knowledge, attitudes, and practices of parents of children with heart disease undergoing cardiac rehabilitation was compiled, which included 38 items (18 in the knowledge dimension, 10 in the attitude dimension, and 10 in the behavior dimension). The knowledge domain was developed according to the knowledge of parents of children with heart disease about cardiac rehabilitation, including growth, nutrition, immunity, activity, psychology, emotion, and medication management. The attitude domain was designed according to the awareness and motivation that parents of children with heart disease attached to cardiac rehabilitation, and the practice domain was designed based on the behavior of cardiac rehabilitation (Fig. 1). Finally, the connotation of children's cardiac rehabilitation was refined, and the first draft of the scale including three dimensions and 38 items was initially constructed.

Phase 2 Evaluation of the scale's psychometric properties

Expert correspondence

A total of 12 medical experts with experience working with children with prior congenital heart disease were invited to evaluate the content of the scale through paper questionnaires and WeChat correspondence. The selection criteria for experts were as follows: (1) working

experience ≥ 10 years; (2) bachelor's degree or above; (3) extensive working experience in the diagnosis and treatment of children with heart disease; and (4) voluntary participation in this study. Experts were invited to evaluate the relevance and importance of each item and topic according to a five-point Likert scoring method, and one column was retained for suggestions. The questionnaires were collected within 2 weeks, and members of the research team conducted statistical analysis and discussed the results of the expert inquiries.

Tools

The survey tool used in this study was the Initial Scale of Knowledge, Attitude, and Practice for Parents of Children with Heart Disease in Cardiac Rehabilitation, which was developed through literature review and expert consultation. Each item of the scale was scored on a five-point Likert scale ("strongly disagree," "disagree," "not sure," "agree," and "strongly agree").

Survey objects

The sample size is usually 5 to 10 times the number of items (Mazur & Szumska-Olczak, 2000; Wan et al., 2016). Therefore, the required sample size of this study was estimated to be 190 participants. We selected family members of children with congenital heart disease who visited the Cardiac Rehabilitation Department in one of the children's hospitals in Shanghai from March 2021 to March 2022. Inclusion criteria were as follows: (1) families of children who were clinically diagnosed with heart disease and received cardiac rehabilitation; (2) no history of mental illness or cognitive impairment, able to communicate normally with language; and (3) informed consent was provided. Exclusion criteria were as follows: (1) families of children with serious diseases such as immunodeficiency diseases and hematological tumors; and (2) families of children who had not been prescribed exercise regimens.

Informed consent

This study was approved by the Ethics Research Committee of Shanghai Children's Medical Center, and informed consent was obtained from the legal guardians of all of the eligible children.

Pre-investigation

The convenience sampling method was used to select 10 parents of children with heart disease who were treated in the rehabilitation department of a specialized children's hospital for pre-investigation. They were asked to judge the readability and clarity of the declarative language of the scale items, and the scale was formed after semantic debugging.

Formal investigation

In this study, the survey was conducted by means of telephone inquiries. The two telephone investigators were both trained in the questioning method of the Initial Scale of Knowledge, Attitude, and Practice for Parents of Children with Heart Disease in Cardiac

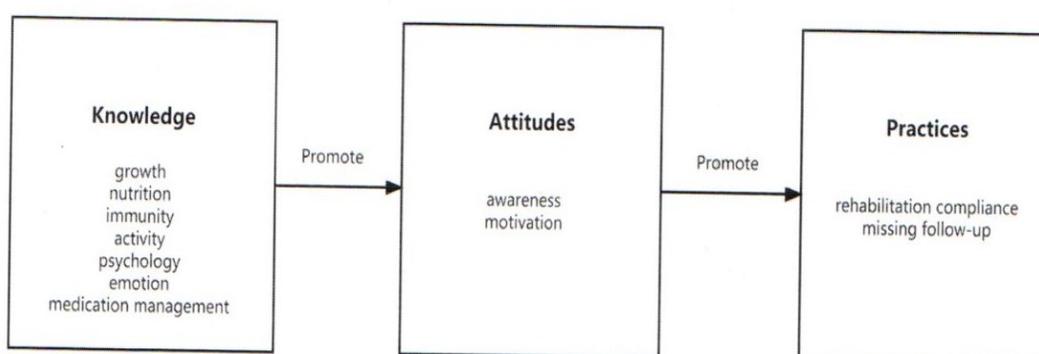


Fig. 1. Theoretical framework of knowledge, attitudes, and behaviors in regard to cardiac rehabilitation for parents of children with heart disease.

Rehabilitation, and they recorded their responses in real time. Before the telephone inquiries, the telephone investigators first informed the parents of the purpose and significance of the study.

Statistical methods

Excel was used for data entry, and SPSS 24.0 was used for data analysis. Expert consultation results used the expert's active coefficient and authoritative degree to evaluate the enthusiasm and reliability of expert consultation. The content validity index was used to evaluate the content validity of items, and EFA was conducted to evaluate the construct validity of the scale. The reliability of the scale was described by the Cronbach's alpha coefficient and split-half reliability. Item adjustments were made according to the correlation coefficient between the item and the total scale score, the critical ratio, and Cronbach's alpha. The degree of discrimination of the knowledge subscale is represented by the critical ratio, and the difficulty level of the knowledge subscale is described by the difficulty value (difficulty value = average score/full score). In this study, $P < 0.05$ was considered to be statistically significant.

Results

In total, 214 telephone questionnaires were taken, of which 200 questionnaires were completed, so the effective recovery rate was 93.46%.

Difficulty and discrimination analysis

The sum of the scores of all of the items of the knowledge subscale is the total score of the knowledge subscale, which reflects the knowledge of the parents of children with heart disease about cardiac rehabilitation. According to the total score of the knowledge subscale, the 200 respondents were sorted from high to low; the top 27% of the respondents were selected as the high-scoring group, and the bottom 27% of the respondents were selected as the low-scoring group (Wan & Xu, 2016). The results show that the overall difficulty value of the knowledge subscale is 0.84 ± 0.08 , indicating it is relatively easy for parents to fill in; the critical ratios are all >3 , and $P < 0.05$, indicating a good degree of discrimination (Polit & Beck, 2017). The results are shown in Table 1.

Content validity analysis

The Delphi method was used for expert consultation, and the content validity index of each item (I-CVI) and the content validity index of the whole scale (CVI) were calculated according to the results to

evaluate the content validity of the scale (Polit et al., 2007). The I-CVI for each item is equal to the number of experts with a relevance score ≥ 3 divided by the total number of experts involved in the consultation. A total of 12 experts from multiple centers were included in this study, including two surgeons, four physicians, five nursing specialists, and one rehabilitation physician, all of whom have extensive experience in cardiac rehabilitation. The consultation form was distributed to all 12 experts through WeChat correspondence or on paper, and the questionnaires were completed within 2 weeks. The recovery rate of the two rounds of expert consultation was 100%, and the enthusiasm of the experts was high. Items with $I-CVI \geq 0.78$ were retained, items with $I-CVI = 0.70-0.78$ were modified, and items with $I-CVI < 0.70$ were discussed to decide if they should be kept or discarded (Sapnas & Zeller, 2002). Then, according to the I-CVI values, the average method (S-CVI/Ave) was used to analyze the CVI of the whole scale. According to the scale formed after two rounds of expert consultation, the item importance was between 4.42 and 4.92, the coefficient of variation was between 0.06 and 0.15, and the Kendall coordination coefficient was 0.189 ($P < 0.01$). The authoritative coefficient (Cr) was $0.962 > 0.7$, and S-CVI/Ave was $0.956 > 0.78$, indicating that the scale had good content validity (See Table 2 for details). Finally, a scale with a total of 38 items was formed. The I-CVI values of items k17 and k18 were <0.70 ; after group discussion, they were retained.

Correlation analysis between each item and the total score

Evaluating the correlation between each item in the knowledge subscale and the total item by the Pearson correlation coefficient, we found that the overall correlation coefficient between items K8, A7, and P3 and the knowledge subscale is <0.4 , which is significantly lower than those for other items, so these three items were removed (see Table 2 for details).

Construct validity of knowledge subscales

EFA was performed on the knowledge subscale using principal components analysis and the maximum variance rotation method. The test results show that the Kaiser–Meyer–Olkin (KMO) value was 0.900, and the Bartlett sphericity test value was 2115.394 ($P < 0.01$), which is suitable for EFA (Smith et al., 2021), and the overall cumulative variance contribution rate was 68.769%. According to the characteristic root >1 and the cumulative contribution rate of variance, the common factor was extracted, and it converged after six rotations. The extracted four common factors were all >0.4 , and K12 belonging to two common factors was removed after group discussion. After deletion, EFA was carried out again (see Table 3 for details). The KMO value of the adjusted knowledge subscale was 0.88, the Bartlett sphericity test value was 1803.440, the overall cumulative variance contribution rate was 67.966, and the construct validity is good (see Table 4 for details). Finally, factor loading 1 was named “Basic Knowledge of Cardiac Rehabilitation,” factor loading 2 was named “immunity prevention and drug management,” factor loading 3 was named “activity and nutrition management,” and factor loading 4 was named “psychological and emotional management.”

Reliability analysis

The Cronbach's alpha value of the total scale was 0.731, and the Cronbach alpha values of the knowledge, attitude, and practice subscales were 0.905, 0.877, and 0.782. According to the odd and even numbers of the items, the split-half reliability was tested; the split-half reliability of the total scale was 0.742, and the split-half reliability values of the knowledge, attitude, and practice subscales were 0.861, 0.824, and 0.738. (See Table 5 for details).

Table 1
The critical ratio and difficulty value of the knowledge item scale.

Entry	Critical ratio	Difficulty value
K1	11.452	0.854
K2	9.186	0.870
K3	9.667	0.890
K4	9.401	0.892
K5	10.882	0.814
K6	11.237	0.696
K7	8.577	0.832
K8	4.373	0.646
K9	9.507	0.856
K10	10.403	0.874
K11	13.233	0.856
K12	12.357	0.914
K13	11.584	0.904
K14	9.577	0.878
K15	7.574	0.908
K16	9.211	0.912
K17	10.631	0.858
K18	5.078	0.674

Table 2

Content validity of each item and correlations between items and total scale scores.

Dimension	Entry	I-CVI ^a	Coefficient of variation	Importance assignment	Pearson correlation coefficient	P-value
Knowledge K1	Children older than 3 months after congenital heart disease require cardiac rehabilitation.	1	0.06	4.92 ± 0.29	0.657	0.000
Knowledge K2	Children with cardiomyopathy need cardiac rehabilitation.	1	0.06	4.92 ± 0.29	0.690	0.000
Knowledge K3	Cardiac rehabilitation includes cardiopulmonary function examination, growth and development assessment, exercise, and psychological assessment and guidance.	1	0.1	4.75 ± 0.45	0.700	0.000
Knowledge K4	Children with congenital heart disease are prone to infection due to low immunity after surgery.	1	0.08	4.83 ± 0.58	0.747	0.000
Knowledge K5	Children with congenital heart disease need a professional evaluation before they can be vaccinated.	0.917	0.12	4.67 ± 0.65	0.522	0.000
Knowledge K6	Infectious endocarditis can be prevented by maintaining good oral hygiene, having regular dental check-ups, and preventing dental caries.	0.917	0.14	4.58 ± 0.67	0.575	0.000
Knowledge K7	Children with congenital heart disease need a high-protein, low-fat diet in the early postoperative period.	0.917	0.15	4.67 ± 0.49	0.559	0.000
Knowledge K8	Children with congenital heart disease need a light diet early after surgery.	0.917	0.15	4.75 ± 0.62	0.201	0.004
Knowledge K9	Children with congenital heart disease need regular monitoring of height and weight after surgery to ensure adequate nutrition.	1	0.11	4.67 ± 0.65	0.594	0.000
Knowledge K10	Parents need to pay attention to their children's emotions.	0.917	0.13	4.75 ± 0.45	0.651	0.000
Knowledge K11	Parents need to manage their emotions in order to maintain a good parent–child relationship with their children.	0.917	0.14	4.75 ± 0.45	0.648	0.000
Knowledge K12	Ensuring adequate sleep is conducive to maintaining a good mood.	1	0.1	4.83 ± 0.39	0.830	0.000
Knowledge K13	The advantages of exercise rehabilitation include promoting development, enhancing heart and lung function and motor coordination, protecting eyesight, and improving mental health and interpersonal communication.	1	0.1	4.92 ± 0.29	0.798	0.000
Knowledge K14	Exercise can be divided into aerobic exercise and anaerobic exercise.	1	0.08	4.92 ± 0.29	0.731	0.000
Knowledge K15	If before and after exercise, the child has muscle pain, loss of appetite, nausea and vomiting, headache, dizziness, and mental depression, then it is necessary to suspend the exercise.	1	0.06	3.92 ± 1.24	0.674	0.000
Knowledge K16	Children with congenital heart disease should not stop or reduce the medication without authorization.	1	0.06	3.92 ± 1.00	0.707	0.000
Knowledge K17	Children with congenital heart disease should not mix the medicine with fruit juice and beverages when taking medicine after surgery.	0.667	0.32	4.75 ± 0.62	0.695	0.000
Knowledge K18	Children taking diuretics can eat foods such as soybeans, peanuts, and bananas to avoid hypokalemia.	0.667	0.25	4.83 ± 0.39	0.435	0.000
Attitude A1	You feel your child needs cardiac rehabilitation after surgery.	0.917	0.13	4.83 ± 0.39	0.71	0.000
Attitude A2	You feel that cardiac rehabilitation is beneficial to your child.	1	0.08	4.42 ± 0.67	0.678	0.000
Attitude A3	You feel that exercise rehabilitation is helpful for your child's cardiorespiratory recovery.	1	0.08	4.92 ± 0.29	0.697	0.000
Attitude A4	You feel your child has the stamina to keep up with sports rehabilitation.	0.9167	0.15	4.75 ± 0.62	0.483	0.000
Attitude A5	You feel the need to pay attention to your child's emotions.	1	0.06	4.83 ± 0.39	0.694	0.000
Attitude A6	You feel the need to manage your emotions.	1	0.1	4.83 ± 0.39	0.687	0.000
Attitude A7	You feel that you need dietary instructions for your child from healthcare providers.	0.917	0.13	4.42 ± 0.67	0.211	0.003
Attitude A8	You feel the need to regularly assess your child's growth and development.	0.917	0.14	4.92 ± 0.29	0.687	0.000
Attitude A9	You feel that you need a healthcare provider to guide your child with medication.	1	0.08	4.75 ± 0.45	0.695	0.000
Attitude A10	You feel that your child's immunizations need to be evaluated by healthcare providers.	0.9167	0.12	4.75 ± 0.62	0.559	0.000
Practice P1	You will take your child for regular cardiac rehabilitation evaluations.	0.9167	0.14	4.67 ± 0.65	0.696	0.000
Practice P2	You will regularly monitor your child's height and weight.	0.75	0.2	4.83 ± 0.39	0.488	0.000
Practice P3	You limit your child to foods high in oil, salt, and sugar.	0.9167	0.15	4.83 ± 0.58	0.305	0.000
Practice P4	You will supervise your child to exercise regularly according to the exercise prescription.	0.9167	0.14	4.67 ± 0.65	0.676	0.000
Practice P5	During exercise, if your child has dizziness, headache, or other discomforts, you will promptly inform the medical staff.	1	0.08	4.33 ± 0.89	0.476	0.000
Practice P6	You will monitor your child's good oral hygiene and have regular dental check-ups.	0.9167	0.13	4.58 ± 0.67	0.674	0.000
Practice P7	You will not have your child vaccinated until they have been evaluated by a healthcare provider.	0.9167	0.13	4.67 ± 0.65	0.468	0.000
Practice P8	You pay attention to your emotions and do not let negative emotions affect your child.	0.9167	0.15	4.83 ± 0.39	0.586	0.000
Practice P9	You will proactively learn about your child's emotions and unusual behavior.	0.9167	0.14	4.75 ± 0.62	0.608	0.000
Practice P10	You will get your child to take the medicine on time as directed by the doctor.	1	0.06	4.92 ± 0.29	0.575	0.000

^a content validity index of each item.

Comprehensive analysis

Statistical analysis based on Pearson correlation between the scores of the three subscales of knowledge, attitude, and practice and the total score of the scale was carried out. The correlation coefficients (*r*) were 0.954, 0.931, and 0.920 ($P < 0.01$, two-sided *t*-test), showing a strong correlation (see Table 6 for details).

Discussion

Although children's cardiac rehabilitation has received more and more attention, the home management of children with heart disease is inseparable from the participation of the family (Meyer et al., 2020). Because heart disease in children tends to develop at a younger age,

parents play a leading role in their children's rehabilitation. At the same time, cardiac rehabilitation requires a substantial amount of time, and it is difficult for children with congenital heart disease to adhere to the rehabilitation schedule alone. Only 15% of children comply with the cardiac rehabilitation program (Jacobsen et al., 2016). At the same time, studies have shown (Thomson et al., 2020) that patients' negative perceptions and attitudes about cardiac rehabilitation can affect their acceptance and compliance with cardiac rehabilitation. Therefore, studies have confirmed (Longmuir et al., 2013) that children's cardiac rehabilitation needs to be family-centered, and it is necessary to combine children with heart disease and their parents as the common intervention object of cardiac rehabilitation. Therefore, in this study, guided by the theory of knowledge, attitude, and practice, we compiled the Knowledge, Attitude, and Practice Scale for parents of

Table 3
Exploratory factor analysis of the knowledge subscale.

Entry	Factor loading				Commonality
	1	2	3	4	
K1	0.811				0.713
K2	0.834				0.749
K3	0.779				0.695
K4	0.672				0.69
K12	0.618	0.572			0.845
K13	0.670				0.749
K14	0.568				0.618
K10		0.871			0.863
K11		0.884			0.877
K5			0.571		0.437
K6			0.618		0.459
K16			0.535		0.578
K17			0.661		0.665
K18			0.735		0.551
K7				0.884	0.818
K9				0.872	0.814
K15				0.552	0.569
Interpretation (%)	24.704	15.368	14.615	13.279	
Characteristic root	3.953	2.459	2.338	2.125	

children with heart disease, in order to increase the compliance of these families to cardiac rehabilitation programs by improving the knowledge and attitudes of these parents. According to a previous study, the adherence of cardiac rehabilitation depends on patients' attitudes (Bakhshayeh et al., 2021). Another study showed that self-efficacy has small indirect effects on cardiac rehabilitation completion (McCleary et al., 2020). Thus, the present study based on knowledge, attitude, and practice theory can promote healthy behaviors and adherence to cardiac rehabilitation through increasing the knowledge of cardiac rehabilitation and developing a positive attitude towards cardiac rehabilitation.

The Cardiac Rehabilitation Knowledge, Attitude, and Practice Scale for Parents of Children with Heart Disease is scientific, because the scale is based on knowledge, attitude, and practice theory, and it was formed with reference to previous ICF-CY related research. ICF-CY belongs to WHO Family International Classifications and has been used as a tool for the rehabilitation of children. The 12 experts who were consulted come from the fields of surgery, internal medicine, rehabilitation, and nursing, and they have extensive experience in the content of postoperative rehabilitation of children with heart disease. Our content

Table 4
Exploratory factor analysis of the adjusted knowledge subscale.

Entry	Dimension	Factor loading				Commonality
		1	2	3	4	
K1	Cardiac rehabilitation basics	0.815				0.713
K2	Cardiac rehabilitation basics	0.839				0.754
K3	Cardiac rehabilitation basics	0.784				0.700
K4	Cardiac rehabilitation basics	0.672				0.691
K13	Cardiac rehabilitation basics	0.673				0.743
K14	Cardiac rehabilitation basics	0.573				0.617
K5	Preventive immunization and medication management		0.581			0.449
K6	Preventive immunization and medication management		0.605			0.452
K16	Preventive immunization and medication management		0.537			0.580
K17	Preventive immunization and medication management		0.659			0.665
K18	Preventive immunization and medication management		0.735			0.551
K7	Activity and nutritional management			0.887		0.821
K9	Activity and nutritional management			0.875		0.817
K15	Activity and nutritional management			0.554		0.565
K10	Psychological mood management				0.867	0.869
K11	Psychological mood management				0.882	0.883
Interpretation (%)		24.704	15.368	14.615	13.279	
Characteristic root		3.953	2.459	2.338	2.125	

Table 5
Reliability analysis.

Dimension	Cronbach's alpha	Split-half reliability
Knowledge	0.905	0.861
Attitude	0.877	0.824
Practice	0.782	0.738
Total	0.731	0.742

Table 6
Correlation analysis of knowledge, attitude, and practice scores and total score.

Dimension	Attitude	Practice	Total score	P-value
Knowledge	0.829	0.793	0.920	0.000
Attitude	–	0.829	0.931	0.000
Practice	–	–	0.954	0.000

validity analysis revealed that the I-CVI value of the two items related to drug management was low, but the importance was assigned >4 points. After discussion by the research group, it was agreed that drug management is still important for children's cardiac rehabilitation after surgery. Therefore, it was retained, and the final S-CVI/Ave value was 0.956 > 0.78, indicating good content validity.

In the construct validity test, the knowledge subscale was divided into four dimensions: basic knowledge of cardiac rehabilitation (six items), preventive immunization and medication management (five items), activity and nutrition management (four items), and psychological and emotional management (two items). The most content with respect to cardiac rehabilitation basics comes from guidelines. This is the most basic knowledge that the parents of children with heart disease need to have. In addition, parents of children with heart disease need to master a wealth of knowledge and care skills, about subjects that include preventive immunization and medication, activities and nutrition, and psychological and emotional support (Amedro et al., 2019), the main content of cardiac rehabilitation. The Association for European Paediatric and Congenital Cardiology (AEPC) proposed in 2020 (Fleck et al., 2018) that adolescents with congenital heart disease need moderate activity. However, due to a lack of knowledge, these parents of children often overprotect their children (Budts et al., 2020), resulting in their actual daily activity time and intensity not reaching the recommended level (Knowles & Bull, 2013). The three subscales of knowledge, attitude, and practice of this scale also have strong correlation

with each other, which reflects the relationship between the knowledge, attitude, and practice of cardiac rehabilitation of parents of children with heart disease. Therefore, this scale can be used to evaluate the levels of knowledge, attitude, and practice of parents of children in cardiac rehabilitation, so as to enhance the parents' basic knowledge of cardiac rehabilitation, improve their acceptance of cardiac rehabilitation, and ensure the compliance with cardiac rehabilitation programs.

The Cronbach's alpha value and split-half reliability were used to test the reliability of the scale. The stability and consistency of the scale are generally evaluated based on reliability. A Cronbach's alpha value between 0.7 and 0.8 indicates that the scale is highly reliable and acceptable; a Cronbach's alpha value between 0.8 and 0.9 indicates the reliability of the scale is very high (Williamson et al., 2021). In this study, the Cronbach's alpha value of the total scale was 0.731, and the Cronbach's alpha values of the knowledge, attitude, and practice subscales were 0.905, 0.877, and 0.782, respectively, indicating that the scale had high reliability and good internal consistency. The split-half reliability of the total scale was 0.742, and the split-half reliability values of the knowledge, attitude, and practice subscales were 0.861, 0.824, and 0.738, respectively, indicating that the internal consistency of the scale is good. The Knowledge, Attitude, and Practice Scale for Parents of Children with Heart Disease prepared in this study has good internal consistency in both subscales and the total scale, and each item has a strong correlation with the total score of the Knowledge, Attitude, and Practice Scale. Therefore, this scale has good reliability, it can reflect the true level of cardiac rehabilitation knowledge, attitude, and practice of parents of children with heart disease, and it can be used as a reliable assessment tool.

Practice implications

The preparation of the Cardiac Rehabilitation Knowledge, Attitude, and Practice Scale for Parents of Children with Heart Disease is of great significance for carrying out targeted education programs in the future to improve the compliance of children with heart disease with cardiac rehabilitation programs. At the same time, cardiac rehabilitation nurses are in close contact with children with heart disease and their parents. During cardiac rehabilitation, the nurses can also urge children with heart disease and their parents to participate in cardiac rehabilitation programs, thereby improving the compliance with cardiac rehabilitation (O'Byrne et al., 2018). Therefore, we should develop a team of cardiac rehabilitation specialist nurses to provide targeted education programs by assessing the knowledge, attitude, and practice of cardiac rehabilitation of parents of children with heart disease, so as to improve parents' disease care skills from the perspective of nursing and to ensure that children with heart disease can receive effective and safe cardiac rehabilitation.

Limitations and strengths

The methodology of this study is standardized, the content of the previous research is solid, and multi-center expert consultation was used to ensure the scientific validity of the scale. Due to difficulties in completing the offline paper questionnaire during the COVID-19 epidemic, we adopted telephone inquiries. We used telephone recordings and random inspections by quality controllers to minimize bias. But conducting survey research over the telephone also removes the anonymity of the participants possibly making the results less reliable. In the future, we will conduct further multi-center and large-sample research to verify the scientific validity of the scale developed here.

Conclusion

We developed a reliable tool to assess the level of knowledge, attitude, and practice of parents of children with heart disease, consisting of three dimensions: knowledge, attitude, and practice. This scale can

guide medical staff to evaluate the knowledge, attitude, and practice level of parents of children with heart disease about cardiac rehabilitation, so as to provide targeted education programs and improve the cardiac rehabilitation of children with heart disease.

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CRedit authorship contribution statement

Chen Lin: Writing – original draft, Formal analysis, Investigation. **Shen Xiaoyi:** Data curation, Investigation. **Cai Xiaoman:** Methodology, Resources. **Guan Yongmei:** Project administration, Supervision. **Wu Yibei:** Project administration, Supervision. **Shen Nanping:** Writing – review & editing, Methodology. **Luo Wenyi:** Writing – review & editing, Project administration, Methodology.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pedn.2022.11.028>.

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