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Research article

Development and psychometric evaluation of the Beliefs about Home Hemodialysis Scale for patients on in-center hemodialysis

Running title: Health beliefs and home hemodialysis

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Abstract: *Objective:* There is no valid and reliable instrument that evaluates health beliefs related to home hemodialysis of patients. This study aimed to develop the Beliefs about Home Hemodialysis Scale (BHHS) and evaluate its psychometric properties in a sample of patients on in-center hemodialysis. *Methods:* This methodological study was carried out with 102 patients on in-center hemodialysis. Data were collected by a questionnaire, the Perceived Social Support from Family Scale, and the BHHS. The analysis of data was carried out using descriptive statistics, Mann-Whitney U test, Pearson's correlation coefficients, and psychometric tests. *Results:* The overall content validity index of the scale was satisfactory with 1.00 for relevance and 0.97 for clarity. The exploratory factor analysis yielded a four-factor structure (perceived benefits, perceived barriers toward the environment, perceived barriers toward the procedure, and perceived barriers toward socioeconomic support) accounting for 64.5% of the total variance. The BHHS had acceptable internal consistency (Cronbach's alpha coefficient = 0.69–0.91), test-retest reliability (intraclass correlation coefficient = 0.88–0.95), concurrent validity with the Perceived Social Support from Family Scale scores and known group validity with wanting to start home hemodialysis. *Conclusions:* The initial psychometric testing of the BHHS is favorable. The BHHS is a valid and reliable instrument for assessing the perceived benefits and barriers to home hemodialysis in patients on in-center hemodialysis. The results of this study will gain a better understanding of the beliefs about home hemodialysis of patients and will lead to more effective intervention strategies.

Keywords: beliefs; home hemodialysis; instrument; reliability; validity

Abbreviations: BHHS: Beliefs about Home Hemodialysis Scale; CVI: Content validity index; CI: Confident interval; HBM: Health Belief Model; HHD: Home Hemodialysis; ICC: Intraclass correlation coefficient; PSS-Fa: Perceived Social Support from Family Scale; SD: Standard deviation.

1. Introduction

The trend of increasing prevalence and incidence of end-stage renal disease all over the world continues. Hemodialysis is the most frequently used method of renal replacement therapy both worldwide and in Turkey [1,2]. Conventional hemodialysis is performed two or three times per week, and each session lasts about 3 to 5 hours. Home hemodialysis also provides development and implementation of individualized treatment plans by considering patients' needs and preferences and thus contributing to overcome social isolation and to restore their sense of normality [3]. The current data show that home hemodialysis (HHD) in end-stage renal disease improves survival, morbidity, and the quality of life of patients compared with in-center modality, but it remains underutilized in the world [4,5]. According to the data provided by the national register in the year 2018, only 0.9% of than 60,643 Turkish patients receiving maintenance hemodialysis use HHD [2].

It is well-known that increasing the utilization of HHD will be critical soon because of pandemics [3,6]. Previous studies have noted several factors associated with the underutilization of HHD, such as sociodemographic and disease-related characteristics, beliefs, and expectations about HHD, housing constraints, family burden, and healthcare services [5,7–20]. In a recent semistructured interview study, five factors that were identified as key contributors to continuation or discontinuation of HHD: the degree of independence, lack of support from family and friends, technical issues, problems related to the home environment, and negative attitude and inappropriate expectations about performing HHD [5]. The identification of patients' beliefs and expectations about HHD is, therefore, very important.

The Health Belief Model (HBM) is a tool used to understand health behaviors, especially related to the uptake of health services [21]. The model-based interventions are effective in changing health behaviors [22,23]. The constructs of the model are identified as perceived seriousness, susceptibility, benefits, barriers, self-efficacy, and health motivation [24]. Demographic, sociopsychological, and structural variables (awareness of health services, etc.) and cues to action (advice from family members, physical symptoms, etc.) also affect an individual's perceptions and behaviors [22,23]. The HBM was used as the theoretical framework in the study to analyze the beliefs related to HHD of patients, and this study mainly dealt with the perceived benefits and barriers. According to the HBM, patients who perceive more benefits of HHD than its barriers are likely to be more motivated to learn HHD [23].

Good patient preparation is the key factor for the prevention and control of complications in patients on HHD. Particularly, the identification of perceptions regarding HHD, health education needs, and preferences of a potentially eligible patient during preparation for treatment initiation is very important in terms of both patient and clinical perspectives (patient pathways, health outcomes, healthcare costs, etc.) [12]. To the best of our knowledge, only a few studies, mostly semi-structured qualitative interviews and cross-sectional studies have been investigated experiences and perceptions about HHD from the perspective of patients [5,7–10,12–20]. However, none of these studies used standardized scales to assess health beliefs. Valid and reliable instruments are required to assess the beliefs of patients in both research and clinical settings. Currently, no valid and reliable instrument

that assesses patients' beliefs on HHD exists. This study, therefore, aimed to develop the Beliefs about Home Hemodialysis Scale (BHHS) and evaluate its psychometric properties in a sample of patients on in-center hemodialysis. An assessment tool designed to determine the beliefs of patients will help identify perceived benefits and barriers related to HHD and construct tailored interventions to overcome barriers.

2. Materials and methods

2.1. Study design, setting, and sample

A convenience sample of patients receiving hemodialysis from two tertiary hospitals in Ankara, Turkey participated in this methodological study. There was not any service for HHD provided in these hospitals. Patients aged 18 years or older with end-stage renal disease who underwent hemodialysis for more than 1 month and were able to communicate in Turkish were included in the study. Patients who had comorbid conditions, including psychiatric disease, terminal cancer, and cognitive impairment and those with clinical instability were excluded from the study. Of the 113 eligible patients, 102 agreed to take part in the study (response rate: 90.3%). The sample size met the recommendation for investigating the factor structure of the scale. The number of participants is required to be 5–10 times higher than the total number of scale items [25].

2.2. Instruments

2.2.1. Participant characteristics

A survey questionnaire was designed based on the literature review to collect data [5,7–10,12–20]. The questionnaire included two parts; Part one: sociodemographic characteristics (age, gender, marital status, education level, employment status, income level, living arrangement, and the presence of a caregiver), and Part two: disease-related characteristics (dialysis vintage, comorbidity, self-rated health, having knowledge about HHD, and wanting to start HHD). Self-rated health was rated on a 4-point Likert scale (very good, good, fair, or poor), and it was categorized as good (very good/good) and poor health (fair/poor) [26].

2.2.2. Perceived family support

Social support from family was measured by the Turkish version of the Perceived Social Support from Family Scale (PSS-Fa) [27]. It contains 20 items that are rated on a 3-point Likert scale (yes, no, or don't know). The total scale score ranges between 0 and 20, with a higher score indicating a higher level of family support. Eskin [27] reported very good internal consistency for the scale (Cronbach's alpha = 0.85). The internal consistency of the PSS-Fa was good in this study (Cronbach's alpha = 0.73).

2.2.3. Health beliefs related to HHD

The BHHS was designed to measure the beliefs about HHD of patients on in-center hemodialysis. In this study, a two-stage process suggested by Lynn [28] for affective instruments was applied for the determination of the content validity of the instrument. Firstly, the development stage of the BHHS consisted of three steps: (1) identification of dimensions, (2) generation of items for dimensions, and (3) instrument formation. This stage was accomplished through a comprehensive review of the literature [5,7–10,12–20]. and semi-structured interviews with 32 patients on in-center hemodialysis before the start of the study [13]. The process provided the conceptual framework for the BHHS and the formation of the specific dimensions and items. A 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) was used for responses.

Secondly, the judgment-quantification stage of the BHHS consisted of two steps: (1) judgment-quantification of content validity of items, and (2) overall scale [28]. An independent panel consisting of six experts (two nephrologists and four registered nurses) evaluated the first version of the BHHS in terms of its relevance (appropriateness) and clarity (understandability). At least a panel of five experts is recommended to have control over chance agreement on content validity [28]. The experts rated the content relevance and clarity of proposed items on a 4-point scale (1 = not relevant/not clear, 2 = somewhat relevant/clear, 3 = quite relevant/clear, and 4 = highly relevant/clear) [29,30]. Then, the content validity index (CVI) of the tool was calculated at the item and scale-levels. The item-CVI was computed as the number of experts ratings for each item of 3 or 4 divided by the total number of experts. The scale-CVI was calculated by dividing the total item-CVI on the instrument by the number of items (average method). We used the two criteria suggested by Lynn [28] to assess CVI fit: (1) item-CVI of at least 0.78 in the panel of six to 10 experts, and (2) scale-CVI of 0.90 or higher. The modifications to the tool were made based on the CVI scores. Finally, the face validity of the second version of the instrument was established in a pilot study, and 40 patients on in-center hemodialysis assessed its practicability and feasibility. The results of the pilot study were not included in the main study.

2.3. Data collection

The study was approved by the Non-interventional Research Ethics Committee of the University (Decision number: 18/212) and performed according to the Declaration of Helsinki. Written informed consent was obtained from each participant before study enrollment. Face-to-face structured interviews were conducted with the participants between October 2018 and March 2019. Interviews lasted approximately 15 to 20 minutes during the hemodialysis session. Test-retest reliability of the BHHS was also determined in a subsample of 20 patients who agreed to re-participate in the study two weeks later.

2.4. Data analysis

The data were analyzed using the SPSS for Windows Statistical Software Package (version 16.0; SPSS Inc., Chicago, IL, USA). Descriptive statistics, including means, medians, standard deviations (SDs), frequency distributions, and percentages were performed for each variable. The normality of the variables' distribution was tested using the one-sample Kolmogorov-Smirnov test.

The internal consistency of the BHHS was measured by Cronbach's alpha coefficient and item-to-subscale total correlations. A Cronbach's alpha coefficient of >0.60 was regarded as the lowest acceptable threshold value for reliability [31]. The certain benchmark values were used to interpret reliability: if the value of alpha is >0.90 = too good, 0.80–0.90 = very good, 0.70–0.80 = good, 0.60–0.70 = adequate, <0.60 = poor [32]. Poorly functioning items were also identified using the two criteria: (1) items that had a low corrected item-subscale total correlations (<0.30), or (2) items that, when deleted, increased the Cronbach's alpha coefficient of the scale by more than 0.10 [33]. The test-retest reliability was examined using the paired samples t-test and intraclass correlation coefficient (ICC; average measure). Based on the 95% confident interval (CI) of the ICC estimate, if the value of <0.50 = poor, 0.50–0.75 = moderate, 0.75–0.90 = good, >0.90 = excellent [34].

Content validity was computed using the item-CVI and scale-CVI. The Kaiser-Meyer-Olkin measure of sampling adequacy, Bartlett's test of sphericity and a scree plot were performed to examine the appropriateness of factor analysis. An exploratory factor analysis was conducted to determine the construct validity of the scale. The principal component analysis (varimax rotation with Kaiser normalization) was used to assess the factor structure of the BHHS. Perceived family support was considered as a criterion of beliefs about HHD (concurrent validity), hence a correlation between the BHHS and the PSS-Fa scores was expected.

Known-group validity was used to assess whether the BHHS scores were able to discriminate between patients who want to start HHD and those who do not. We hypothesized that patients who want to start HHD would have worse (lower) perceived barriers and better (higher) perceived benefits scores than those who do not. The Mann-Whitney U test was conducted for the comparison of two independent groups. The correlations were assessed using Pearson's correlation coefficient. Correlations higher than 0.70 were considered as strong and correlations less than 0.40 were considered weak [35]. One composite score (perceived barriers) were also calculated to operationalize the dimension by summing the scores on the items (total of 10 items) in the relevant three subscales (perceived barriers toward the environment, perceived barriers toward the procedure, and perceived barriers toward socioeconomic support). A p-value of less than 0.05 was considered statistically significant.

3. Results

3.1. Participant characteristics and perceived family support

Tables 1 and 2 show the sociodemographic and disease-related characteristics of the study sample. The mean age of the study group was 57.8 years (SD 14.2, range = 28–85) and the median dialysis vintage was 60 months (mean 70.8, SD 63.0, range = 3–240). Most of the participants were male (56.9%), married (66.7%), were not working (83.3%), had an adequate or moderate level of income (74.5%), had a comorbid condition (79.4%) and had poor self-rated health (74.5%). About half of the participants (51.0%) had less than high school education. Ninety-five patients (93.1%) were living with family, and 75 (73.5%) had a caregiver. The majority of the participants reported having knowledge about HHD (69.6%) and not wanting to start HHD (84.3%). As shown in Table 2, the PSS-Fa mean score of the participants was 13.3 (SD 5.1, range = 0–20).

Table 1. Descriptives of participant characteristics and comparison of the BHHS subscale scores by participant characteristics (N = 102).

				Perceived Barriers					
		Perceived Benefits		Environment		Procedure		Support	
Variables	n (%)	M (SD)	z†	M (SD)	z†	M (SD)	z†	M (SD)	z†
Gender									
Female	44 (43.1)	32.1 (9.0)	−0.30	14.0 (3.9)	−0.39	11.2 (2.9)	−0.27	10.2 (2.9)	−0.45
Male	58 (56.9)	32.6 (9.3)		13.8 (3.3)		11.3 (2.7)		10.4 (2.8)	
Marital status									
Married	68 (66.7)	33.1 (8.7)	−1.03	14.2 (3.3)	−1.20	11.7 (2.5)	−1.91	10.5 (2.6)	−0.82
Unmarried	34 (33.3)	31.0 (10.0)		13.2 (4.0)		10.4 (3.2		10.0 (3.2)	
Education level									
High school or greater	50 (49.0)	35.0 (8.8)	−2.95*	13.2 (3.4)	−2.25*	10.7 (2.7)	−1.77	9.6 (2.7)	−2.60*
Less than high school	52 (51.0)	29.8 (8.8)		14.6 (3.6)		11.8 (2.9)		11.0 (2.8)	
Employment status									
Working	17 (16.7)	35.1 (8.6)	−1.38	13.4 (2.9)	−1.21	11.1 (3.2)	−0.14	10.4 (2.8)	−0.05
Not working	85 (83.3)	31.8 (9.2)		14.0 (3.7)		11.3 (2.7)		10.3 (2.8)	
Income level									
Adequate/moderate	76 (74.5)	34.0 (8.9)	−2.88*	14.0 (3.6)	−0.68	11.4 (2.7)	−0.67	10.2 (2.6)	−1.05
Inadequate	26 (25.5)	27.8 (8.4)		13.5 (3.6)		10.9 (3.2)		10.7 (3.3)	
Self-rated health									
Good	26 (25.5)	35.2 (10.0)	−1.84	13.4 (3.7)	−1.07	10.0 (3.0)	−2.54*	9.4 (2.8)	−1.95
Poor	76 (74.5)	31.4 (8.7)		14.1 (3.5)		11.7 (2.6)		10.6 (2.8)	
Ever heard or read about HHD									
Yes	31 (30.4)	35.0 (9.7)	−1.96	13.5 (3.8)	−0.42	10.9 (2.9)	−0.77	9.9 (3.0)	−1.03
No	71 (69.6)	31.3 (8.7)		14.0 (3.5)		11.4 (2.8)		10.5 (2.7)	
Want to start HHD									
Yes	16 (15.7)	41.6 (5.0)	−4.41**	11.3 (3.1)	−3.41*	9.9 (3.0)	−2.20*	9.4 (3.3)	−1.61
No	86 (84.3)	30.7 (8.7)		14.4 (3.4)		11.5 (2.7)		10.5 (2.7)	

Note: BHHS: Beliefs about Home Hemodialysis Scale; M: Mean; SD: Standard deviation; HHD: Home Hemodialysis. †Group differences were measured by Mann Whitney U test. *$p < 0.05$, **$p < 0.001$.

Table 2. Means, standard deviations, ranges, medians and comparison of the BHHS subscale scores by various parameters (N = 102).

				Perceived Benefits	Perceived Barriers		
					Environment	Procedure	Support
Variables	M (SD)	Range	Median	r†	r†	r†	r†
Age (years)	57.8 (14.2)	28–85	61.0	−0.06	0.08	0.05	0.03
Dialysis vintage (months)	70.8 (63.0)	3–240	60.0	0.05	−0.06	−0.09	−0.07
PSS-Fa	13.3 (5.1)	0–20	15.0	0.49**	−0.18	−0.22*	−0.22*

Note: BHHS: Beliefs about Home Hemodialysis Scale; PSS-Fa: Perceived Social Support from Family Scale. †Pearson's correlation coefficient was used to calculate p values. *$p < 0.05$, **$p < 0.001$.

3.2. Validity analysis

3.2.1. Content validity

The literature review and interviews with patients on in-center hemodialysis provided information related to health beliefs about HHD. The first version of the instrument consisted of 20 items within two dimensions (perceived benefits and perceived barriers) consistent with the HBM [24]. The content validity of the instrument was evaluated by the panel. The scale-CVI was 1.00 for relevance and 0.97 for clarity. The range of item-CVI values was 0.67–1.00. All items were considered excellent validity regarding relevance and 18 regarding clarity, and two items needed modification. Then, the modified version of the instrument was presented for assessing to patients, and all the items were found comprehensible in the pilot study.

3.2.2. Construct validity

The exploratory factor analysis was used to determine the construct validity of the BHHS. First, data were investigated to identify whether it would be appropriate for factor analysis. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.82, which was higher than the recommended value of 0.50 [36], and Bartlett's test of sphericity was also significant ($\chi^2 = 1064.166$, $df = 190$, $p < 0.001$). These analyses revealed that the dataset was suitable for factor analysis. The principal component analysis produced a four-factor solution with eigenvalues greater than 1, which accounted for 64.5% of the total variance. These dimensions included factor 1 "perceived benefits (10 items)", factor 2 "perceived barriers toward the environment (four items)", factor 3 "perceived barriers toward the procedure (three items)", and factor 4 "perceived barriers toward socioeconomic support (three items)" (Table 3). Scree plot analysis confirmed the four-factor solution. Factor loadings above 0.40 were considered acceptable in this study [33]. The factor loadings for each item ranged from 0.57 to 0.84. The highest loading item was "the flexibility in the dialysis schedule facilitates participation in social activities" for factor 1 (loading of 0.84), "the rearrangement of home for dialysis procedure affects normal life" for factor 2 (loading of 0.82), "the fear of not learning the procedure prevents performing dialysis" for factor 3 (loading of 0.78), and "the increase in electricity and water consumption prevents performing dialysis" for factor 4 (loading of 0.76) (Table 3).

Table 3. Results of the Principal Components Analysis with Varimax Rotation of the BHHS (N = 102).

No	Item	Factor 1	Factor 2	Factor 3	Factor 4
11	The flexibility in the dialysis schedule facilitates participation in social activities.	0.84			
19	Performing dialysis at home improves the quality of life.	0.83			
7	Performing dialysis at home enables the person to spend more time with family or relatives.	0.80			
13	The flexibility in the dialysis schedule provides more comfortable working in a job.	0.79			
4	The waiting time before the dialysis procedure is shortened.	0.78			
8	Performing dialysis in the home environment provides a sense of comfort.	0.71			
14	Performing dialysis at home provides more protection of privacy.	0.70			
17	Performing dialysis at home enables individuals to take care of their care.	0.69			
3	Not going to a healthcare facility for dialysis prevents a waste of time.	0.66			
1	Home hemodialysis enables dialysis to be performed at times suitable for the person.	0.64			
15	The rearrangement of home for dialysis procedure affects normal life.		0.82		
16	The lack of space at home prevents performing dialysis.		0.76		
20	The lack of authorized health personnel in home hemodialysis prevents performing dialysis.		0.66		
2	The feeling of loneliness emerges due to staying away from other patients and healthcare personnel.		0.58		
5	The fear of not learning the procedure prevents performing dialysis.			0.78	
6	The security concern associated with problems that may occur during a dialysis procedure emerges.			0.76	

Continued on next page

No	Item	Factor 1	Factor 2	Factor 3	Factor 4
9	The fear of vascular access prevents performing dialysis.			0.62	
18	The increase in electricity and water consumption prevents performing dialysis.				0.76
10	Home hemodialysis increases the burden of care for families or relatives.				0.62
12	The lack of support from family or relatives prevents performing dialysis.				0.57
Eigenvalue		5.94	4.23	1.59	1.13
% of variance		29.71	21.13	7.97	5.66
Cumulative % of variance					64.50

Note: BHHS: Beliefs about Home Hemodialysis Scale; Factor 1, Perceived benefits; Factor 2, Perceived barriers toward the environment; Factor 3, Perceived barriers toward the procedure; Factor 4, Perceived barriers toward socioeconomic support.

3.2.3. Concurrent criterion-related validity

The BHHS scores were hypothesized to correlate with the PSS-Fa scores. The perceived benefits scores were moderately positively correlated ($r = 0.49$, $p < 0.001$), while the perceived barriers toward the procedure and socioeconomic support scores were weakly negatively correlated with the PSS-Fa scores ($r = -0.22$, $p = 0.026$; $r = -0.22$, $p = 0.024$, respectively) (Table 2).

3.2.4. Known-group validity

The Mann-Whitney U test was used for comparing the BHHS scores between two groups. As shown in Table 1, patients wanting to start HHD had significantly higher perceived benefits ($z = -4.41$, $p = 0.003$) and lower perceived barriers toward the environment and procedure scores ($r = -3.41$, $p = 0.001$; $r = -2.20$, $p = 0.028$, respectively).

3.3. Reliability analysis

The four subscales yielded Cronbach's alpha coefficients of 0.91, 0.77, 0.74, and 0.69 for perceived benefits, perceived barriers toward the environment, perceived barriers toward the procedure, and perceived barriers toward socioeconomic support, respectively. Cronbach's alpha coefficients for the BHHS subscales ranged between 0.69 and 0.91, indicating adequate to too good internal consistency [32]. The corrected item-subscale total correlations for the scale ranged from 0.43 to 0.79 (Table 4). Test-retest reliability was assessed using the ICCs and revealed good to excellent reliability at two weeks [34], with a 95% CI (range = 0.88–0.95, $p < 0.001$; Table 5). Paired samples t-tests showed no significant differences between test and retest scores of the BHHS subscales ($p > 0.05$; Table 5).

Table 4. Item mean scores, standard deviations, corrected item-subscale total correlation (CITC) and Cronbach's alpha if item deleted (CAID) for the BHHS subscales (N = 102).

BHHS	M (SD)	CITC	CAID†
Perceived benefits			
Item 7	3.43 (1.25)	0.76	0.90
Item 17	3.37 (1.16)	0.62	0.91
Item 8	3.33 (1.21)	0.66	0.91
Item 3	3.29 (1.18)	0.60	0.91
Item 1	3.26 (1.23)	0.55	0.91
Item 4	3.22 (1.25)	0.72	0.90
Item 19	3.14 (1.19)	0.79	0.90
Item 11	3.13 (1.29)	0.78	0.90
Item 14	3.13 (1.22)	0.61	0.91
Item 13	3.08 (1.22)	0.72	0.90
Perceived barriers toward the environment			
Item 20	3.70 (1.16)	0.62	0.68
Item 16	3.69 (1.06)	0.62	0.69
Item 15	3.42 (1.08)	0.64	0.68
Item 2	3.09 (1.31)	0.43	0.80
Perceived barriers toward the procedure			
Item 6	3.95 (1.10)	0.58	0.64
Item 9	3.80 (1.08)	0.59	0.62
Item 5	3.50 (1.26)	0.53	0.70
Perceived barriers toward socioeconomic support			
Item 10	3.72 (1.26)	0.53	0.55
Item 12	3.55 (1.15)	0.52	0.57
Item 18	3.06 (1.17)	0.45	0.66

Note: BHHS: Beliefs about Home Hemodialysis Scale; M: Mean; SD: Standard deviation. †Cronbach's alpha: Perceived benefits = 0.91, Perceived barriers toward the environment = 0.77, Perceived barriers toward the procedure = 0.74, Perceived barriers toward socioeconomic support = 0.69.

Table 5. Comparison of the BHHS subscales test-retest mean scores and correlations.

BHHS	1st interview Mean (SD)	2nd interview Mean (SD)	Paired samples t-test	p	ICC (95% CI)
Perceived benefits	32.4 (9.1)	35.9 (8.0)	−0.56	0.574	0.93 (0.83–0.97)*
Perceived barriers					
Environment	13.9 (3.6)	15.5 (2.8)	−1.18	0.237	0.94 (0.84–0.98)*
Procedure	11.3 (2.8)	11.6 (3.1)	−0.41	0.684	0.95 (0.86–0.98)*
Support	10.3 (2.8)	10.6 (2.5)	−0.26	0.796	0.88 (0.70–0.95)*

Note: BHHS: Beliefs about Home Hemodialysis Scale; SD: Standard deviation; ICC: Intraclass correlation coefficient, average measure; CI: Confidence interval. *$p < 0.001$ (2-tailed).

3.4. Descriptive analysis of the BHHS and comparison of the scale scores by participant characteristics

The mean BHSS subscale scores of the participants are found in Table 5. The mean perceived benefits score was 32.4 (SD 9.1), and ranged from 15 to 50. The mean perceived barriers toward the environment, procedure and socioeconomic support scores were 13.9 (SD 3.6; range = 4–20), 11.3 (SD 2.8; range = 4–15) and 10.3 (SD 2.8; range = 3–15), respectively. Based on the HBM [24], one composite score for the BHSS (perceived barriers) was derived by combining scores of the relevant subscales. The overall mean score for the perceived barriers was 28.6 (SD 6.1), ranging from 12.7 to 39.3. As shown in Table 4, the most reported benefit was "performing dialysis at home enables the person to spend more time with family or relatives" (item 7; mean 3.43, SD 1.25). The least reported benefit was "the flexibility in the dialysis schedule provides more comfortable working in a job" (item 13; mean 3.08, SD 1.22). The most perceived barrier was "the security concern associated with problems that may occur during a dialysis procedure emerges" (item 6; mean 3.95, SD 1.10). The barrier related to fear of vascular access (fear of cannulation or needle fear) had the next highest mean score (item 9; mean 3.80, SD 1.08). The least perceived barrier was "the increase in electricity and water consumption prevents performing dialysis" (item 18; mean 3.06, SD 1.17).

The Mann-Whitney U test indicated statistically some significant differences in the BHHS scores by characteristics of the participant (Table 1). Better-educated patients had significantly higher perceived benefits ($z = -2.95$, $p = 0.003$) and lower perceived barriers toward the environment ($r = -2.25$, $p = 0.024$) and socioeconomic support scores ($r = -2.60$, $p = 0.009$) than less-educated patients. Compared with patients with an inadequate income, those with an adequate or moderate level of income had significantly higher perceived benefits scores ($z = -2.88$, $p = 0.003$). Patients with good self-rated health had significantly lower perceived barriers toward the procedure scores compared to those with poor self-rated health ($z = -2.54$, $p = 0.011$). The Pearson's correlation coefficients showed that the BHHS subscale scores did not significantly correlate with age and dialysis vintage ($p > 0.05$) (Table 2).

4. Discussion

The identification of the health beliefs of patients is useful in constructing tailored interventions. The BHHS was developed to provide a comprehensive description of beliefs about HHD in patients on in-center hemodialysis. The results of psychometric testing of the BHHS provided initial evidence for acceptable validity and reliability. The scale has adequate psychometric properties for use in research and practice settings to measure the beliefs about HHD. The results of this study contributed to better understanding the health beliefs about HHD of patients on in-center hemodialysis as well as planning care and education to meet their specific needs. The implementation of the BHHS will be an important step towards helping patients reduce their barriers related to HHD. The use of a standardized instrument for assessing health beliefs about HHD across different populations will furthermore increase our knowledge on this subject and provide an opportunity to compare the results across studies.

The findings showed the face and content validity of the BHHS. Content validity is defined as "the degree to which a sample of items, taken together, constitutes an adequate operational definition of a construct" [37]. The results of the study also confirmed the construct validity of the scale. The BHHS consisted of 20 items and four subscales (perceived benefits, perceived barriers toward the environment, perceived barriers toward the procedure, and perceived barriers toward socioeconomic support). We also derived one composite score (perceived barriers), that is consistent with the HBM [24].

Concurrent validity was assessed by correlations between the BHHS and PSS-Fa scores. Concurrent validity demonstrates the degree of agreement between two different assessments at the same time [38]. Our findings revealed that patients with greater support from family members had perceived higher levels of benefits and lower levels of barriers about HHD, providing support for concurrent criterion-related validity. Interestingly, the most frequently reported benefit related to HHD in our study was "performing dialysis at home enables the person to spend more time with family or relatives". These findings are in line with the HBM [23]. Our findings are also congruent with previous studies, suggesting that family support is an important factor contributing to HHD utilization [5,8,11,18,39].

Known-group validity was demonstrated by significant differences between patients who want to start HHD and those who do not. Known-group validity is a form of construct validity [33] and it is performed "when a test or questionnaire can discriminate between two groups known to differ on the variable of interest" [40]. The instrument was able to discriminate patients who want to start HHD from those who do not want to start the modality for all subscale scores except for the perceived barriers toward socioeconomic support subscale. The results of the present study confirmed our hypothesis that patients who want to start HHD had higher perceived benefits and lower perceived barriers scores compared with other patients. Our results support the HBM, suggesting that knowledge, skill, and motivation are modifying factors for health beliefs [23].

The findings supported the internal consistency of the BHHS (Cronbach's alpha coefficient = 0.69–0.91). In our study, internal consistencies for the perceived barriers toward the environment (0.77), procedure (0.74), and socioeconomic support subscales (0.69) were lower than the perceived benefits subscale (0.91). This situation may be related to the number of items on the subscales [33]. Test-retest reliability for the BHHS over two weeks was found to be good to excellent (ICCs = 0.88–0.95), indicating that the subscale scores remained relatively stable over brief intervals for patients [34].

The mean perceived benefits score (32.4) of the patients was higher than the mean score of barriers (28.6) in our study. The findings demonstrated that patients may be motivated to learn and use HHD [22]. Healthcare professionals must understand the impact of patients' beliefs on the selection of treatment modalities and identify their beliefs and perceptions about HHD using the BHHS. Healthcare professionals should give training to patients and their families about the modality and design tailored interventions to address perceived barriers related to HHD. Understanding patients' perceptions of HHD may help plan more effective interventions for increasing the utilization of modality.

This study had some limitations, including the use of convenience sampling method and self-reported data. Participants were recruited by convenience sampling based on the inclusion criteria from two hemodialysis centers which are currently not offered the HHD program. The scale items will likely be influenced by the education received by health care professionals in hemodialysis centers providing successful HHD programs. Patients with comprehensive education about HHD may more likely to perceive more benefits and fewer barriers to the modality rather than other patients. Moreover, patients with a central venous catheter may less likely to be concerned about vascular access. However, we did not consider possible effects of type of dialysis access on perceived benefits and barriers toward HHD as it was not relevant to our study focus. The beliefs and perceptions of patients regarding HHD may also change over time as a result of their experiences in their life. Follow-up studies should, therefore, be conducted to understand the potential effect of time on the patients' beliefs and perceptions about HHD. Consequently, the generalization of the results beyond the study sample may be limited. Further research is needed to evaluate the stability of BHHS and its factor structure over time and across various practice settings.

5. Conclusions

The BHHS is an assessment tool that focuses on the beliefs about HHD for patients on in-center hemodialysis. The initial psychometric testing of the BHHS is favorable. The results of the study show that the BHHS is a valid and reliable tool for assessing the beliefs about HHD in patients on in-center hemodialysis. The instrument can be used to determine the perceived benefits and barriers to HHD in this population. The availability of this instrument will contribute to determining the patients' perceived benefits and barriers related to HHD and planning more effective intervention strategies.

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Conflict of interest

The author declares no conflicts of interest in this paper.

References

1. Leonberg-Yoo A, Weiner D (2016) Epidemiology of end-stage renal disease. In: Magee C, Tucker J, Singh A, Eds., *Core Concepts in Dialysis and Continuous Therapies,* Boston, MA, USA: Springer, 3–13.
2. Süleymanlar G, Ateş K, Seyahi N (2019) *The Nephrology, Dialysis and Transplantation in Turkey: Registry 2018.* Ankara, Turkey: Miki Matbaacılık.
3. Kara B (2020) COVID-19 pandemic and hemodialysis: A review of the literature. *AIMS Medical Science* 7: 90–92.
4. Hajj JJ, Laudanski K (2017) Home hemodialysis (HHD) treatment as effective yet underutilized treatment modality in the United States. *Healthcare (Basel)* 5: 90.
5. Seshasai RK, Wong T, Glickman JD, et al. (2019) The home hemodialysis patient experience: A qualitative assessment of modality use and discontinuation. *Hemodial Int* 23: 139–150.
6. Weiner DE, Watnick SG (2020) Hemodialysis and COVID-19: An achilles' heel in the pandemic healthcare response in the United States. *Kidney Med* 2: 227−230.
7. Bolgg A, Hyde C (2006) Enhancing lifestyle through home haemodialysis. *J Ren Care* 32: 179−182.
8. Cafazzo JA, Leonard K, Easty AC, et al. (2009) Patient-perceived barriers to the adoption of nocturnal home hemodialysis. *Clin J Am Soc Nephrol* 4: 784−789.
9. Cafazzo JA, Leonard K, Easty AC, et al. (2010) Patient perceptions of remote monitoring for nocturnal home hemodialysis. *Hemodial Int* 14: 471−477.
10. Cases A, Dempster M, Davies M, et al. (2011) The experience of individuals with renal failure participating in home haemodialysis: An interpretative phenomenological analysis. *J Health Psychol* 16: 884−894.
11. Jayanti A, Morris J, Stenvinkel P, et al. (2014) Home hemodialysis: Beliefs, attitudes, and practice patterns. *Hemodial Int* 18: 767−776.
12. Kara B (2016) The beliefs and experiences about home hemodialysis: A review of the current evidences. *Turk Neph Dial Transpl* 25: 17−23. (in Turkish)
13. Kara B, Yazıcıoğlu İ (2018) Knowledge, beliefs and attitudes of Turkish patients on in-center hemodialysis toward home hemodialysis: A pilot study. *J Clin Pract Nurs* 1: 23−25.
14. Pipkin M, Eggers PW, Larive B, et al. (2010) Recruitment and training for home hemodialysis: Experience and lessons from the nocturnal dialysis trial. *Clin J Am Soc Nephrol* 5*:* 1614−1620.
15. Polaschek N (2005) Haemodialysing at home: The client experience of self-treatment. *EDTNA ERCA J* 31: 27−30.
16. Rygh E, Arild E, Johnsen E, et al. (2012) Choosing to live with home dialysis-patients' experiences and potential for telemedicine support: A qualitative study. *BMC Nephrol* 13: 13.
17. Seshasai RK, Mitra N, Chaknos CM, et al. (2016) Factors associated with discontinuation of home hemodialysis. *Am J Kidney Dis* 67: 629−637.
18. Tong A, Palmer S, Manns B, et al. (2013) The beliefs and expectations of patients and caregivers about home haemodialysis: An interview study. *BMJ Open* 3: e002148.

19. Walker RC, Howard K, Morton RL, et al. (2016) Patient and caregiver values, beliefs and experiences when considering home dialysis as a treatment option: A semi-structured interview study. *Nephrol Dial Transplant* 31: 133−141.
20. Wong J, Eakin J, Migram P, et al. (2009) Patients' experiences with learning a complex medical device for the self-administration of nocturnal home hemodialysis. *Nephrol Nurs J* 36: 27−32.
21. Rosenstock IM (1966) Why people use health services. *Milbank Mem Fund Q* 44: 94–127.
22. Janz NK, Becker MH (1984) The Health Belief Model: A decade later. *Health Educ Q* 11*:* 1−47.
23. Janz NK, Champion VL, Strecher VJ (2002) The Health Belief Model. In: Glanz K, Rimer BK, Lewis FM, Eds., *Health Behavior and Health Education*. San Fransisco, USA: Jossey-Buss Co, 45–63.
24. Rosenstock IM, Strecher VJ, Becker MH (1988) Social learning theory and the Health Belief Model. *Health Educ Q* 15: 175–183.
25. Tinsley HE, Tinsley DJ (1987) Uses of factor analysis in counseling psychological research. *J Couns Psychol* 34: 414−424.
26. Kara B (2017) Self-rated health and associated factors in older Turkish adults with type 2 diabetes: A pilot study. *J Transcult Nurs* 28: 40−47.
27. Eskin M (1993) Reliability of the Turkish version of the perceived social support from friends and family scales, scale for ınterpersonal behavior, and suicide probability scale. *J Clin Psychol* 49: 512−522.
28. Lynn MR (1986) Determination and quantification of content validity. *Nurs Res* 35*:* 382–385.
29. Davis LL (1992) Instrument review: Getting the most from a panel of experts. *Appl Nurs Res* 5: 194−197.
30. Halek M, Holle D, Bartholomeyczik S (2017) Development and evaluation of the content validity, practicability and feasibility of the innovative dementia-oriented assessment system for challenging behaviour in residents with dementia. *BMC Health Serv Res* 17: 554.
31. Fan S, Lê Q (2011) Developing a valid and reliable instrument to evaluate users' perception of web-based learning in an Australian university context. *J Online Learn Teach* 7: 366−374.
32. Tolmie A, Muijs D, McAteer E (2011) *Quantitative Methods in Educational and Social Research Using SPSS.* UK: Open University Press.
33. Kara B (2014) Health beliefs related to salt-restricted diet in patients on hemodialysis: Psychometric evaluation of the Turkish version of the Beliefs about Dietary Compliance Scale. *J Transcult Nurs* 25: 256−264.
34. Koo TK, Li MY (2016) A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *J Chiropr Med* 15: 155–163.
35. Fowler J, Jarvis P, Chevannes M (2002) *Practical Statistics for Nursing and Health Care*. West Sussex, UK: John Wiley & Sons.
36. Williams B, Brown T, Onsman A (2010) Exploratory factor analysis: A five-step guide for novices. *Australas J Paramedicine* 8: 1−13.
37. Polit DF, Beck CT (2006) The content validity index: Are you sure you know what's being reported? Critique and recommendations. *Res Nurs Health* 29: 489–497.

38. Engelman KK, Daley CM, Gajewski BJ, et al. (2010) An assessment of American Indian women's mammography experiences. *BMC Women's Health* 10: 34.
39. Tennankore KK, Hingwala J, Watson D, et al. (2013) Attitudes and perceptions of nephrology nurses towards dialysis modality selection: A survey study. *BMC Nephrol* 14: 192.
40. Davidson M (2014) Known-groups validity. In: Michalos AC, Ed., *Encyclopedia of Quality of Life and Well-Being Research.* Dordrecht, Netherlands: Springer, 3481–3482.

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