

## **Original Article**

# **Subjective Hemodialysis Adequacy Can also be Measured: Development and Psychometric Properties Evaluation of Subjective Adequacy Questionnaire**

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**ABSTRACT.** Long-term prognosis of chronic hemodialysis patients is affected by dialysis adequacy that can have effect on the hemodialysis (HD) outcomes, especially mortality rate. Given the limited knowledge about HD patient's perceptions and experiences about subjective HD adequacy (SHA) and the lack of SHA measuring questionnaire (SHAMQ), this study was conducted with the aim of developing the SHAMQ and evaluating its psychometric properties based on the operational definition of SHA concept. This mixed-method sequential exploratory design study was conducted from 2016 to 2018 in eight HD units of Mashhad, Iran. In qualitative phase, conventional content analysis method was used, and participants were recruited through purposive, snowball, and selective sampling techniques. Data were collected through semi-structured interviews with 25 HD patients, dialysis nurses, caregivers, and nephrologists, and analyzed using MAXQDA software (V10). SHAMQ was developed based on operational definitions extracted from qualitative phase. Quantitative and qualitative face and content validity; construct validity; internal consistency; and stability were used for psychometric properties evaluation of SHAMQ. Data were analyzed using Statistical Package for Social Sciences version 22.0 (IBM Corp., Armonk, NY, USA). Physical vitality, inner consistency, a sense

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of well-being, positive social interactions, effective self-empowerment, and weathering financial crisis were 6 generic categories emerged from qualitative phase. The final version of SHAMQ included 30 items in four factors (subscales). Scale-content validity index, , and intraclass correlation were 0.92, 0.88, and 0.91, respectively. The results of this

study showed that factors such as well-being, self-enforcement to effective care, physical vitality, and spiritual health are the most important SHA outcomes. The development of a scale for measuring SHA can help to the better evaluation of HD patients' conditions and accordingly perform effective interventions.

## Introduction

Both chronic kidney disease and hemodialysis (HD) cause a plethora of problems for HD patients, some of which lead to frequent hospital admissions, poor quality of life (QOL), and high financial and treatment costs for patients' families and healthcare systems, especially in the developing countries.<sup>1</sup>

Previous studies showed that patients undergoing quality dialysis have a lifespan equal to those receiving kidney transplantation.<sup>2</sup> Accordingly, the HD adequacy is one of the predominant factors in determining the survival of HD patients.<sup>3</sup>

High-quality dialysis that can affect short- and long-term mortality and morbidity<sup>3</sup> has a set of objective and subjective properties that can lead to the subjective feeling of well-being.<sup>4</sup> The objective aspect of dialysis adequacy is related to indicators such as Kt/V and urea reduction ratio (URR), which can measure physiological dimensions of adequate HD.<sup>5</sup> However, the subjective aspect of dialysis adequacy cannot be dependent on the purification of blood and biological fluids of a substance and calculation of a laboratory parameter such as static quantity and requires evaluation of unique characteristics of each patient.<sup>6</sup>

The subjective indicators of dialysis adequacy can predict HD outcomes. However, measurement of subjective aspects of adequacy such as emotions, perceptions, and judgments of the patient cannot be determined by objective measures or accurate observation.<sup>7</sup>

So far, a wide range of studies have been conducted on the HD adequacy in, but in none of them, dialysis adequacy has been studied with regards to all the psychological, cultural, social, and spiritual aspects. Researchers

worldwide have solely relied on physiological indicators of Kt/V and URR for the assessment of HD adequacy. For this reason, there is no precise and comprehensive information as to all aspects of HD adequacy.<sup>8</sup> On the other hand, measuring all the dimensions of dialysis adequacy necessitates the development of a specific questionnaire whose validity and reliability are in accordance with methodological principles and precise scientific processes. Thus, the present study was designed for developing of a subjective HD adequacy (SHA) questionnaire on basis of operational definition of SHA concept.

## Methods

The present study was an exploratory sequential mixed methods, which was performed during 24 months from June 2016 to May 2018 in eight public, private, and charity HD centers of Mashhad, Iran. Based on Waltz (2010) four-steps of tool development, we selected qualitative content analysis as conceptual model. For this purpose, we extracted the experiences of 25 participants (19 HD patients, 2 HD nurses, 2 caregivers and 2 nephrologists) on the SHA by semi-structured interviews and analyzed them using the MAXQDA V10 software (VERBI Software based in Berlin, Germany), and following the analysis steps of Hsieh and Shannon 2005. Then, we selected measurement objectives and prepared the tool's blueprint on the basis of the qualitative phase (included 222 items, as well as operational definitions and their sources). These items were reviewed several times by the research team members, and ultimately, 83 items were given to target groups for the assessment of face and content validity. In the qualitatively evaluate face validity, 10 HD patients were interviewed about the difficulty of understanding, the degree of proportionality, and the probability of misunderstanding phrases or deficiencies in the meanings of the words. The face validity was also confirmed quantitatively using the item impact method. Item impacts larger than or equal to 1.5 were considered as fit.<sup>9</sup>

Quantitative and qualitative methods were used to evaluate the tool’s content validity. The panel of experts whose opinions were used for content validity included 10 experts (2 nephrologists, 3 nursing PhDs experienced in tool development, 3 nursing PhDs experienced in HD, and 2 head nurses with a long working experience in HD units). To establish quantitative content validity, experts were asked to comment on the necessity and relevance of each item on the adequacy of HD, as well as the simplicity and clarity of the items and the comprehensiveness of the tool and the chosen scale. Subsequently, items with a content validity ratio (CVR) of lower than the acceptable value based on the Lawshe’s table (0.62) were excluded.<sup>10</sup> We also excluded all the items whose content validity index (CVI) was <0.8.<sup>11</sup> We considered modified Kappa coefficients (k\*) higher than 0.74 as great, between 0.60 and 0.74 good, and <0.6 weak.<sup>11</sup> Stability reliability of questionnaire was reviewed by test–retest, two weeks later (*n* = 40) and internal consistency with Cronbach’s alpha calculation.

To investigate construct validity, used the exploratory factor analysis (EFA), based on the five-step guide of Williams et al (2010). Kaiser–Meyer–Olkin of 0.746 and the significance of Bartlett’s spherical test (*P* <0.001) indicated sampling sufficiency and factorability of the data.

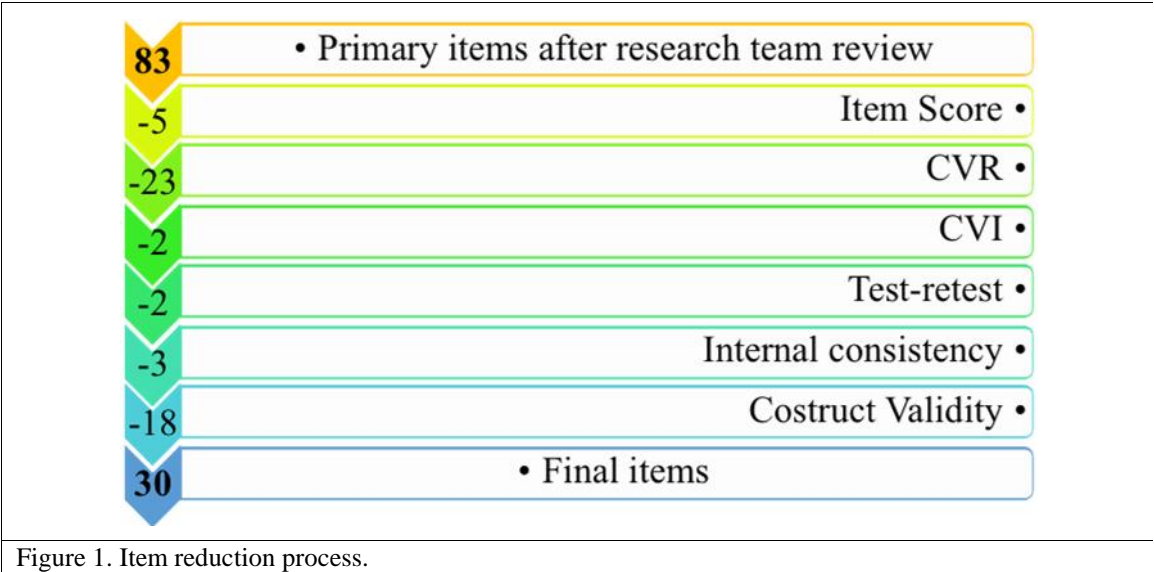
Maximum likelihood estimation (MLE) was determined as the analysis method and having an eigenvalue >1, factor loading outside the horizontal line formed by the scree plot, and explaining at least 50% of the variance by the extracted factors were set as the basis of primary factor extraction.<sup>12</sup> From different rotations, varimax rotation was selected due to the creation of the factors that provided the best interpretation and were in line with the qualitative part of the study. The items that were not loaded onto any of the remaining factors, with a factor loading of <0.5, were removed, and overlapping items with a correlation of more than 0.5 were re-examined. Finally, the correlation between the explored factors showed that the extracted factors were all independent.

Results

At the end of the first phase of the study, the concept of SHA was defined as: the effectiveness of HD in satisfying the physical, psychological, social, educational, and economic needs of the patient at all times, which entails physical vitality, internal consistency, a sense of well-being, positive social interactions, effective self-empowerment, and weathering financial crisis (Table 1). Five generic categories emerged from qualitative phase

Table 1. Qualitative phase emerged categories.

Emergед categories	Subcategories
Inner consistency	Emotional health
	Mental health
	Spiritual health
	Positive body image
Sense of well-being	Self-acceptance
	Understanding satisfaction
	Understanding objectives
	Well-being
	Understanding safety
Positive social interactions	Normal social function
	Understanding support
Effective self-empowerment	Voluntary exploration of health literacy
	Voluntary adherence to treatment
	Focus on self-care behaviors
Weathering financial crisis	Occupational prosperity
	Reduced treatment costs



included inner consistency, sense of well-being, positive social interactions, effective self-empowerment, and weathering financial crisis.

During the validation assessment process, we deleted five items in item score, 23 in CVR, and two in CVI. In the stability reliability assessment, we merged pairwise four similar items and also identified and removed the three items that caused the internal consistency of the questionnaire to drop. Cronbach's alpha of 0.87 showed desirable internal consistency of questionnaire (Figure 1).

The 53-item questionnaire was investigated for EFA construct validity (MLE method). 538 HD patients (10 subjects per item) completed 53-item questionnaire in this phase. Finally, a questionnaire with 30 items and four factors was obtained (Table 2). The four factors extracted from factor analysis were sense of well-being, self-obligation for effective care, physical vitality, and spiritual health.

The first dimension, named as “a sense of well-being,” means that a HD patient has a sense of inner feeling of well-being and having a passion for being alive as a result of quality

Table 2. Final questionnaire of subjective hemodialysis adequacy.

	Items	Scoring				
1	Despite my illness, I have several strengths	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
2	I have come to terms with my new physical condition	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
3	I do not think myself sick	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
4	I can get along with others.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
5	I want to manage my life better	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
6	With hope for the future, I feel livelier	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
7	I am confident in the support of my family	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
8	I am working to attain my goals	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

Continuation of Table 2.

9	I am not worried about how others think about me	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
10	I trust my doctors and nurses	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
11	I resort to Imam in hardships	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
12	I trust God in all matters	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
13	Along with sickness, God has given me great blessings	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
14	The disease for me is a divine test	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
15	With more self-care, treatment costs have dropped	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
16	By searching various resources, I am careful and adherent to my treatment.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
17	I have a regular schedule for workout.	Never	Rarely	Occasionally	Very frequently	Always
18	I am rigidly adherent to my drug regimen	Never	Rarely	Occasionally	Very frequently	Always
19	I am hard on myself to follow the recommended diet	Never	Rarely	Occasionally	Very frequently	Always
20	I will continue dialysis until I reach dry weight	Never	Rarely	Occasionally	Very frequently	Always
21	I take the necessary preventive measures against seasonal diseases	Never	Rarely	Occasionally	Very frequently	Always
22	I try to look neat	Never	Rarely	Occasionally	Very frequently	Always
23	After or during dialysis, I feel nauseous	Never	Rarely	Occasionally	Very frequently	Always
24	I suffer from shortness of breath in activities.	Never	Rarely	Occasionally	Very frequently	Always
25	After dialysis, I feel light and comfortable	Never	Rarely	Occasionally	Very frequently	Always
26	I have good appetite	Never	Rarely	Occasionally	Very frequently	Always
27	I have the physical strength necessary for marital relationship	Never	Rarely	Occasionally	Very frequently	Always
28	I do my routine personally	Never	Rarely	Occasionally	Very frequently	Always
29	My blood sugar and blood pressure do not fall later or during dialysis	Never	Rarely	Occasionally	Very frequently	Always
30	The taste and smell of my mouth is not pleasant	Never	Rarely	Occasionally	Very frequently	Always

Table 3. Reliability of subjective hemodialysis adequacy questionnaire.

Factor name	Item number		Mean (SD)	ICC Absolute agreement	CI (95%)	P	SEM
Total	30	0.87	88.565 (15.82)	0.91	0.873–0.997	0.000	1.58
Sense of well-being	10	0.8	21.425 (7.88)	0.97	0.89–0.98	0.000	1.36
Self-obligation for effective care	8	0.77	29.45 (8.11)	0.858	0.702–0.94	0.000	5.13
Physical vitality	8	0.47	31.07 (4.93)	0.805	0.695–0.871	0.000	2.18
Spiritual health	4	0.79	6.45 (2.39)	0.936	0.903–0.957	0.000	0.6

SD: Standard deviation, ICC: Intraclass correlation coefficient, CI: Confidence interval, SEM: Standard error of measurement.

dialysis. Improved health condition after having high-quality dialysis can create this positive attitude. The sense of well-being is accompanied by better acceptance of changes in physical and mental conditions, which leads to more effort to attain goals.

The second dimension, dubbed as self-obligated for effective care, means that the HD patient with adequate dialysis is encouraged to do the necessary behaviors to maintain and improve the current level of health and reduce disease complications using the knowledge and skills that enable him to manage the disease.

The third dimension, called physical vitality,

means that the patient experiences signs of physical healing after high-quality dialysis, while recovering from previous irritating physical symptoms.

The 4<sup>th</sup> dimension, called spiritual health, indicates that the hemodialysis patient is also improved in terms of spirituality. Health level is enhanced by improving the relationship with God and Imams.

CVI of SHA questionnaire was 0.92, Cronbach's alpha of 0.87, theta of 0.88, intraclass correlation coefficient of 0.91, and standard error of measurement of 1.58 (Table 3).

To relationship study between score of SHA

Table 4. The relationship between subjective hemodialysis adequacy factors and Kt/V score.

Variable	SHA factors	Correlation coefficient	Significance
Kt/V	Sense of well-being	0.15	0.008
	Self-obligation for effective care	–0.054	0.349
	Physical vitality	0.05	0.381
	Spiritual health	0.08	0.156

SHA: Subjective hemodialysis adequacy.

Table 5. The relationship between subjective hemodialysis adequacy factors means and Kt/V levels.

Hemodialysis adequacy levels	SHA factors Means			
	Sense of well-being	Self-obligation for effective care	Physical vitality	Spiritual health
Kt/v<1	15.64	21	24.88	6.12
Kt/v=1–1.2	16.17	17.45	23.5	6.4
Kt/v<1.2	18	17.67	25.36	6.27
P	0.18	0.04	0.059	0.91

SHA: Subjective hemodialysis adequacy.



factors and Kt/v used Pearson correlation test. There was significant correlation between score of well-being factor and Kt/v (Table 4).

To relationship study between score of SHA factors and Kt/v levels used one-way ANOVA. Score of self-obligation for effective care factor was more significantly in Kt/v <1.2 patients (Table 5).

## Discussion

The results of qualitative phase showed that HD patients, after receiving high-quality dialysis, would have pleasurable physical and nonphysical experiences that reflect the complex physical, psychological, social, educational, and economic dimensions of this concept. The four factors extracted from tool factor analysis included physical vitality, spiritual health, sense of well-being, and self-obligation for effective care.

Sense of well-being is a subjective mental construct that can have diverse meanings for different people. How patients with severe disorders and disabilities can perceive life as a good experience, while patients with more acceptable and favorable clinical conditions perceive lower QOL can be a good indicator of sense of well-being. Santos in his study on Brazilian HD patients considered subjective well-being to be an important outcome in treating ESRD patients undergoing HD. He further emphasized the necessity of familiarizing the treatment team with a means of measuring these subjective dimensions and using it in daily work to improve the sense of wellness in HD patients.<sup>7</sup> In this study, sense of well-being (a pleasant feeling of being well and healthy, along with satisfaction from being alive and positive attitude toward the surrounding environment) as a subcategory of the sense of well-being is one of the factors derived from the experiences of HD patients regarding the SHA.<sup>13,14</sup>

The results of studies performed in HD patients showed that higher levels of spirituality and religiosity are associated with higher QOL, less depression, higher social support, greater satisfaction with life and

treatment, less need for supportive care, such as intubation<sup>15</sup> and more hope.<sup>16</sup> In our study, similar to previous studies, spiritual health was found as one of the experiences of HD patients and an outcome of SHA.

In his 2006 study, Jules showed that the adequacy of HD has a direct and significant relationship with higher health and physical performance, such that the higher the adequacy of dialysis, the higher the quality of social, family, and occupational roles.<sup>17</sup> Kalender and Tosun also after a year of study on 112 HD patients found that physical function was associated with URR, which is one of the indicators of HD adequacy.<sup>18</sup> We also found in this study that HD quality improves the patient's physical condition and his energy to perform daily activities.

Riis et al in 2005 showed that scores derived from measuring subjective dimensions are generated only from patients' reports, and products of this kind of measurement, which are emotions, perceptions, and judgments of the patient, cannot be obtained through objective measurement or direct observation of patients.<sup>19</sup> We also in this study developed an instrument from participants' experiences.

The SF QOL questionnaire, a tool designed to assess the QOL in the general population, without focus on the type of disease, reviews eight dimensions of health, namely physical functioning, constraints imposed by health problems, physical pain, general health, vitality, social functioning, constraints imposed by mental problems, and mental health.<sup>20,21</sup> The SHA measurement questionnaire (SHAMQ) evaluates the physical, psychological, individual, and social dimensions of SHA in the four dimensions of f sense of well-being, self-obligation for effective care, physical vitality, and spiritual health, especially in HD patients. Quality of sleep, spirituality, demand for proper treatment, and communication are categories that have been investigated in SHAMQ and are absent in SF QOL.

## Conclusion

These results can be key to effective inter-

ventions in the clinical model of HD to reduce mortality and morbidity and improve the QOL in HD patients. Considering the mixed findings of this study, along with the growing annual costs of renal patients in Iran, reviewing and preparing standard indicators to monitor the quality of HD in Iran seem essential. This study also sheds light on the non-physiological barriers of HD adequacy and opens up a new window for the authorities in this area to facilitate and eliminate management barriers and strengthen surveillance networks.

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