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Dimensionality and Reliability of the Adult Responses to Children's Symptoms Questionnaire in Iranian Children with Chronic Diseases

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ABSTRACT

Background: The purpose of this research is to determine the dimensionality and reliability assessment of the questionnaire of Adult Responses to Symptoms (ARCS) of Iranian children suffering from chronic diseases. When adults respond appropriately to the physical symptoms of sick children, they can manage chronic diseases more effectively and prevent the worsening of symptoms associated with psychological factors.

Methods: In this psychometric and validation study, 290 parents of children aged 4 to 16 with chronic diseases were selected through consecutive sampling. They were recruited from a children's educational and therapeutic center in Rasht city (north of Iran) and participated by answering the ARCS questionnaire between December 2021 and June 2022. Confirmatory factor analysis (CFA) was used to determine the construct validity. Pearson correlation coefficient and intraclass correlation coefficient (ICC) were employed to assess the test-retest reliability over a 4-week interval.

Results: In the CFA, the factor loadings of all the items were above 0.3, and the fit indices of the modified Iranian model (PCFI = 0.69, PNFI = 0.62, CMIN/DF = 2.80, RMSEA = 0.07, IFI = 0.90, CFI = 0.90 and GFI = 0.92) were obtained, which shows the confirmation of the three-factor model of the ARCS questionnaire (i.e. protective, encouraging and minimizing dimensions). The test-retest reliability of the ARCS questionnaire scores for the dimensions of protective, encouraging/monitoring and minimizing responses were equal to 0.85, 0.94 and 0.87 ($p = 0.001$). Furthermore, ICC for the dimensions of protective, encouraging/monitoring and minimizing responses was obtained as 0.90, 0.97, and 0.93, respectively. The Cronbach's alpha coefficients were also calculated for the three above-mentioned subscales as 0.83, 0.70, and 0.60, respectively.

Conclusions: The ARCS questionnaire has desirable reliability coefficients and construct validity. It can be used for clinical monitoring, educating families of children with chronic illnesses, and evaluating improvements in treatment outcomes.

Keywords: Dimensionality, Reliability, Validity, Chronic diseases, Parents, Children

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Introduction

Children may suffer from all kinds of diseases during their childhood, but the experience of illness and chronic pain can be very difficult and exhausting for children and their families. Long-term chronic diseases can affect many aspects of children and their parents' lives. A chronic condition also known as chronic disease is a health condition or disease that lasts for more than three months or otherwise long-lasting in its effects, and is not fully responsive to treatment (1). It is estimated that between 10 to 30 percent of children, depending on the diagnostic criteria of the disease, are suffering from chronic diseases (2).

A child with a chronic disease may experience many symptoms, including pain and fear; however, children may not be able to properly express their pain and symptoms due to their lack of perception of their physical conditions. Therefore, parents' responses to their needs are very important (3). Parents are considered as the primary caregivers of children, and according to Bandura's social learning theory, it can be said that the way parents respond to their children, affects how the child understands and expresses the symptoms of illness (4). Parents' responses to children's symptoms include cognitions, emotions and behaviors that encourage and support the child to show adaptive or maladaptive behaviors (5-7).

In general, parents' behavioral responses to children's symptoms are divided into three categories: 1. Protective responses, which includes paying too much attention to the child and avoiding activities and responsibilities; 2.Minimizing responses, which includes behaviors that ignore the child's needs or deal with them aggressively; 3. Encouraging/ monitoring responses, that makes parents control the situation when the child suffers from pain and disease and encourage the child to continue participating in daily and social activities (8,9). In fact, children with chronic diseases may receive more attention from their parents due to constant pain or other symptoms, and the responsibility of work may be taken away from them. This causes avoidance of daily, physical, and social activities (5,10). Research has shown that excessive parental care behaviors, such as protectiveness and catastrophizing, can lead to excessive absence from school, persistence, and increasing severity of symptoms (11, 12).

A brief look at the results of the aforementioned studies makes us pay more attention to the discussion of adults' responses to children's symptoms and also to the development of suitable tools for its evaluation. In the meantime, no measurement tool has been produced and used in Persian language, so the lack of suitable and up-to-date tools guarantee the necessity of conducting this study. Adult Responses to Children's Symptoms questionnaire (ARCS) is a tool to measure adults' responses to children's symptoms. The ARCS questionnaire was created and designed in English by Van Slyke and Walker in 2006. Several scales have been designed to examine parents' responses to disease symptoms. The first scale was the IBES scale, which examined adults' reactions to episodes of abdominal pain and other symptoms in children, and focused exclusively on behaviors associated with anxiety (13). Later, this scale was expanded to Social Consequences of Pain questionnaire (SCP), which measured the positive and negative reactions of teachers, peers and parents, and finally Illness Behavior Encouragement Scale (IBES) became the ARCS questionnaire with some changes (14).

Moreover, it should be noted that the type of response from adults to the needs of children in any society, according to the specific cultural aspects of that society, can have large or small differences compared to other societies. No study in Iran has examined the dimensions of parents' responses to the symptoms of children suffering from chronic illnesses. Chronic illnesses in children and the special care needs that arise from them can impact their educational performance, relationships with peers, and even their future careers and family lives. Therefore, it is essential for the parents of these patients to adjust their responses to the symptoms of their sick children. Given the absence of a validated tool in Persian

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and the importance of understanding adult responses to children's symptoms in this cultural context, the present study aims to determine the dimensionality and reliability of the ARCS questionnaire in Iranian children with chronic diseases.

Methods

This is a psychometric and validation study which falls into the category of quantitative research. The initial step in ensuring a high-quality translation is to choose the most effective method for translating the research instrument. To carry out the translation of the questionnaire, a committee-based framework (TRAPD approach: translation, review, adjudication, pretest, and documentation) was selected (15). At first, the main language of the ARCS questionnaire (English) was translated by three translators, independently and in parallel, and then, by examining the phrases of each translation one by one, the best and most expressive version was extracted from these three translations. Then the translation was reviewed and refined by two research group members. Subsequently, mistranslations were corrected and integrated into a single copy. At this stage, to better understand the question, item 20 was changed from "Let your child sleep in a special place (like in your room)" to "Let my child sleep in a special place (like in our room)". For the adjudication stage, the translated text was given to a group of ten master's students of psychology (as a pretest) from the University of Gilan to provide their opinions and possible criticisms. In addition, possible changes were made to make the questions more understandable and to confirm the face validity of the ARCS. Finally, the final version of the translation was reviewed by members of the research team (Health psychologist, pediatrician and statistician) and ready to implement the next steps. Furthermore, the process for producing final translations was documented.

The statistical population of this research consisted of parents of children aged 4 to 16 with chronic diseases who were hospitalized in a children's educational and therapeutic center in Rasht city from December 2021 to June 2022. Sampling method was done as consecutive sampling. The inclusion criteria involved speaking Persian or understanding Persian, parents' ability to read and write, informed consent to enter the study, having a child with a chronic physical disease (as diagnosed by a treating physician) between the ages of 4 and 16 and that the respondent parents do not suffer from any physical illnesses and mental disorders (based on self-report and taking medication related to the physical illness and mental disorders). Moreover, the exclusion criteria involved incomplete answers to the test questions. AMOS-26 and SPSS-26 software were used to analyze data and check the dimensionality (construct validity) and reliability of the Persian version of the ARCS questionnaire.

To calculate the sample size needed for assessing construct validity and conducting confirmatory factor analysis (CFA), a minimum ratio of 5 observations for each parameter in the ARCS questionnaire's confirmatory model was applied. Given the number of parameters in the measurement model, this necessitated a sample of 290 participants. Additionally, various fit indices such as the chi-square/degrees of freedom ratio (CMIN/Df), Parsimonious Normed Fit Index (PNFI), Comparative Fit Index (CFI), Parsimonious Comparative Fit Index (PCFI), Incremental Fit Index (IFI), Goodness of Fit Index (GFI), and Root Mean Square Error of Approximation (RMSEA) were utilized to evaluate model fit. Based on the proposal of Kline (17), the unit of quantitative measures of the goodness of fit on the unacceptability of the fit of the proposed model of the ARCS questionnaire (including the three dimensions of protective, encouraging/ monitoring and minimizing behaviors) complies with the collected data. According to the view of Weston and Gore (18), since the hypothesized model shows a perfect fit with the data, , by choosing the model modification step and removing factor loadings less than 0.3 in two ways (19) and creating multiple paths of covariance between error residuals for pairs of ARCS

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questionnaire items, the fit of the proposed model with the data was improved.

Pearson's correlation coefficient was used to measure the test-retest reliability of the Persian version of ARCS; In this way, 30 of the participants who answered the ARCS questionnaire in the first stage, after four weeks (that is, during the visit of the treating doctor) completed the questionnaire again, and the scores of these two stages of evaluation were correlated. The most acceptable test to determine the consistency (reliability test) is intraclass correlation coefficient. In addition, intraclass correlation coefficient (ICC) index was used to measure consistency reliability of the ARCS questionnaire. If the ICC value is higher than 0.80, reliability is at a very favorable level, if it is between 0.6 and 0.8, it is at moderate level, and if it is less than 0.6, it is poor (20). In order to determine the internal consistency, Cronbach's alpha coefficient of this tool was calculated for 290 parents with children aged 4 to 16 with chronic diseases in Rasht, Iran. It is notable that, according to Van Griethuijsen (21), Cronbach's alpha values between 0.6 and 0.7 are considered acceptable. The description of the tools of this study is as follows:

***ARCS*:** In the current research, the ARCS tool was used to examine the responses of adults to children's symptoms in Iran, and before that, the psychometric indicators of this tool were evaluated in several stages. This questionnaire was designed and developed by Van Slyke and Walker in 2006 (14). The original scale consisted of 33 items that described the behavior of adults towards children with pain. Additional questions were removed and the final version had 29 questions with three subscales. 8 questions were related to encouraging and monitoring responses (questions 1, 4, 6, 10, 12, 24, 26, 28), 15 questions were about protective responses (questions 3, 5, 7, 8, 11, 13, 15, 16, 17, 19, 20, 22, 23, 25, 29) and 6 questions (questions 2, 9, 14, 18, 21, 27) related to minimizing responses. All questions were scored using a 5-point scale ranging from never (score 0) to always (score 4). The items of parental protective responses refer to having special attention to the child and limiting his/her daily activities and responsibilities. The internal reliability of this questionnaire was acceptable, and the Cronbach's alpha coefficient of the subscales of protective, minimizing and encouraging/monitoring responses was reported as 0.87, 0.67 and 0.79, respectively. In the study of Walker, Levy and Whitehead (22), the Cronbach's alpha coefficient of the protective answers of this questionnaire was 0.84, and in the study of Claar et al. (23) the alpha coefficient of the subscales of protective responses, and minimizing and encouraging /monitoring responses were reported as 0.82, 0.78 and 0.82, respectively. In addition, the criterion validity of the questionnaire using the list of children's functional disability and depression showed protective responses were positively associated with functional disability ($\beta = 0.26$, $p < 0.05$) and also with children's depression ($\beta = 0.17$, $p < 0.05$).

Results

In this study, 290 parents of children aged 4 to 16 with chronic diseases in Rasht, Iran, were examined (see table-1). The average age of parents was 38.19 ± 6.92, with the average ages of mothers and fathers being 37.46 ± 6.55 and 40.83 ± 7.46 respectively, within an age range of 25 to 60. In addition, the average age of children was 9.04 ± 3.78, with the average ages of girls and boys being 8.84 ± 3.46 and 9.21 ± 4.03 respectively. Before performing statistical analysis, outlier data were identified using the square of the Mahalanobis distance, and a total of 15 outlier data were excluded from the analysis.

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Table 1. Demographic characteristics of parents of children aged 4 to 16 with chronic diseases (n=290)

Demographics	Level	Count	Percentage
Parent's gender	Female	224	77.2%
	Male	66	22.8%
Education level	Below high school diploma	65	22.4%
	High school diploma	96	33.1%
	Associate degree	47	16.2%
	Bachelor's degree	58	20%
	Master's degree	24	8.3%
Parent's employment status	Employed	115	39.7%
	Retired	3	1%
	Homemaker	172	59.3%
Marital status	First marriage	257	88.6%
	Second marriage	18	6.2%
	Divorced	11	3.8%
	Widowed	4	1.4%
Income status (in million Tomans)*	< 4	152	52.4%
	4-9	114	39.3%
	> 9	24	8.3%
Type of pregnancy	Planned	196	67.6%
	Without spouse's consent	4	1.4%
	With spouse's consent	14	4.8%
	Accidental	76	26.2%
Child's gender	Female	130	44.8%
	Male	160	55.2%
Child's disease	Cancer	85	29.3%
	Gastrointestinal	18	6.2%
	Diabetes	40	13.8%
	Dialysis	9	3.1%
	Asthma	34	11.7%
	Epilepsy	31	10.7%
	Immune deficiency	19	6.6%
	Thalassemia	19	6.6%
	Other	35	12.1%

* Each dollar was equivalent to 30,000 tomans on average at the time this study was conducted.

In the proposed model, 4 items numbered 11, 18, 21, and 24 had a factor load of less than 0.3. In the first step, these 4 items were removed from the proposed research model, and in the second step, the final correction was made by plotting the correlation between the covariance errors.

The results in this section show that for the current variable of protective responses, 113 units in the degree of freedom, and 593/425 units of the chi-square of the modified model were reduced by creating error covariance (e) for items e28-e29, e26-e29, e23-e29, e20-e29, e27-e28, e27-e24, e26-e23, e20-e16, e19-e18, e19-e17, e18-e17 and e17-e15, and for the underlying variable of encouraging/monitoring behaviors by creating covariance between the error residuals for items e7-e10 and e11-e13, and in total, with the modifications made As a result of these modifications, the fit indices in the modified model are PCFI = 0.69, PNFI = 0.62, CMIN/DF = 2.80, RMSEA = 0.07, IFI = 0.90, and CFI = 0.90 , and GFI = 0.92 was obtained, which shows the confirmation of the three-factor model of the ARCS questionnaire (Table 2).

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Table 2. The model fit indices of confirmatory factor analysis model of ARCS questionnaire

Model fit indices*	χ^2	df	P	CMIN/df	RMSEA (90%CI)	PNFI	CFI	PCFI	IFI	GFI
Before modification	1324.87	374	0.001	3.54	0.09 (0.09-0.10)	0.50	0.82	0.57	0.82	0.87
After modification	731.44	261	00.01	2.80	0.07 (0.07-0.08)	0.62	0.90	0.69	0.90	0.92

***Acceptable Fit Indices,** PCFI, PNFI (0.5 <), IFI, CFI, GFI (.9 <), RMSEA (0.08 >), CMIN/df (3 > good, 5 > acceptable) (17).
***Abbreviations:** CFA: Confirmatory Factor Analysis; CMIN/DF: Chi-square/degree-of-freedom ratio; RMSEA: Root Mean Square Error of Approximation; PCFI: Parsimonious Comparative Fit Index; GFI: Goodness of Fit Index; PNFI: Parsimonious Normed Fit Index; IFI: Incremental Fit Index; CFI: Comparative Fit Index.

Figure-1 and Table-2 show the results related to the factor loadings of the three-factor structure of the ARCS questionnaire measurement model for children with chronic diseases after modifying the proposed model. The standardized factor loadings between the items and the underlying constructs of the ARCS questionnaire in factor analysis show confirmation after model modification. All factor loadings are higher than 0.3 and statistically significant.

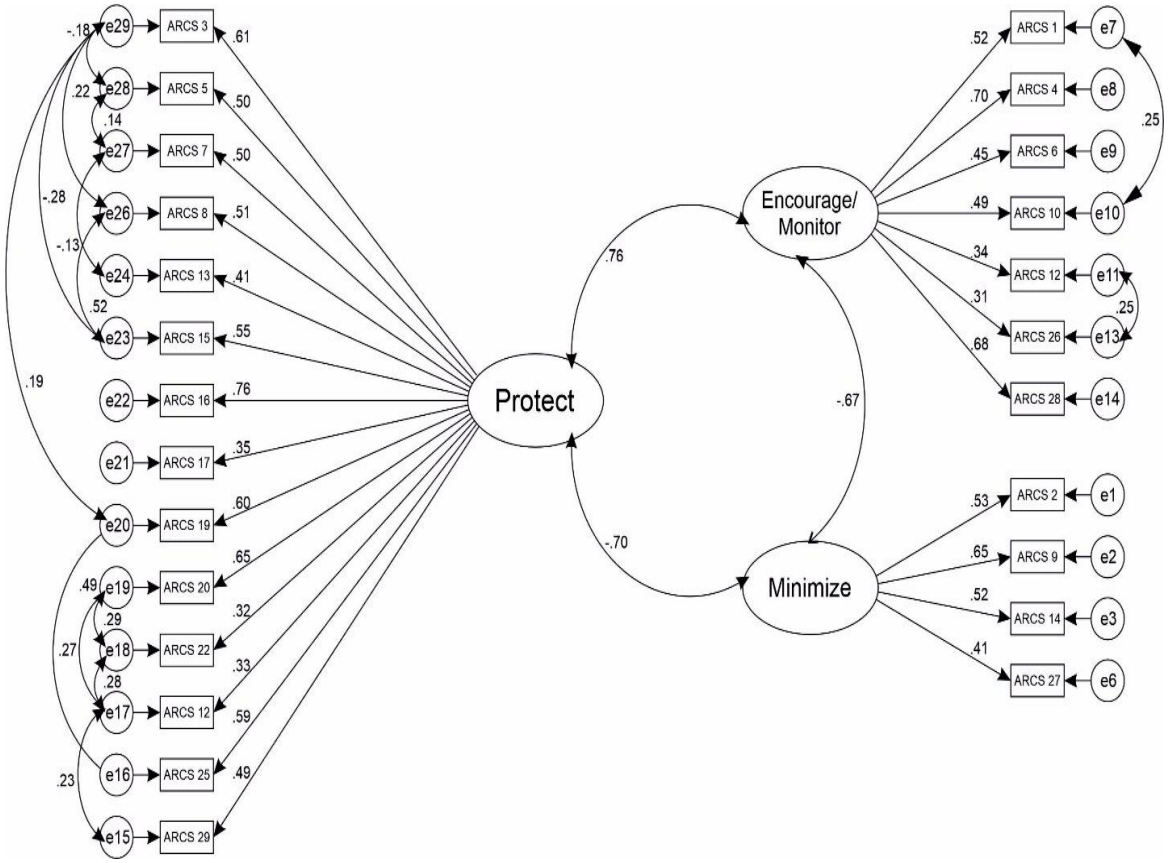


Figure 1. The structure of the Persian version of the ARCS questionnaire: the modified model resulting from the confirmatory factor analysis

Moreover, to measure the construct validity of ARCS, the item-total score correlation of the subscales was used. The results showed that the items of each dimension had the highest correlation with the total score of that dimension. So that the values of the correlation coefficient of the items with the dimensions of ARCS were respectively in the dimension of encouraging/ monitoring responses in the range of 0.35 to 0.72, the dimension of protective responses in the range of 0.44 to 0.73, and the dimension of minimizing responses were calculated in the range of 0.53 to 0.66. Therefore, the results show that the items were correctly classified in each of the dimensions.

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Pearson's correlation coefficient was used to measure the test-retest reliability of the Persian version of ARCS. Correlation coefficients between the scores of 30 participants on two occasions with an interval of four weeks to measure the retest reliability of the Persian ARCS version, respectively, for the dimensions of protective responses ($r = 0.85$, $P < 0.001$), encouraging/monitoring responses ($r = 0.94$, $P < 0.001$) and minimizing responses ($r = 0.87$, $P < 0.001$) were obtained. Considering that the value of the correlation coefficient was higher than 0.80, based on the Pearson correlation analysis, the Persian version of the ARCS questionnaire had acceptable retest reliability or consistency over time.

Also, intraclass correlation coefficient (ICC) index was used to measure consistency reliability of the ARCS questionnaire. To determine ICC, consistency method with two-way mixed model was used. The test-retest method assumes that the variables or concepts to be measured, as well as the characteristics of the examinees, will not change during a period of time. The results of Table 3 show the acceptability and appropriateness of the temporal consistency or repeatability of the Persian version of the ARCS questionnaire over time.

Table 3. Intraclass correlation coefficient of the Persian version of the ARCS questionnaire with a time interval of four weeks

Dimensions of the ARCS questionnaire	ICC	95% CI		P-value
		Lower	Upper	
Protective responses	0.90	0.75	0.95	0.001
Encouraging/monitoring responses	0.97	0.93	0.98	0.001
Minimizing responses	0.93	0.85	0.96	0.001

The results of the internal consistency show the correlation results of dimension items with its total score, as well as the reliability value of the dimensions after removing each item in the ARCS questionnaire. As can be seen in this table, most of the correlation values of the items of each dimension with the total score of that dimension were obtained at a medium to strong level, which indicates a strong internal consistency between the dimensions and related items in the ARCS questionnaire. Cronbach's alpha coefficients of the dimensions of the ARCS questionnaire were 0.70 and 0.83 respectively in the dimension of encouraging/monitoring responses and 0.83 in the dimension of protective responses, showing that the internal consistency of the Persian version of the ARCS questionnaire was at an acceptable level (above 0.70). In addition, the value of Cronbach's alpha for the minimizing responses was estimated as 0.60, which according to Van Griethuijsen's view was acceptable.

Discussion

In this study, determining the dimensionality (construct) validity and reliability of ARCS questionnaire in Iranian children with chronic diseases was the focus of attention. The results of the present study were in line with Claar et al. (23). In the final and modified model of this research [deletion of items 11, 18, 21, 24], model fit indices were obtained. Also, the results showed acceptance of the proposed three-factor model with data from Iranian parents. Therefore, three subscales of protective, encouraging/monitoring behaviors, and minimizing responses were recognized. The results of the item-total score correlation show that the items of each dimension have the highest correlation with the total score of that dimension. Therefore, structurally, it seems that the items were correctly categorized in each of the dimensions. The results of the present study reveal the degree of correlation of each of the items regarding the Persian version of ARCS with its total score at an optimal and satisfactory level. This analysis is performed for the first time for the ARCS questionnaire, and its results are not comparable with previous studies. In the field of behaviors of parents with a child with a chronic disease, another questionnaire, Coping Health Inventory for Parents (CHIP), has been translated and used by Nikfarid. et al. in Iran; However, the exact validity and reliability as well as the item-total score correlation

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of the Persian version of the questionnaire have not been reported (24).

According to the obtained results, it can be said that the Persian version of the ARCS questionnaire has an acceptable retest reliability or consistency over time. It should be noted that test-retest reliability has not been investigated in previous studies, and it can be mentioned as an important difference between studies outside of Iran and the present research.

Cronbach's alpha coefficient of the dimensions of the ARCS questionnaire—encouraging/monitoring, protective, and minimizing responses—shows that the internal consistency of the Persian version of the ARCS questionnaire was at an acceptable level. These results were consistent with the results by Van Slyke and Walker (14), Claar et al. (23) and Walker, Levy and Whitehead's study (22). According to the results of the previous studies, it was found that the highest Cronbach's alpha coefficient is related to the dimension of protective responses, and the lowest coefficient is related to the dimension of minimizing responses. With these results, it can be said that the Persian version of ARCS has high consistency, and all the items are useful for measuring the responses of adults to the symptoms of children with chronic diseases. The alpha coefficients obtained due to alignment with previous studies show that the internal consistency of this tool is suitable. In fact, the consistency in the results of different studies shows the stability in the internal consistency of the instrument, and the Persian version of the ARCS questionnaire has a satisfactory reliability.

Furthermore, based on the results, it can be said that the Persian version of ARCS is a reliable tool with satisfactory reliability coefficients for use in the community of Iranian parents and can be used in future studies. However, the current research design, like other studies, had limitations, which are listed below. These limitations should be considered to caution researchers when generalizing the results: because the target community of this research was selected only from one city; therefore, its findings cannot be generalized to the entire Iranian society. Nonetheless, since the Persian language is common among the provinces of Iran, it is feasible to use this tool elsewhere. Unlike the validated English version of ARCS, which focused on children with chronic abdominal pain, the present study was conducted on children with various chronic diseases due to limitations in collecting the necessary sample size. Furthermore, the design of this study did not allow for the determination of cut-off points for the raw scores of this questionnaire through the receiver operating characteristic curve (ROC) in the context of comparisons.

Given the limitations of the current research design, it is suggested that similar projects be conducted in other regions and provinces of Iran, considering the existing cultural differences, and its results be compared with this research. It is also recommended to determine the cut-off points of the Persian version of ARCS to identify parents who exhibit destructive responses and have poor knowledge about the symptoms of children's physical diseases.

Conclusions

Four items were excluded from the Persian version because of low factor loadings. However, the Persian version of ARCS demonstrates suitable face validity, test-retest reliability, stability, and internal consistency reliability. Additionally, the three-factor structural model of ARCS fits well within the Iranian population.

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Conflict of interest

The authors declared no conflict of interest.

Ethical considerations

The Ethics Committee of University of Guilan approved the study. The researcher introduced himself to the participants, explained the study objectives, and assured them that their information would remain confidential. Informed consent was

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obtained from parents, who were assured that no physical or psychological harm would be caused to their child.

Code of ethical

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Authors' contributions

S. R and A. Z, designed the study; Y. L and S. R, collected data, conducted data analyses, and wrote the manuscript; Sh. M and B. D, supported the study; and S. R and A. Z, critically reviewed the manuscript. All authors gave their final approval of the manuscript.

Data Availability Statements

Data are available uponon request.

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