Relationship between the Level of Health Literacy, Diet Adherence and Dialysis Adequacy in Patients Undergoing Dialysis

Motahareh Mousavi Ghahfarokhi
* Department of Nursing, Abadan University of Medical Sciences, Abadan, Iran.
Department of nursing, Dezful University of Medical Sciences, Dezful, Iran.
(Corresponding author): M.musasavighahfarokhi@abadanums.ac.ir
Hora Tartifizadeh
Department of Nursing, Abadan University of Medical Sciences, Abadan, Iran.
Hosna Tartifizadeh
Student Research Committee, Shoushtar Faculty of Medical Sciences, Shoushtar, Iran
Shorough Asakereh
Department of Nursing, Abadan University of Medical Sciences, Abadan, Iran.
Negin Eskandari
Department of Nursing, Abadan University of Medical Sciences, Abadan, Iran.
Mohammad Kogani
Research Center for Contaminants (RCEC), Abadan University of Medical Sciences, Abadan, Iran.
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ABSTRACT

Background and Objectives: The number of patients affected by Chronic Kidney Disease (ckd) grows every year. Adherence to nutritional restrictions can affect the adequacy of dialysis treatment and also it is heavily dependent on suitable and sufficient health literacy level of patients undergoing dialysis. Considering the progressive increase of dialysis patients in Abadan, present research was performed to investigate the relationship between health literacy and adherence to diet and adequacy of dialysis.

Materials and Methods: The present research is a descriptive- cross-sectional study performed on 207 patients referring to the dialysis ward of the hospitals covered by Abadan University of Medical Sciences via regular systematic randomized method. Data collection was performed using three questionnaires including demographic information, Health Literacy for Iranian Adults (HELIA), ESRD-AQ, and KT/V investigation Data analysis was performed using descriptive and inferential statistical tests plus logistic regression model in SPSS 27.

Results: Out of 207 patients examined, 28.50% of patients had poor adherence while 71.50% showed strong adherence. Among patients with poor adherence, 58.2% had low health literacy, 40% average and 1.8% high. Furthermore, logistic regression model showed that by increasing in the health literacy level of the patients, the chance of adherence would grow by 6.3 times, which was statistically significant (CI= 3.13). However, no significant relationship was found between level of health literacy and adequacy of dialysis (CI=1.73).

Conclusion: Considering the significant relationship between health literacy and adherence to the diet, it becomes important to make attempts for showing the significance of enhancing the health literacy of patients undergoing dialysis in order to enhance adherence to the diet and thus support the success of dialysis treatment method and enhance the general care of these patients.

Paper Type: Research Article
Keywords: Health literacy, Diet, Dialysis, Kidney Disease.

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Introduction

Chronic kidney failure disease is a secondary clinical syndrome causing definite changes in the structure and function of the kidneys (1). In order to prevent progression of Chronic Kidney Disease (CKD), alternative treatments are required. Dialysis is currently used as renal replacement treatment (2) .There is progressive concern about the increase in the CKD risk worldwide (3). The epidemic of CKD affects more than 10% of the global population, i.e. 600 million people (4). Meanwhile, the number of patients grows every year (5) the prevalence of this disease in 2023 was 10-15% of the world population (6) Furthermore, in men it has grown from 1. 3% case of development to 15.7%, while rising from 2. 2% to 11.7% among women (7). The population of patients suffering from CKD in Iran is 320, 000 (8). The rate this disease rises annually by 15% (9). Out of this number, 48% use hemodialysis and 3% employ peritoneal dialysis (10). Suffering from CKD as well as progression of this disease is influenced by many factors including hypertension, diabetes, polycystic syndrome, and proteinuria, and all these are heavily affected by the diet of the person (2). In spite of considerable advances in dialysis technologies, due to the gradual decline of the kidney function in patients suffering from CKD and defects in the intake and levels of minerals, sodium, phosphorus, potassium, magnesium, and other nutrients, the role of adherence to proper diet becomes highlighted for these patients (2). In CKD, adherence to nutritional constraints as part of the self-care active management system is very crucial for more effective treatment and quality of life (4, 7). The ability of adherence to nutritional limitations and in the end stages of CKD in comparison to its early stages is more challenging (12). Adherence to the diet can prevent from numerous complications of the disease. Lack of adherence to the diet especially low potassium diet and limiting fluids can lead to, inter-dialysis weight gain, severe hypertension, and cardiac arrest. Ultimately, these complications can threaten the life of the patient and eventually lead to death (12, 13). The factors affecting the extent of adherence for patients include suitable and sufficient health literacy (6, 14). Health literacy refers to the ability of individuals to receive and process understandable information and use this information to improve and maintain health (15). According to the world Health Organization definition, health literacy has been defined as cognitive and social skills to determine the motivation, ability of perception, and use of health information to preserve and enhance health (11). Literacy is not merely the ability of reading and writing or understanding information; rather, it also covers the ability of self-health system active management and proper decision-making in this regard (15, 16). Due to the high rate of chronic diseases and the relatively long duration of affliction with these diseases including CKD, existence of self-management skills has become important in management of these diseases (15). In this regard, the level of health literacy has been defined as one of the important and influential indicators affecting health in many chronic diseases (4, 8). Meanwhile, the effectiveness of dialysis has been established as one of the most important preventable issues in patients undergoing treatment with

dialysis (17). The extent of effectiveness or adequacy of dialysis is measured using a special computational formula (18) (URR and KT/V). Measurement and specification of this item is important since it heavily affects the quality of life of patients and their extent of survival or longevity (17). Since adherence to nutritional restrictions and proper diet can affect the adequacy of dialysis treatment and health of patients as well as prevention from incidence of complications in the end stages of CKD (6, 19), and adherence to the diet is heavily dependent on suitable and sufficient health literacy level of patients undergoing dialysis, the importance of health literacy of dialysis patients with regards to diet becomes highlighted (11). In this regard, in a study performed in 2019 by Ivana et al. in 20 dialysis clinics in Slovakia, the relationship between several domains of health literacy and lack of adherence to the diet (high serum potassium, high serum phosphate, and the relative overhydration) was evaluated. The prevalence of lack of adherence in these patients ranged from 21. 7% to 43. 3% for clinical indices and self-reported ones. The results indicated that lacking sufficient information for health management, passivity in health management, and low interaction with healthcare providers were associated with lack of adherence to diet and consumption of fluids (6). Furthermore, in another study, in 2019 by Ozon et al. on dialysis patients, it was found that the extent of lack of adherence to diet was 39. 1%, that of restrictions of fluids was 33. 6%, and medications was 20. 1% (20). The study conducted in Kerman showed an insufficient level of health literacy and a low overall health literacy score (21). In addition, the research by Murali et al. (2019) indicated poor adherence of dialysis patients (14). Since previous research has mostly focused on adherence to drug regiments and participation in dialysis sessions, absence of information regarding examination of the role of health literacy in adherence to diet as well as its association with the factor of dialysis adequacy warrants close attention. Accordingly, we intend to improve the general care of dialysis patients, for whose fulfillment we should specify the factors affecting the treatment of these patients including adherence to the diet and adequacy of dialysis and its association with health literacy through precise measurement. By applying the results of this research in future studies, we can find better solutions and therapeutic interventions. Accordingly, the aim of this study has been to examine the effect of health literacy on adherence to diet and its association with the factor of dialysis adequacy in patients undergoing dialysis in 2023.

Materials and Methods

Study Design and Data Collection

The present research is a cross-sectional study of descriptive- analytical type, performed from August to February 2023 in hospitals affiliated with Abadan University of Medical Sciences on 207 patients undergoing dialysis. 16, 21, 37, 56, 45, and 32 patients were selected from Taleghani, Alavi, Valiasr, Beheshti, Moarefizadeh, and Arvandkanar hospitals, respectively, and the questionnaires were completed. Considering that the number of dialysis patients in hospitals covered by Abadan University of Medical Sciences is estimated to be 450, the sample size was determined to be 207 patient

based on the opinion of the honorable statistician and based on Cochran's formula(n=(Nz^2 pq)/(Nd^2+z^2 pq)) and Morgan's table. Simple sampling method was used in this study. After receiving permission from ethics committee of the mentioned university, with the code IR.ABADANUMS.REC.1402.084 researchers presented to the dialysis health care centers of the mentioned hospitals and collected the samples in several stages. The required sample was chosen via regular systematic randomized method from among kidney disease patients undergoing treatment with dialysis alternately from the files of patients of the dialysis ward of each Hospital. The inclusion criteria were: 1) having kidney disease with glomerular filtration rate lower than 30 ml/min 1.73 m2(22), at stage 5 or higher stage of CKD as confirmed by physician, 2) undergoing treatment with dialysis for at least three months, 3) age 18 to 65 years, 4) having suitable physical conditions for answering the questions, 5) lack of psychological or cognitive diseases) Based on the evidence in the file and the patient's clinical symptoms(, 6) having minimum literacy of reading and writing by the patient. The exclusion criteria included: 1) lack of willingness to participate in the study, 2) deterioration of the patient status and hospitalization along the study, 3) inability of filling in the questionnaire by the patient or their companion due to dementia or mental retardation, 4) inability of reading Persian language or Arabic by the patient or their companions. Note that before collecting the samples and completing the questionnaires, in a meeting held in the dialysis ward by the colleagues of the research, the research as well as its objectives and the required questionnaires were explained to the participants for receiving written informed consent. Then, the mentioned questionnaires were completed as interview with participants. Then, in order to obtain and assess the dialysis adequacy criterion, the participant's present files in the dialysis ward were used after receiving permission from the head nurse.

Survey Instrument

For data collection, four instruments were used including three questionnaires capturing demographic information, Health Literacy for Iranian Adults (HELIA), and treatment adherence questionnaire plus investigation of dialysis adequacy criterion. The demographic information questionnaire included eight items (age, gender, level of education, occupation, comorbidities, economic status, duration of initiating dialysis treatment, number of dialysis sessions per week). Also, the items of the Health Literacy for Iranian Adults (HELIA) questionnaire consisted of 33 items and 5 elements. The elements included accessibility covering items 1 to 6, reading skill including items 7-10, understanding covering items 11 to 17, evaluation including items 18 to 21, and decision-making as well as application of health information including items 22 to 33. Items 1-6 and 11-33 were scored based on five options (always, most of the time, sometimes, rarely, never), while items 7-10 were scored with five options (it is absolutely easy, it is easy, it is hard, it is absolutely hard, neither easy nor hard) in 1-5 Likert scale directly. In this questionnaire, the highest and lowest levels of health literacy were assigned 33 and 165 scores respectively. The level of

health literacy in this research was categorized into the three following groups: low (122-165), average (78-121), and high (33-77). The content validity of this questionnaire was investigated in 2014 by 15 specialists in different healthcare fields (23). Regarding reliability of the questionnaire, the Cronbach Alpha was reported 0.72-0.89, thereby being confirmed in this regard as well (23). Also, the questionnaire of extent of adherence in patients suffering from end stages of CKD (ESRD-AQ) developed by KIM et al. The response to this questionnaire is based on a combination of Likert scale, multiple choice, and Yes/No format. The minimum score of this questionnaire was zero and the maximum was 1200. Accordingly, they were divided into strong and poor adherence levels. The content validity of this questionnaire was evaluated by 7 experts (24) (KIM et al.). The content validity of this questionnaire using content validity index (CVI) was announced above 0.78, which is acceptable (24). This questionnaire was used in the study by Rafei Vardenjani et al. in 2013 in Iran. For confirming the content, the questionnaire was provided to 15 specialists of CKD and hemodialysis as well as renal failure. Accordingly, validity was confirmed as 0.98 and reliability as 0.85 (25). Also, this questionnaire was used in a study in 2021 by Sheikhi in Hamadan (26). ktv is a ratio that expresses urea clearance. The adequacy of dialysis was investigated based on delivered Kt/V (Kt/V formula was calculated as follows: K*T/V, where K represents dialysis clearance or filtering for the urea in the blood, T denotes the duration of dialysis per hour, and V shows the diffuse urea throughout the entire body fluids) criterion (extent of urea clearance), recorded in the file of dialysis patients referring to the hospitals affiliated with Abadan University of medical sciences. This item is calculated each month and recorded in the file indicating adequacy of dialysis in that month. It was reported as a standard value on average over the three past months. Kt/V>1.2 has been considered as the minimum acceptable adequacy of dialysis according to health ministry of Iran (17).

Statistical Analysis

The data were analyzed by descriptive and inferential statistics using SPSS 27. To determine the relationship between qualitative variables, chi-square test (or Fisher's exact test) was utilized. To explore the relationship between quantitative variables, Pearson correlation coefficient (and in case of abnormality, Spearman correlation coefficient), for mean comparisons independent t-test (and in case of abnormality of variables, Mann-Whitney test) for comparing the levels of variables, ANOVA (analysis of variance) (and in case of abnormality, Kruskal-Wallis test) were employed. To prevent confounding variables such as age, gender, occupational factors, education, and the method of obtaining the information, logistic regression model was used; in this way, the independent effect of level of health literacy on adherence to diet and adequacy of dialysis was measured.

Results

The total number of patients referring to the hospitals covered by Abadan University of Medical Sciences,was 450; out of them 207 were included in the study. Most of the patients were male and fewer were female. The oldest and youngest patients being 65

and 18 years of age respectively. In this study, most patients, had dialysis duration of more than one year. Also, most of them were illiterate and fewer of them were housewives; among them, most of the participants, had average income. The most common comorbidity in these patients was hypertension and diabetes (Table 1).

Table 1. Frequency distribution of demographic characteristics of dialysis patients

Variable		Number	Percent
Sex	Female	84	40/58
	Man	123	59/42
Education	illiterate	65	31/40
	elementary	61	29/47
	guidance	25	12/08
	High school	42	20/29
	university	14	6/76
Employment	Unemployed	54	26/09
	housewife	74	35/75
	Retired	25	12/08
	student	1	0/48
	other	53	25/60
Dialysis duration	Less than 6 months	35	16/91
	6 months to 1 year	31	14/98
	More than 1 year	141	68/12
Income	weak	81	39/13
	medium	84	40/58
	Good	42	20/29
Comorbidities	Blood pressure + diabetes	163	78/98
	blood pressure	20	9/8
	diabetes	15	7/12
	other	9	4/1

The results indicated that most of the patients with high literacy had strong adherence, on the contrary most of the patients with high health literacy, had inadequate dialysis quality (Table 2).

Table 2. Associations of health literacy with adherence to diet and dialysis adequacy

Health literacy level	Diet adherence		Dialysis adequacy	
	Weak	Strong	inadequate	adequate
	N (%)	N (%)	N (%)	N (%)
low	32(15.45)	15(7.24)	27(13.04)	16(7.72)
medium	22(10.62)	66(31.88)	57(27.53)	27(13.04)
high	1(0.48)	71(34.29)	45(21.73)	24(11.59)

By controlling other variables, per each unit increase in the health literacy level of the patients, the chance of adherence would grow times, which is statistically significant (CI=3.13). Furthermore, per each year of increase in the age of patients, the chance of adherence significant increase (1.05) (Table 3).

Table3.The relationship between health literacy and diet adherence with using the logistic regression model

Diet adherence		Odds Ratio	Std. Err.	z	P>z	[95% Conf.	Interval]
Health literacy		6.352421	2.284468	5.14	0.000	3.13927	12.85434
Age		1.030264	.0139394	2.20	0.028	1.003302	1.05795
Duration of dialysis		1.084131	.2880808	0.30	0.761	.6440149	1.825019
Sex (female)		1.154583	1.270696	0.13	0.896	.133543	9.982267
Education	illiterate	1.367561	.3058758	1.40	0.162	.8821908	2.119975
	elementary	.8729473	.9937139	-0.12	0.905	.0937623	8.127328
	guidance	.6235832	.5391102	-0.55	0.585	.1145513	3.394602
	university	.9646042	.554168	-0.06	0.950	.3128465	2.974178
Income (weak)		1.879272	.6131759	1.93	0.053	.9914172	3.562238
_Cons		.001853	.0034268	-3.40	0.001	.0000494	.0695021

No significant relationship was found between level of health literacy and adequacy of dialysis (CI=1.73). Results showed that per each unit increase in the time of dialysis, the chance of dialysis adequacy grows albeit being insignificant (CI=2.21). Furthermore, the chance of adequacy of dialysis is greater in women compared to men (CI=14.40). Finally, results showed that retired individuals have greater chance of dialysis adequacy compared to unemployed subjects, though it is not statistically significant (CI=4.06) (Table 4).

Table 4. Relationship between health literacy and dialysis adequacy by controlling other demographic variables using logistic regression model

KT/V		Odds Ratio	Std. Err.	z	P>z	[95% Conf.	Interval]
Health literacy		1.005516	.28078	0.02	0.984	.5817009	1.738114
Age		1.000493	.0122735	0.04	0.968	.9767242	1.02484
Duration of dialysis		1.390183	.3294626	1.39	0.165	.8736626	2.212076
Sex (female)		2.770686	2.329927	1.21	0.226	.5330827	14.40058
Education (illiterate)		1.081282	.1910189	0.44	0.658	.7648315	1.528663
Employment	housewife	1.303913	1.200574	0.29	0.773	.2145397	7.924826
	Retired	1.14435	.7403833	0.21	0.835	.3219878	4.067036
	other	1.053163	.5280956	0.10	0.918	.3941583	2.813974
Income (weak)		1.062235	.2644727	0.24	0.808	.652064	1.730416
Cons		.0319663	.0454248	-2.42	0.015	.001973	.5179259

Discussion

The results of the present study are consistent with the findings of Ghobadi et al. (2015), performing a study to examine the prevalence of low health literacy, difference of negative emotional state, and self-care behaviors based on levels of health literacy and the mediating role of negative emotions on the relationship between health literacy and self-care in patients undergoing dialysis. They stated that more than one fourth of the individuals had desirable level of health literacy (27). However, Rafei et al. (2021) study examining the level of health literacy of patients undergoing hemodialysis in relation to diet and its influential factors found that

more than 83% of the patients had poor and moderate level of health literacy on average, and only less than 17% of patients acquired acceptable score in the health literacy domain (28). Nevertheless, it seems that the difference of the present study results and the results of Rafi's study can be attributed to the limited sample size in the mentioned study. Also, the results of Skoumalova et al. (2019) performed to examine whether the health literacy of dialysis patients is associated with adherence to dietary recommendations and consumption of fluids indicated limited health literacy level in these patients (29). In this regard, it should be noted that one of the reasons behind the difference of the present study results and those of Skoumalova et al. can be cultural and the researched population differences.

In this research, there was a significant relationship between health literacy and adherence to diet. According to the results of Skoumalova et al. (2019) again limited health literacy level was associated with lack of adherence to diet and consumption of fluids; in this study it has been stated that lack of sufficient information for health management and less interaction with healthcare providers are associated with lack of adherence to the diet and consumption of fluids (29). The results of Yu-Chi Chen et al. (2018) performed to examine the relationships between social support, health literacy, as well as self-management and factors affecting self-management of chronic kidney disease (CKD) also indicated that health literacy was positively correlated with self-management behaviors (30). In the study by Beerappa et al. (2019) conducted to investigate the extent of adherence to diet and restriction of fluids in patients undergoing hemodialysis, it was found that there is acceptable to good level of adherence for restrictions on fluids and diet among patients (31). On the other hand, Kutner et al. found that many patients have challenges in adherence to the diet and restricting fluids (32). Unlike the results of this study, Nerbass et al. in a research performed in Portugal noted that adherence of patients undergoing dialysis to the diet is poor, while the patients show good level of knowledge with regards to food sources rich in phosphorus (33). This difference can be due to the relatively long time difference between the current research and the researches of Kutner and Narbas, which were conducted in 2002 and 2010, respectively. This is because this multiyear gap has been associated with increased level of awareness as well as collective education and thus enhanced extent of adherence. In addition, the results of Zakari et al.'s 2023 study showed the absence of a significant relationship between the level of health literacy and adherence to treatment in patients (34), while the study by Aghajanlou et al. 2023 showed that there is a significant relationship between the level of health literacy and adherence to medication regimen. In this sense, it is consistent with the present study (35).

According to the results obtained in this study, no significant relationship was found between level of health literacy and dialysis adequacy. The present study shows that the dialysis adequacy of most of the patients based on calculating the KT/V criterion is low and poor. According to the results of Baluchi et al. (2021) the extent of dialysis adequacy among dialysis patients of the East

Mediterranean region was poor. This value can be generally affected by social differences, economic status, and health literacy level of the dialysis patients (36). Meanwhile, the results of Ebrahimi et al. (2015) showed a significant relationship between the extent of dialysis adequacy and quality of life (37). Since quality of life showed direct correlation with health literacy in the study by Arzhangi et al. (2022) performed to investigate the relationship between health literacy and quality of life of hemodialysis patients (38); thus enhancing health literacy of these patients is effective on improving the adequacy of dialysis. Nevertheless, the relationship between these two variables did not become significant in our study.

According to the results obtained in this study, no significant relationship was found between age and adherence to diet, level of education, occupation, as well as duration of dialysis and adherence to diet. In this regard, in line with the study of Taylor et al. (2016) performed to investigate the effect of limited health literacy on advanced kidney failure, it was found that low level of health literacy was not significantly correlated with socioeconomic status (39). Rafei Vardenjani et al. (2014) in a study performed to determine the status of adherence to hemodialysis treatment and its association with some factors in hemodialysis patients stated that adherence to dialysis regimen had a significant relationship with increased age and insignificant relationship with other personal variables such as the number of years of dialysis, education, and the cause of kidney failure, again being concordant with the present study results (25). Also, the results of Sheikhi et al. (2023) study show the correlation between treatment compliance behaviors with education level, gender, and marital status(26), and Mirzaei et al. (2023) They showed that medication compliance is better among patients with higher education and those who are employed, which means that the results of these 2 studies are inconsistent with the results of the present study(40). On the other hand, the study by Rafei et al. (2021) showed a significant correlation between health literacy and level of education. In addition, Montazeri et al. (2014) stated that patients with higher levels of education had more favorable health literacy (28). It is also consistent with the study by Lambert et al. (2017) to find factors affecting non-adherence to diet in hemodialysis patients and Nurten OZEN's study (2019) showed that patients with a lower level of health literacy had poorer treatment adherence (20, 41).With regards to the relationship between diet and occupation, the study by Lambert et al. (2017) indicated that employee patients had weaker adherence, which does not concur with the present study results (41). Concerning the relationship between age and extent of adherence to diet, it is similar to the results of Lambert et al. (2017) showing significant correlation between age and adherence (41). Insignificance of the relationship between gender as well as duration of dialysis and extent of adherence to diet in the present study is not in line with the results of OZEN et al. and Bee Rappa et al. (2019) who showed that gender and duration of dialysis are factors that have a direct and significant correlation with adherence to diet (20, 31). Nevertheless, all of these differences can arise from differences in the place of

research, researched population, as well as use of different assessment methods.

Study Limitations and Strengths: In spite of the maximum efforts for precise measurement of the relationship between the three variables of the present research, this study had also some limitations. Most of the research population consisted of Arabic speaking subjects who had partial mastery or no mastery over Persian, thereby causing some communications barriers in completing the questionnaires. To resolve this issue, a colleague with mastery over Arabic was employed for interviewing and completing the questionnaire for Arabic speaking patients. Another limitation was the fatigue and avolition or chronic pain during dialysis. In this regard, first for psychological and spiritual support of the patient and then interpreting the study objectives and applications in a practical and simple language was done. Then attempts were made to perform interview and complete the questionnaire once the patient has better physical and spiritual state such as after dialysis. Further, in case of persistence of avolition, aggravation of the patient status, and unwillingness to participate, that patient would be excluded. Since this study only examined dialysis patients covered by Abadan University of Medical Sciences, it may not be generalizable to other dialysis patients. Also, the tool for evaluating and completing the questionnaires was the patient's self-report, hence the possibility of errors in the answers is possible, and in order to solve this problem, if the patient's family is accessed, an interview with one of the family members is also done to ensure the answers given. In addition, the cross-sectional nature of the study makes it difficult to follow the relationship of variables over time and in different conditions, so, conducting more studies on larger populations over different periods of time will help to solve this issue.

Conclusion

The results of the study showed a strong correlation between the level of health literacy and adherence to diet. Our result suggest that enough health literacy improve dialysis patients' adherence to nutritional diet. However, there was not a significant relationship between HL and dialysis quality. In this way, the healthcare team who are in direct communication with patients would appreciate the importance of this issue and make their attempts for enhancing the awareness level of patients thereby improving the treatment quality.

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Consent for publication: All respondents have given consent for publication, provided that anonymity was ensured.

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from ethics committee of Abadan University of medical sciences. All patient and hospital managers gave consent for participation after reviewing the study method and questionnaire items.

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