



# Development and psychometric analysis of care needs scale for mothers of children with congenital heart disease

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## ABSTRACT

**Purpose:** This cross-sectional study aimed to create and evaluate a care needs scale for mothers of children with congenital heart disease (CHD) to determine its psychometric properties.

**Design and methods:** This methodological research was conducted with 155 mothers whose children were diagnosed with CHD and were treated at a university hospital. The study's methodology included scale development, specialist opinions, and a pilot test. Data analysis involved descriptive statistics, exploratory and confirmatory factor analyses, and reliability assessments.

**Results:** The 11-item scale was created using component analysis, expert comments, and pilot testing. It was divided into two categories: Information Needs Regarding Disease and Treatment and Needs Regarding Care. The Exploratory Factor Analysis revealed a 2-factor structure, explaining 41.5% of the variance. Reliability analysis showed reliable dimensions, and Tukey's scalability test indicated the scale requires separate dimension evaluation. The model fit indices were obtained as CMIN/DF (72.751/41) = 1.774, GFI = 0.925, IFI = 0.923, TLI = 0.893, CFI = 0.920, RMSEA = 0.071, SRMR = 0.063. The Cronbach's alpha coefficient for subdimension 1 was 0.758, and for subdimension 2 was 0.678, indicating reliable dimensions.

**Conclusion:** The developed scale provides a valuable tool for assessing the care needs of mothers of children with CHD, contributing to enhancing maternal support programs in pediatric cardiology clinics.

**Practice implications:** Assessment of the care needs of mothers who have children with CHD is promising for the development of educational programs on this subject and to ensure the competence of mothers for care.

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## Introduction

Congenital heart disease (CHD) is one of the most common congenital abnormalities in the World (Zokirovna, 2023). Significant achievements in congenital heart surgeries have increased children's survival rates with CHD (Tsao et al., 2023). These achievements have led to a shift in the healthcare focus toward the physical and psychosocial care of children and their mothers (Biber et al., 2019). Unlike some chronic diseases that may develop later in life, CHD is present from birth and requires lifelong management (Lisanti et al., 2021). These requirements include monitoring, interventions, and potential surgeries at various stages of life, from infancy through adulthood (Gaskin & Kennedy, 2019). The unique characteristics of CHD, including its complexity, lifelong management, challenges such as growth and development, exercise tolerance, nutrition, psychosocial well-being, transition of care,

and risk of complications such as heart failure, necessitate specialized comprehensive care approaches distinct from those of other chronic diseases (Best & Rankin, 2016; Lisanti et al., 2021; Ni et al., 2016; Rempel & Harrison, 2007; Roberts et al., 2021; Tsao et al., 2023). Being the mother of children with CHD may cause the most tremendous responsibility for managing children's care (Nayeri et al., 2021). Rempel and Harrison (2007) defined the parenting process of parents of children with CHD as "unusual parenting." Mothers may face difficulties in caregiving by feeling obliged to be physically close to providing comfort and care for the children (Ay & Koç, 2023). They are responsible for comprehending intricate surgery protocols, managing complex care needs such as feeding, pain management, and infection control, and maintaining effective communication with healthcare professionals (Ay et al., 2023; Ay & Koç, 2023; Harvey et al., 2013). These responsibilities are often assumed without prior training, adequate knowledge, or sufficient support systems.

The literature includes studies reporting maternal problems such as a lack of knowledge regarding children's care, ineffective coping, and

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difficulties in providing care to children (Ay & Koç, 2023; Sabzevari et al., 2016; Strange et al., 2020). Also, qualitative studies have indicated that mothers need information about their children's diagnosis and treatment processes, emotional support, and physical care (Ay, Çınar Özbay, Boztepe and Gürten, 2023; Gramszlo et al., 2020; Nayeri et al., 2021). Mothers of children with CHD are significantly at higher risk for having psychological problems, such as anxiety, depression, caregiver burden, and poor quality of life when their care needs are failed by healthcare professionals (Ay et al., 2023; Ay & Koç, 2023; Nayeri et al., 2021; Sabzevari et al., 2016). Healthcare professionals should be aware of possible risks and take precautions to make sure that mothers of children with CHD are not adversely affected by the situation.

The CHD Care Standards and Specifications stated that CHD care should be established around parents' physical and psychosocial assessment and support needs (NHS England, 2016). Healthcare professionals must recognize mothers as the primary caregivers and tailor the children's care to accommodate their needs (Ay & Koç, 2023). Also, healthcare professionals must identify, fulfill, and consistently monitor the care needs of mothers during the early stages to mitigate the development of psychosocial problems (Ay et al., 2023; Nayeri et al., 2021). By systematically assessing the care needs of these mothers, it is possible to mitigate the stress arising from their underestimated care needs while enhancing the quality of care and parental self-efficacy (Ay & Koç, 2023; Ni et al., 2016). In other words, characterizing the mothers' care needs is essential to improve interventions to address these needs and provide adequate care to mothers. Upon reviewing the literature, it became apparent that parental self-efficacy scales were predominantly employed for evaluating the caregiving requirements of mothers of children with CHD (Ay & Koç, 2023; Edraki et al., 2014; Ni, Chao and Xue, 2016). One study adapted the Mothers' Information Needs Instruments to address the specific informational needs of mothers related to caring for children at home following cardiac surgery (Stinson & McKeever, 1995). However, mothers' care needs have been under investigation, as no valid and reliable tools have been developed to assess their knowledge and skill requirements related to the child's physical care and psychosocial care needs during the diagnosis and treatment period. Existing tools, such as the 'Parent Readiness for Hospital Discharge Scale' (Weiss et al., 2020), focus primarily on whether parents are ready for the discharge process, which is very important but only part of a broader range of needs of parents of children with CHD. Similarly, the 'Child Vulnerability Scale' measures mothers' perceptions of their children's vulnerability (Forsyth et al., 1996), which is essential for understanding mothers' psychological states but does not capture the comprehensive care needs of these mothers. Our instrument, the Care Needs Scale for Mothers of Children with CHD, differs significantly because it aims to capture a broader range of care needs specific to this demographic. These include not only psychological adjustment and adaptation but also practical, emotional, and information needs directly related to the management of the child's CHD. Scales such as the 'Psychological adaptation and adjustment of mothers of children with congenital heart disease: stress, coping, and family functioning' (Davis et al., 1998) provide valuable information about stress and coping mechanisms but do not fully address the diverse and specific needs that our scale aims to capture. Furthermore, instruments such as the 'Pediatric Quality of Life Inventory™ in children with heart disease' (Uzark et al., 2003) and 'Development and psychometric evaluation of the cardiovascular health behavior scale for children' focus on children's quality of life and health behaviors (Celik & Bektas, 2020). In contrast, our scale is specifically designed to assess and address the needs of mothers, who are often the primary caregivers. By identifying these needs, our scale aims to provide a comprehensive assessment that can guide tailored interventions to support mothers more effectively. In conclusion, while existing tools are statistically valid and widely used, our Care Needs Scale for Mothers of Children with CHD fills a significant gap by focusing specifically on the holistic needs of

these mothers. We believe that incorporating this tool into practice will enhance the support system for mothers and ultimately improve both their well-being and the care provided to their children. Therefore, this study aimed to develop and validate the care needs measuring scale for mothers of children with CHD, the Care Needs Scale for Mothers of Children with CHD.

## Conceptual framework

Meleis's Transition Theory model was used to conceptualize the care needs of mothers of children with CHD. It posits that a healthy transition can be achieved by considering the following three basic components: the nature of transition (developmental, healthy illness), transition situations (factors facilitating and inhibiting transition), and response patterns (progress and outcome indicators) (Meleis, 2010). According to Meleis's Theory of Transition, 'types of transition' is the most comprehensive component of this model and is present at the beginning of the transition, which led us to evaluate the care needs of mothers. Becoming a mother of children with CHD is an important developmental and health-illness transition for mothers, which occurs both about and simultaneously with each other, adding new caregiver roles and responsibilities to their lives (Ay et al., 2023). When a child is diagnosed with CHD, the transition is complex and multidimensional, requiring changes in mothers' care skills and expectations. The transition phase may be more difficult for these mothers than for mothers with other chronic conditions due to cardiac monitoring and management, respiratory support, nutritional requirements, physical activity limitations, and developmental delays (Ay et al., 2023; Golfenshtein et al., 2022; Harvey et al., 2013; Nayeri et al., 2021; Strange et al., 2020). These are crucial turning points for a mother of a child with CHD. The mother's ability to care for her child may be affected by the child's health problems, which can impact her satisfaction with her role and ability to meet the child's needs (Korukcu et al., 2017). Facilitators in the transition situation component ensure the mother's adaptation to the new care role. It emphasizes the importance of assessing and managing risk factors, such as care needs, to understand different aspects that positively adjust individuals to chronic conditions (Meleis, 2010; Meleis et al., 2000). In this context, the information and care skills provided by health professionals within the community characteristics by determining the care needs are included as facilitating factors in the transition and adaptation to the role (Korukcu et al., 2017; Meleis, 2010). Patterns of response to transition include feeling connected, interacting, developing confidence, and coping (Joly, 2015). It is crucial to maintain congenital heart care beyond hospital routines, create a caring approach according to the specific requirements of mothers' care needs, and achieve positive outcomes for both mothers and children (Ay & Koç, 2023). According to Meleis's Transition Theory, mastery of new skills needed to manage a transition and developing a fluid integrative identity are outcome indicators (Korukcu et al., 2017; Meleis, 2010). Nurses should understand the significant physiological and psychological care needs changes that mothers experience in the CHD diagnosis and treatment process and thus provide them with relevant training, guidance, and counseling (Ay & Koç, 2023; Gramszlo et al., 2020; Nayeri et al., 2021). Understanding the transition process of a mother of children with CHD, determining her care needs and possible risks, and planning effective interventions to promote well-being is essential to reach a healthy transition to children's congenital heart care (Fig. 1).

## Methods

### Study design

A cross-sectional, methodological, and descriptive study was conducted to develop and assess the psychometric properties of the care needs scale for mothers of children with CHD.

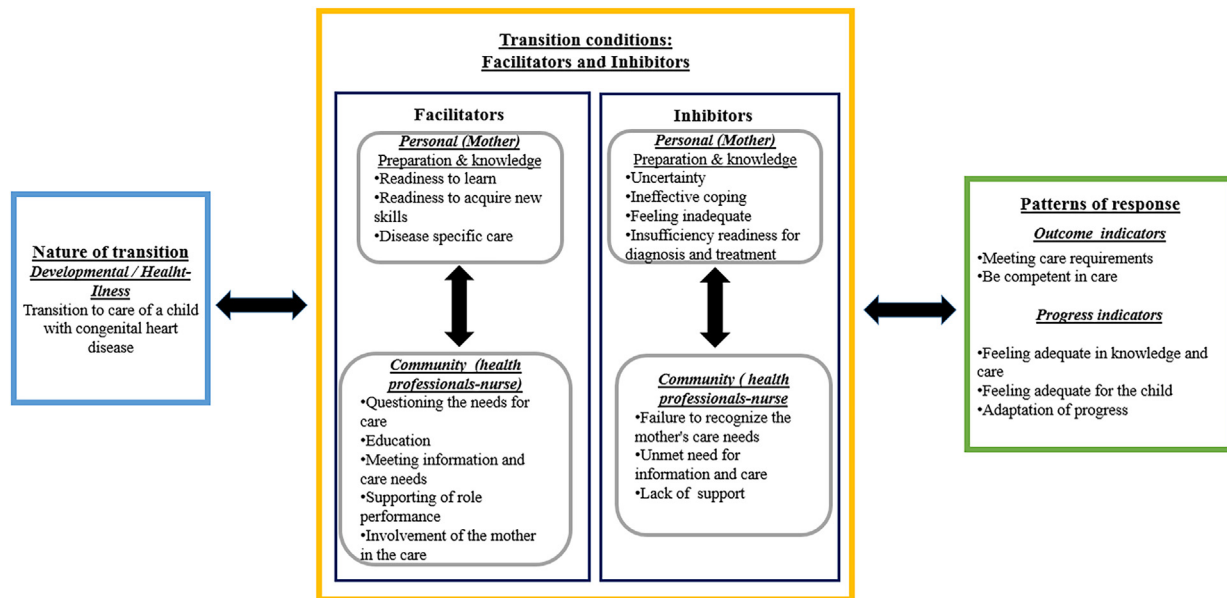


Fig. 1. Conceptual framework of the study.

### Setting and sample

The research population consists of mothers whose children are diagnosed with CHD and who apply to a university hospital's pediatric cardiology outpatient clinic and cardiovascular surgery clinic in Ankara between November 2022 and October 2023. The care needs of mothers can be affected by the time of CHD diagnosis or surgery period of the children (Harvey et al., 2013; Lisanti et al., 2019; Sood et al., 2018). All periods must be considered so that effective interventions can be planned for mothers of children with CHD and their children (Lisanti et al., 2019). Therefore, the mothers having children in the initial diagnosis, undergoing first-time surgery, and having repetitive surgery were included in the study. This scale can be administered at any time after CHD diagnosis.

For exploratory and confirmatory factor analysis, the sample size was calculated. Literature emphasized that 5–10 participants per item should be recruited to perform factor analysis in scale development studies. To verify the validity and reliability of the care needs scale (22 items, remaining items in the scale after expert opinions) for mothers of children with CHD, the study's sample size was calculated to include 154 mothers of children with CHD, with seven participants per item. A total of 155 mothers were reached in the research.

Inclusion criteria were that the mother had a child diagnosed with CHD aged 0–24 months, that the mother was literate in Turkish, and that she was a volunteer. Exclusion criteria were withdrawing from the study and incompletely completing the survey data.

### Data collection tools

Research data were collected using the Mother Information Form and Care Needs Scale for Mothers of Children with Congenital Heart Disease.

**Mother Information Form:** The form prepared by the researchers includes the sociodemographic characteristics of the mothers. The form consists of 8 questions: mother's age, employment status, education level, family income level, child's age, diagnosis time, surgery, and treatment status.

**Care Needs Scale for Mothers of Children with Congenital Heart Disease:** The scale aiming to measure the care needs of mothers of

children with CHD was developed by researchers considering the related literature (Ay & Koç, 2023; Golfenshtein et al., 2022; Lisanti et al., 2021; Roberts et al., 2021). The scale consists of 11 items and is scored as a five-point Likert scale (1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always). The scale comprises two subdimensions: Information Needs Regarding Disease and Treatment (M1, M2, M3, M4, M7, M12) and Needs Regarding Care (M9, M10, M14, M19, M22). An increase in scale scores indicates an increase in maternal needs. The minimum score that can be obtained from the scale is 11, and the maximum score is 55.

### Study procedure

#### Generation of item pool

In the first stage of the study, an item pool consisting of 25 items was created, in line with the information obtained from the literature on the care needs of mothers of children with CHD. Care was taken to ensure that the items were understandable. The following search strategy, initially used in PubMed, the Cochrane Library, Scopus, CINAHL, Embase (OVID), Web of Science, PsycINFO were adapted for other searched databases: ((“Congenital Heart Defects”[Mesh] OR “Heart Defects, Congenital”[Mesh] OR “Congenital Heart Disease”[Mesh]) AND (“Needs Assessment”[Mesh] OR “Parental Stress”[Mesh] OR “Psychometric Analysis”[Mesh] OR “Scale Development”[Mesh] OR “Instrument Validation”[Mesh])) AND (“Mothers”[Mesh] OR “Maternal Health”[Mesh] OR “Caregivers”[Mesh] OR “Parenting”[Mesh]) AND (“Pediatrics”[Mesh] OR “Child”[Mesh] OR “Pediatric Cardiology”[Mesh]) AND (“Quality of Life”[Mesh] OR “Supportive Care”[Mesh] OR “Family-centered Care”[Mesh])). The literature review followed the traditional method specified in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. Two authors (AA, RS) analyzed the articles by title and abstract by installing COVidence. Articles that met the inclusion criteria were reviewed to assess the care needs of mothers. A group discussion followed, starting from personal views and moving toward a synthesis of the 24 articles included in the literature review. As a result of the discussion, a scale pool consisting of 25 items was created with the consensus of four authors. After each item was discussed, voting was conducted to verify whether the authors reached a consensus. All authors agreed to retain the scale of the proposed items.

Specialist opinion

It is recommended that the item pool created be sent to at least ten experts to determine whether the scale items are understandable or similar and whether they serve the purpose of the research. Opinions were obtained from ten experts, associate professors, or professors in child health and diseases nursing for the content scales. Polit and Back methods were used to calculate the scale-level content validity index (S-CVI) and item-content validity index (I-CVI) (Polit and Beck, 2006). The experts evaluated whether the items in the scale measure the relevant concept and whether they should remain on the scale by scoring between 1 and 4 points (1 = Not applicable, 2 = The item needs to be replaced appropriately, 3 = Suitable but needs minor modification, 4 = Very suitable). The scale-level content validity index (S-CVI) and item content analysis were calculated separately for each item. The items that experts gave 1 and 2 points were revised.

Pilot test

After obtaining expert opinions, it is recommended that the scale be applied to a sample of 20–30 people with similar characteristics to those to be measured but not included in the sample (Çapık et al., 2018; Şencan, 2005). The draft scale, created by taking expert opinion, was applied to 30 mothers who met the inclusion criteria. As a result of the pilot application, the clarity of each item was evaluated, and necessary corrections were made. The scale was finalized and made ready for application.

Data analysis

The data were analyzed using IBM SPSS version 23 (IBM Corporation, Armonk, NY) and IBM AMOS version 24 (Amos Development Corporation, Meadville, PA, USA). Descriptive statistics were presented as numbers and percentages. Exploratory factor analysis was employed to determine the structures of the scale. Principal component analysis was used for factor extraction, and the varimax method was utilized for the rotation process in the exploratory factor analysis. The structural validity of the scales was examined through confirmatory factor analysis, and due to the assumption of multiple normality not being met, Bootstrap ML (Maximum Likelihood) was used as the calculation method. In the Bootstrap method, 800 resamples were used. The internal consistency of the scale was examined using Cronbach's alpha coefficient. The statistical significance level was accepted as  $p < 0.05$ .

Ethical considerations

Ethics committee permission to conduct the study was obtained from the University's Non-Invasive Clinical Trials Ethics Committee (Date: 25.10.2022 and No: KA22/427), while institutional permission was obtained from the hospital. The mothers were informed about the research; participation was voluntary and anonymous. Mothers were provided with a clear explanation of the study's objectives, and their consent was taken verbally and in writing. Furthermore, it was conveyed to the mothers that they could withdraw from the study at any time, without the need to provide a specific reason, should they choose to do so. Personal health information and all sensitive data were anonymized and stored in password-protected documents. To ensure mothers' comfort and privacy, the data was collected in a private room of the clinics, where the noise, light, and temperature were in a safe range. This study adhered to the principles of the Declaration of Helsinki adopted by the Declaration of the World Medical Association. Except for the researchers, no one had access to the collected data stored on the first researcher's computer.

Results

The characteristics of the participants are presented in Table 1. It was determined that the mean age of the mothers was  $31.52 \pm 4.47$  years. Most of the mothers, all of whom were married, had a university degree

Table 1  
Characteristics of participants (N = 155).

Characteristics	Mean $\pm$ SD	Min-Max
Age (years)	31.52 $\pm$ 4.47	20–43
Number of children	1.72 $\pm$ 0.76	1–4
Age of children with CHD*	9.35 $\pm$ 6.92	1–24
	n	%
Educational Status		
Illiterate	1	0.6
Primary education	18	11.6
High school	59	38.1
University and above	77	49.7
Employment status		
Full time	13	8.4
Part-time	28	18.1
Not working	114	73.5
Income Status		
Income is less than expenses	49	31.6
Income equals expenses	89	57.4
Income exceeds expenses	17	11.0
Diagnosis of the child with CHD		
Defect that increases pulmonary blood flow	83	53.5
Contraction defects	14	9.0
Mixed defects	31	20.0
Defects that reduce pulmonary blood flow	27	17.5

\* months, CHD: Congenital Heart Disease.

or higher. Most mothers' income was income equal to their expenses, and the mean age of their children with CHD was  $9.35 \pm 6.92$  months. Most children with CHD have defects that increase pulmonary blood flow.

Results of validity analysis

The first version of the scale consisted of 25 items, and the first version was sent to ten experts. After expert opinions, 22 items were added to the scale, three items were removed, and five items were revised according to the recommendations. The final version of the scale was arranged and consisted of 22 items. The agreement among experts ranged from 0.95 to 0.97 for each item (I-CVI) and 0.96 for the whole scale (S-CVI).

In explanatory factor analysis (EFA), the principal component analysis method was used for factor extraction, and the varimax method was used for rotation. As a result of the first analysis, the extraction values of the items were examined, and items 6, 8, 11, 16, 17, 18, 20, and 21 were removed from the scale because their extraction values were lower than 0.3. The results obtained by removing eight items from the scale are presented in Table 2. After removing these items, the KMO value was obtained as 0.734, and the Chi-square value for the Bartlett test was 575.531 ( $p < 0.001$ ). These values indicate the suitability of the dataset for factor analysis. The scale of 14 items showed that all extraction values were 0.3 and above, and all diagonal values in the anti-image correlation matrix were above 0.5. As a result of the analysis, a 2-factor structure was revealed. Subdimension 1 explains 20.99% of the variance, and Subdimension 2 explains 20.51%. In total, 41.5% of the total variance is defined by two dimensions.

In confirmatory factor analysis (CFA), all problems related to the data (outliers, skewed and skewed values, missing data, etc.) should be eliminated before starting the study. To use maximum likelihood, the data must be suitable for normal distribution. In the Multivariate normality test, the critical value was determined to be 39,444. While it is an excellent result that this value is below ten, studies have shown that up to 20 is generally not a problem (Doornik & Hansen, 2008; Shanthi, 2019). Since the assumption of multiple normality was not met, Bootstrap ML (Maximum likelihood) was used as the calculation method, and 800 resamples were preferred in the Bootstrap analysis.

In the first-level CFA created with 14 items and two subdimensions (Fig. 2), the path coefficients of item 5 under subdimension one and



**Table 2**  
Explanatory factor analysis result of the scale.

Items	Subdimensions		Extraction	Anti-image correlation coefficient
	1	2		
2. Providing a clear explanation about my child's heart surgery	0.723		0.718	0.529
3. Providing information about the treatments applied to my child	0.653		0.772	0.427
1. Providing a clear explanation about my child's heart disease	0.625		0.662	0.456
4. Providing information about common symptoms of my child's illness	0.62		0.856	0.495
7. Providing information about my participation in the care of my child	0.613		0.759	0.428
5. Being informed about my child's health status during the hospitalization	0.585		0.505	0.414
12. Providing information about identifying and managing my child's pain	0.544		0.853	0.427
14. Supporting my practices/skills in the preparation/storage of medicines prescribed to my child		0.687	0.775	0.473
19. Providing support by the healthcare team involved in the care and treatment of my child		0.602	0.807	0.431
15. Supporting my practices/skills in identifying and managing problems that may occur in my child at home		0.598	0.682	0.359
9. Supporting my practices/skills in feeding and breastfeeding my child		0.598	0.668	0.401
13. Supporting my practices/skills in protecting my child from infections		0.566	0.699	0.329
10. Supporting my practices/skills in my child's hygiene care needs (diaper hygiene, bathing, wiping bath, etc.)		0.547	0.659	0.300
22. Providing support to continue/participate in my daily life (sleeping, hygiene, resting, etc.)		0.516	0.762	0.340
<b>Eigenvalue</b>	2.938	2.872		
<b>Explained variance</b>	20.986	20.514		
<b>Total explained variance</b>	20.986	41.5		
<b>KMO coefficient</b>	0.734			
<b>Barlett tests</b>	575.531; $p < 0.001$			

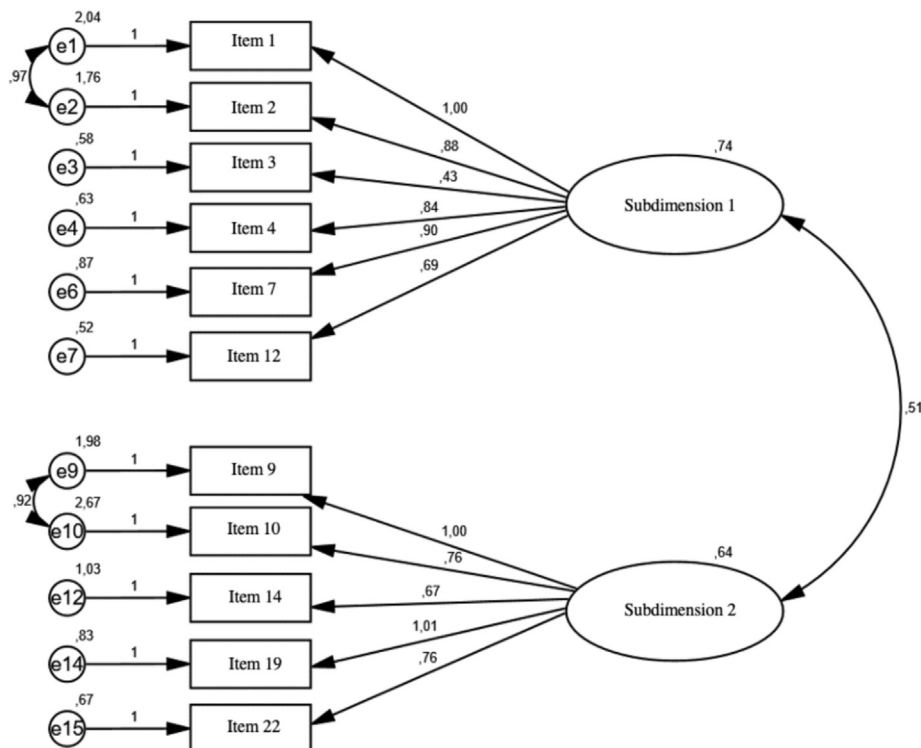
KMO: Kaiser-Meyer Olkin coefficient.

items 13 and 15 under subdimension two were not statistically significant ( $p > 0.050$ ) (Fig. 3). Therefore, these three items were removed from the scale, and the results obtained are presented in Table 3. Three modification processes were performed in the CFA. The model fit indices were obtained as Minimum Discrepancy Function by Degrees of Freedom divided (CMIN/DF)  $(72.751/41) = 1.774$ , Goodness-Of-Fit Index (GFI) = 0.925, Incremental Fit Index (IFI) = 0.923, Tucker Lewis Index (TLI) = 0.893, Comparative Fit Index (CFI) = 0.920, Root Mean Square Residual (RMSEA) = 0.071, Standardized Root Mean Squared Residual (SRMR) = 0.063. The model fit indices were within acceptable limits. Additionally, all item path coefficients were statistically significant ( $p < 0.05$ ).

#### Results of reliability analysis

The Cronbach's alpha coefficient for subdimension 1 was 0.758, indicating a reasonably reliable dimension. The Cronbach's alpha coefficient for subdimension 2 was 0.678, indicating a sufficiently reliable dimension. When examining the item-total correlation coefficients, it was found that all items in the scale had item-total correlation coefficients above 0.3 (Table 4).

The scale's factorial validity was examined using Tukey's scalability test, and the test result indicated that the scale did not have a scalable structure ( $F = 56.656$ ;  $p < 0.001$ ). It is necessary to evaluate each dimension separately.



**Fig. 2.** Unstandardized path coefficients.

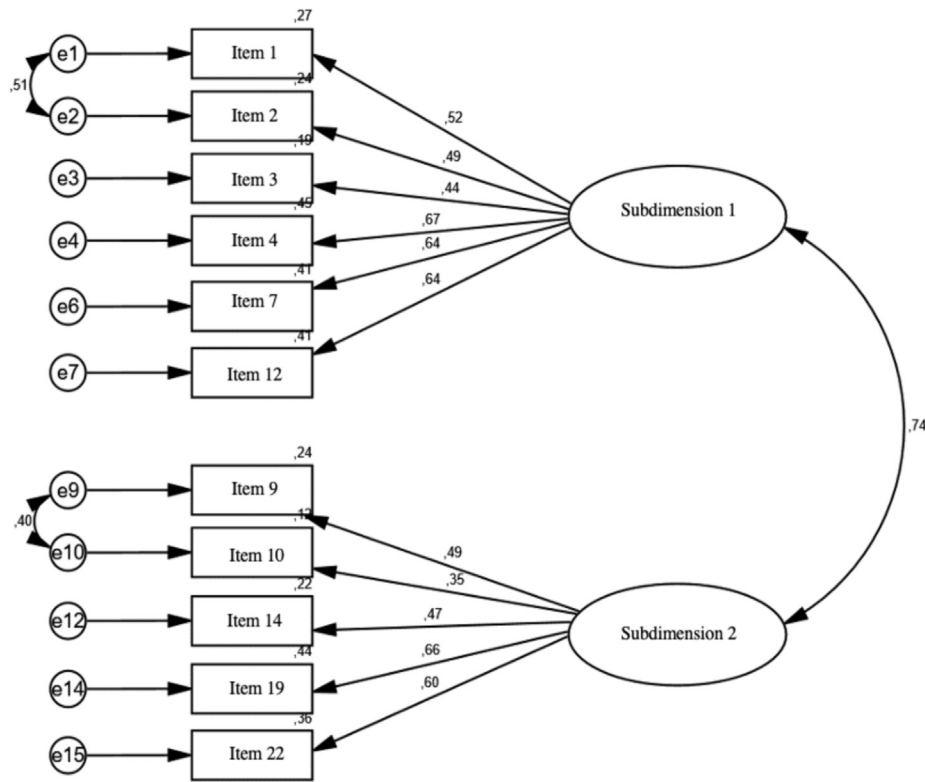


Fig. 3. Standardized path coefficients.

## Discussion

The study was conducted to develop and assess the psychometric properties of the care needs scale for mothers of children with CHD. Resulting in the final version of the scale consisting of 11 items. Content validity evaluates the comprehensibility of the scale's instructions, scale items in terms of expression and language, and whether they cover the subject to be measured (Almanasreh et al., 2019). To determine the ability of the scale items to cover the attribute to be measured (content validity) or the ability of the item to be related to the relevant construct (construct validity), expert decisions are essential, not the developers themselves (Shi et al., 2012). Polit and Beck emphasized the importance of a priori and a posteriori effort to enhance content validity through careful conceptualization and expert assessment, which aligns with the approach taken in the study (Polit & Beck, 2006). Literature suggested that the I-CVI and S-CVI of the scale should be 0.78 or above to make up a scale with excellent content validity (Shi et al., 2012). In this study, the agreement among experts for each item and the whole scale was high, with the I-CVI and S-CVI higher than 78. The expert

evaluation and content validation process showed that items are relevant and comprehensive. The development and assessment of the care needs scale for mothers of children with CHD align with the principles of content validation and the growing focus on holistic care in the context of chronic conditions.

The EFA conducted in the study utilized the principal component analysis method for factor extraction and the varimax method for rotation (McDonald, 2014). This approach aligns with the standard factor extraction and rotation techniques highlighted in the literature (Akhtar-Danesh, 2017). The lower limit for the factor loading value is accepted as 0.30; items with a loading value >0.50 give better results and are considered significant (Melnyk et al., 2021). In this study, the analysis results led to removing several items from the scale because their extraction values were <0.3, a standard practice in EFA. A KMO value of 0.90 and above is considered excellent, and 0.80 and above is considered very good (Hill, 2011). As the KMO value approaches 1, it is considered perfect, and 0.50 and below is unacceptable. After removing lower factor load items, The KMO value of 0.734 and the significant Bartlett's test chi-square value indicated the adequacy of the data for

**Table 3**  
Confirmatory factor analysis result of the scale.

Subdimension	Items	$\beta_1$ (%95 CI)	$\beta_2$ (%95 CI)	SE	p
Subdimension 1	1	0.515 (0.288–0.691)	1 (1–1)	...	...
	2	0.493 (0.272–0.685)	0.876 (0.623–1.146)	0.134	<b>0.003</b>
	3	0.437 (0.126–0.688)	0.429 (0.123–0.731)	0.153	<b>0.011</b>
	4	0.674 (0.452–0.827)	0.845 (0.462–1.606)	0.290	<b>0.003</b>
	7	0.638 (0.4–0.82)	0.899 (0.424–1.77)	0.362	<b>0.003</b>
	12	0.636 (0.361–0.835)	0.693 (0.263–1.476)	0.322	<b>0.003</b>
Subdimension 2	19	0.663 (0.389–0.851)	1.006 (0.542–1.837)	0.368	<b>0.003</b>
	22	0.597 (0.309–0.795)	0.762 (0.325–1.425)	0.294	<b>0.003</b>
	14	0.47 (0.157–0.74)	0.674 (0.274–1.187)	0.344	<b>0.003</b>
	10	0.349 (0.174–0.504)	0.759 (0.445–1.186)	0.210	<b>0.003</b>
	9	0.494 (0.294–0.651)	1 (1–1)	...	...

SE: Standard error,  $\beta_1$ : Standardized path coefficient (95% Bootstrap confidence interval),  $\beta_2$ : Unstandardized path coefficient (95% Bootstrap confidence interval).

**Table 4**  
Reliability results of the scale.

Subdimension	Items	Mean	SD	Item-total correlation	Cronbach's alpha when item is deleted	Cronbach's alfa
Subdimension 1	M1	3.832	1.674	0.589	0.703	0.758
	M2	4.097	1.532	0.602	0.694	
	M3	4.755	0.848	0.442	0.742	
	M4	4.568	1.081	0.526	0.719	
	M7	4.419	1.216	0.477	0.729	
Subdimension 2	M12	4.677	0.939	0.438	0.741	0.678
	M9	3.807	1.624	0.532	0.578	
	M10	3.445	1.748	0.450	0.629	
	M14	4.536	1.153	0.454	0.623	
	M19	4.465	1.218	0.397	0.643	
	M22	4.684	1.024	0.378	0.653	

SD: Standard Deviation, Tukey's test of additivity ( $F = 56.656$ ;  $p < 0.001$ ).

factor analysis. These results showed that the scale's items sufficiently explained variation and demonstrated the scale's construct validity. This finding aligns with the common practice of interpreting the variance explained by the factors in EFA (Beavers et al., 2013). The use of varimax rotation in the EFA is consistent with the methodological recommendations in the literature, as it aids in achieving a more straightforward structure with greater interpretability (Rokstad et al., 2012). Established literature on EFA and factor analysis supports the study's approach to factor extraction and rotation and the interpretation of variance explained by the factors (Akhtar-Danesh, 2017; Beavers et al., 2013; McDonald, 2014).

The issue of multivariate normality in CFA has been a research subject, with studies indicating the importance of assessing and addressing departures from normality in the data (Royston, 1983). Moreover, the significance of path coefficients in CFA has been emphasized in the literature, highlighting their role in determining the relationships between latent constructs and observed variables (Kılıç & Doğan, 2021). In this study, three modification procedures were performed, and the model fit indices obtained were within acceptable limits, indicating a satisfactory model fit (Kılıç & Doğan, 2021). The CFA determined the subdimension factor loadings to be  $>0.30$ . The RMSEA was  $<0.080$ , while the GFI, IFI, and CFI were all larger than 0.90. These findings validated the two-factor structure and demonstrated that the data are consistent with the model. These results demonstrated the instrument's validity, the scale's structural validity, and the appropriate representation of the scale items in subdimensions. In health research, particularly with limited sample sizes, EFA and CFA are advised to be conducted on the same dataset (Sousa & Rojjanasrirat, 2011). However, caution is urged against this practice, especially in studies with smaller samples, as splitting the dataset for EFA and CFA analyses with  $<500$  participants may lead to biased outcomes (Doğan & Karaman, 2017). Consistent with the literature, both EFA and CFA were performed in our study, and consequently, the CFA results were retained in our findings.

Cronbach's alpha coefficients for subdimensions 1 and 2 were 0.758 and 0.678, respectively, indicating reliable dimensions. Considering the Cronbach alpha values should be above 0.7, Nunnally stated that a reliability of 0.5 or 0.6 is sufficient for exploratory research (Nunnally, 1967). The high Cronbach's alpha coefficients indicate that the items within each subdimension are closely related, supporting the internal consistency of the scale (Başer et al., 2021; Sağlam & Koç, 2022; Şatir & Hazar, 2021; Şolt et al., 2023). Since the care needs of mothers may vary individually, it can be said that the validity values of the subdimensions are lower than expected. However, the findings of this study are consistent with the literature on measurement theory and practice and demonstrate internal consistency reliability. All items in the scale had item-total correlation coefficients above 0.3, further supporting the scale's reliability. The results are consistent with

previous studies that have highlighted the significance of Cronbach's alpha as a measure of internal consistency reliability in psychometric evaluations (Başer et al., 2021; Roaldsen & Halvarsson, 2019; Sağlam & Koç, 2022; Şatir and Hazar, 2021). The reliability of the dimensions is crucial in ensuring the accuracy and consistency of the measurements obtained from the scale. Moreover, the psychometric properties of the scale, including Cronbach's alpha coefficients, are essential for establishing the validity and reliability of the instrument, as supported by the literature on the development of measures for assessing mentalizing and fatigue (Gori et al., 2021; Şatir and Hazar, 2021; Şolt et al., 2023). These findings are consistent with the principles of measurement theory and practice, emphasizing the significance of internal consistency reliability in developing and evaluating measurement instruments.

### Strengths

It is essential to meet the educational, care skills, and psychological needs of mothers of children with CHD to provide holistic patient care. The Care Needs Scale for Mothers of Children with Congenital Heart Disease offers a tailored assessment tool specifically designed to address the informational and care-related needs of mothers with children diagnosed with CHD, providing valuable insights into areas where additional support may be required in managing the condition. Existing tools are statistically valid and widely used. Still, our Care Needs Scale for Mothers of Children with CHD fills a unique gap by focusing specifically on the holistic needs of these mothers. It complements existing tools by providing additional information that is crucial for the comprehensive care and support of mothers dealing with CHD.

### Limitation

This study has some limitations. Firstly, individual variations in maternal care needs may influence the scale's validity, suggesting that subdimension validity values might be lower than anticipated. Secondly, the study's focus on mothers of children with CHD may limit the generalizability of the findings to other populations. Future research employing longitudinal designs and diverse samples could address these limitations. Thirdly, it acknowledges that there may be differences in validity scores because mothers' care needs are individual, so ongoing evaluation and improvements may be necessary as the scale is applied in different contexts and populations. Finally, both EFA and CFA were conducted on the same data set due to the small sample size in this study. Although this approach enables the use of comprehensive data under limited subject availability, it is acknowledged that performing EFA and CFA on the same small sample may lead to biases that may affect the generalizability and reliability of the findings. While the study successfully developed and validated a care needs scale, carefully considering these limitations is essential to interpret the findings in detail and guide future research efforts in this critical area.

### Conclusion

Through developing and evaluating a comprehensive care needs scale for mothers of children with CHD, this research has made a significant contribution to the field. A reliability and validity-proven instrument has been produced via the detailed processes of scale creation, content validation, EFA, and CFA. Following the guidance of experts, the content validation procedure ensured that the scale's components met mothers' needs for holistic care in the context of CHD while also being linguistically and conceptually sound. The scale's construct and structural validity were thoroughly examined in the ensuing EFA and CFA stages, and the results confirmed that the instrument is suitable for evaluating the complex aspects of maternal care needs. The reliability analyses, particularly Cronbach's alpha coefficients and item-total correlations, reinforced the scale's internal consistency, indicating that the items within each subdimension were closely related.

## Practice implications

The developed care needs scale serves as a valuable tool to assess the care needs of mothers with children diagnosed with CHD. By identifying and addressing the nuanced needs of these mothers, healthcare professionals in pediatric cardiology clinics can improve the quality and effectiveness of maternal support programs. By systematically assessing the needs of mothers, health professionals can tailor interventions and support services to meet this population's unique requirements better. However, it is crucial to recognize that further validation of the scale in different populations and clinical settings is necessary. Future research efforts should prioritize validation of the scale to ensure its applicability and effectiveness in various contexts. The implementation of the developed care needs scale has the potential to significantly improve the quality of care and support provided to mothers of children with CHD. Through ongoing validation and refinement, this tool can continue to serve as a valuable resource in improving maternal well-being and optimizing patient outcomes in pediatric cardiology practice.

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## CRediT authorship contribution statement

**Ayşe Ay:** Writing – review & editing, Writing – original draft, Methodology, Data curation, Conceptualization. **Remziye Semerci:** Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Conceptualization. **Eysan Hanzade Savaş:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Kübra Nur Kabakçı Sarıdağ:** Writing – review & editing, Writing – original draft, Methodology, Data curation, Conceptualization.

## Data availability

The data supporting this study's findings are available upon reasonable request from the corresponding author.

## Declaration of competing interest

The authors declare no conflicts of interest.

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