




Factors Affecting Adherence of Recipients to Immunosuppressive Therapy after Liver and Kidney Transplantation

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Abstract

Background: Organ transplantation has important outcomes: decreased mortality, increased graft survival, reduced morbidity, and improved quality of life. One of the most important preventable factors that negatively affect these outcomes and put the success of solid organ transplants at risk in organ transplant recipients is non-adherence to immunosuppressive treatment.

Aim: The purpose of this study is to examine the adherence of recipients to immunosuppressive therapy after liver and kidney transplantation and affecting factors.

Methods: This is a descriptive study. A total of 310 patients who underwent liver or kidney transplantation at a university hospital between February and July 2015 were included in the study. Data were collected with Sociodemographic and Clinical Characteristic Form, SF-36 Quality of Life Scale, and Immunosuppressant Therapy Adherence Scale. The Mann-Whitney *U* test, Fisher's exact test, and Chi-square test were used to analyze the data. Factors affecting adherence were examined by univariate logistic regression analysis.

Results: The edits made to the sentence 'Immunosuppressive Therapy Adherence Scale scores of the recipients ranged between 7 and 12 with a mean of 11.34 ± 0.81 and recipients who had Immunosuppressive Therapy Adherence Scale scores of <12 were considered non-adherent. Age, time elapsing after transplantation, total number of drugs used, education on drug use, and the quality of life mental component summary score were found to affect adherence to immunosuppressive therapy. Gender, educational status, marital status, employment status, donor and organ transplant type, and the quality of life physical component summary score were found to be ineffective in adherence to immunosuppressive therapy.

Conclusion: Organ transplant recipients adherent to immunosuppressive therapy were found to be older, use a higher number of drugs, and have a higher mental health summary scores than those not adherent to the immunosuppressive therapy. Besides, a higher rate of the recipients adherent to immunosuppressive therapy was found to receive education on medication use and have a shorter time elapsing after transplantation. It can be recommended that nurses should be aware of the factors likely to affect adherence to immunosuppressive therapy, evaluate the adherence regularly by using a valid and reliable tool, and perform effective interventions.

Keywords: Liver transplantation, kidney transplantation, immunosuppressive therapy, adherence

Introduction

The number of kidney and liver transplantations has gradually risen in Turkey and the rest of the world and the life expectancy of the recipients has increased.¹⁻³ In the United States, there were a total of 42 887 transplantations in 2022, of which 36 420 were from deceased donors and 6467 were from live donors.² In Europe, a total of 6805 people had transplantation in 2021, of which 5624 were from deceased donors and 1181 were from live donors.³ According to data from the Turkish Ministry of Health, a total of 3621 kidney transplantations and 1610 liver transplantations were performed in 2022.³

Organ transplantation has 4 important outcomes: decreased mortality, increased graft survival, reduced morbidity, and improved quality of life. One of the most important preventable conditions affecting these health outcomes in organ transplantation recipients is nonadherence to immunosuppressive therapy (IST).⁴ It refers to forgetting to take immunosuppressants at least once a month, taking the wrong drug at least once a month, or taking the drug 2 hours or 2½ hours late at least once a month. Nonadherence is also considered as changing, forgetting, and missing the dose of the immunosuppressants

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at least once a month or missing at least 3% or 10%-20% of the doses of the immunosuppressants.⁵

Research on solid organ transplantations has focused on nonadherence to IST in the past 2 decades.⁴ The rate of nonadherence ranges from 0% to 68% depending on many factors including patient characteristics, healthcare services of countries, and health insurance coverage (changes in health insurance coverage can cause difficulty in accessing medications) and it is higher than expected.^{6,7} In a meta-analysis including 147 studies about the post-transplantation period, of all the studies about adherence to IST, 49% were kidney transplant recipients and 20% were liver transplant recipients. The rate of nonadherence to IST after solid organ transplantation was 33.4% in North America, 13.5% in Europe and other countries, 35.6% in kidney transplant recipients, and 6.7% in liver transplant recipients.⁸

In studies about adherence to IST in kidney transplant recipients from Iran, 45.5% of the patients in 1 study were adherent to IST,⁷ 58.3% and 41.7% of the patients in another study had good adherence and partial adherence to IST respectively,⁹ while 55% of the patients in another study were found to lack adherence.¹⁰ In a study in the Czech Republic, 82% of the patients were shown to have adherence to IST.¹¹ A study in Thailand revealed that of all the liver transplant recipients, 82.6% had high scores (12), 16.3% had moderate scores (10-11), and 1.2% had low scores (0-9) on Immunosuppressive Therapy Adherence Scale (ITAS). ITAS scores were reported to have a significant relation with time elapsing after transplantation and education.¹² In 1 study with kidney transplant recipients from the United States, 85.7% of the patients were found to have adherence (59.1% had an ITAS score of 12 and 26.6% had ITAS scores of 10-11) and 14.3% of the patients were found to lack adherence (ITAS scores of 0-9).¹³ A study on adherence to IST in kidney transplant recipients from Turkey, 88.8% of the patients had adherence,¹⁴ and a study on liver transplant recipients showed that the patients had a mean ITAS score of 11.18 out of 12, which can be considered a very high score for adherence.¹⁵ The causes of nonadherence were reported to be forgetting or not taking the immunosuppressive medication on time.¹⁵ A study on adherence to IST in kidney transplant recipients in Turkish Republic of Northern Cyprus showed that the mean ITAS score was 11.49 out of 12 and that 63% of the patients had complete adherence, but that 37% of the patients did not have adherence. The study also emphasized that as time elapsing after transplantation increased so did nonadherence.¹⁶

The most important cause of nonadherence reported in the literature is unconscious forgetfulness of the patients, followed by age, gender, education, marital status, financial status, employment status, high costs of the medications, low income, stress, depression, anxiety, low cognitive perception, mental diseases, multiple medications, concurrent use of medications, and complex treatment regimens.^{6,9,13,15,17-21} In addition, the belief that medications interrupt the lifestyle and are harmful, low familial and social support, low satisfaction with life, low self-respect, social isolation, inability to receive healthcare, insufficient information, long time elapsing after transplantation, side effects of the medications (diarrhea, sleeplessness, weakness, etc.), and alcohol intake are considered as the other causes of nonadherence.^{9,16-23}

According to the results of several studies on the causes of nonadherence to IST, 83% of the kidney transplant recipients experienced forgetfulness, 6% had financial problems, and 3% could not access their medications.¹⁰ Taking multiple medications, getting confused

with the use of medications, having difficulty in remembering medications, and not having enough information about medications were the other reported causes of nonadherence.⁷

Nonadherence to IST creates a risk in terms of the success of solid organ transplantations and this may cause rejection, mortality, morbidity, rehospitalizations, re-transplantations, presentation to health centers, and increased healthcare costs.⁴ The first step to evaluate adherence of the patients to medications and to make recommendations about their lifestyle is to determine the causes of poor adherence or non-adherence.²⁴

Immunosuppressive treatment regimens are complex and require continuous self-care.²¹ Nurses have not only important roles during transplantation like treatment and care but also many favorable influences since they are the health professionals that can allocate time for the patients.⁹⁻²⁰ Nurses and other health professionals should provide transplantation recipients and their families with education and counseling perform cognitive, emotional, and behavioral interventions, use motivating interview techniques, and reduce anxiety and depression to increase adherence to IST after transplantation.^{9,15,20,21,24}

There has been a limited number of studies on the rates of adherence to IST and affecting factors.¹⁴⁻¹⁶ Therefore, the aim of this study was directed toward examining adherence to IST and factors affecting this adherence in kidney and liver transplant recipients. The results of the study will reveal adherence rates and influential factors in kidney and liver transplant recipients and can contribute to planning nursing interventions that can reduce nonadherence.

Materials and Methods

Study Design

The study has a descriptive design.

Study Population and Sample

The study population comprised all the patients presenting to and followed in the general surgery outpatient clinic after liver transplantation and all the patients presenting to and followed in nephrology outpatient clinic after kidney transplantation at a university hospital between February and July in 2015. The study sample included 310 patients undergoing liver and kidney transplantations and fulfilling the following inclusion criteria: having liver or kidney transplantation, at least 6 months elapsing after transplantation, being older than 18 years, being able to speak and write in Turkish, using immunosuppressive medications independently, and voluntarily participating in the study. The exclusion criteria were having the diagnosis of a psychiatric disease and any visual, hearing, cognitive, and motor function disabilities likely to prevent responding to the questions in the data collection tools.

Data Collection Tools

Data were gathered with self-report tools including a sociodemographic and clinical characteristic form, SF-36 Quality of Life Scale, and ITAS.

Sociodemographic and Clinical Characteristic Form

The sociodemographic and clinical characteristic form was created by the researchers and had 2 sections including 18 questions. The first section was composed of 7 questions about sociodemographic

characteristics including age, gender, education, marital status, health insurance, financial status, and occupation. The second section was composed of 11 questions about clinical features including type of organ transplantation (liver or kidney), date of transplantation, time elapsing after transplantation, type of donor (live or deceased), causes of transplantation, immunosuppressants used after transplantation, other regularly used medications, the total number of medications used, receiving education about the use of medications, the person giving education, and the place of education.

SF-36 Quality of Life Scale

SF-36 Quality of Life Scale, originally named The Medical Outcomes Study 36 Item Short Form (The MOS SF-36) Health Survey, is a self-report questionnaire developed by Ware in 1987 to evaluate the quality of life. The scale is composed of 35 items, 8 subscales, i.e., physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-mental, and mental functioning, and 2 component scores, i.e., physical component summary score and mental component summary score. In addition, 1 question is used to evaluate to what extent current health status changes compared to the previous year.²⁵ The validity and reliability of the scale were tested by Ware and Gandek in 1998 and the validity and reliability of its Turkish version were tested by Koçyiğit et al in 1999.

Responses to the fourth and fifth questions of the scale are yes and no and responses to the other questions are evaluated on 3-point, 5-point, and 6-point Likert scales. Weighted mean scores for the questions in the subscales of SF-36 Quality of Life Scale are added to obtain physical and mental components summary scores. There is no total score for the scale. The summary scores range from 0 to 100. The score 0 indicates poor health and the score 100 indicates good health. The purpose of obtaining summary scores is to facilitate interpretation and comparisons.^{26,27}

Immunosuppressant Therapy Adherence Scale

ITAS was developed, and its validity and reliability were tested by Chisholm et al²⁸ in the United States in 2004 to evaluate adherence of organ transplant recipients to IST after transplantation. The scale was adapted to Turkish, and the validity and reliability of its Turkish version were assessed by Bayhan and Karayurt in 2016.²⁹ Cronbach's alpha was reported to be 0.81 for the original scale and 0.65 for its Turkish version. It was found to be 0.70 in the present study.

ITAS is a 4-point Likert scale composed of 4 items used to assess adherence to IST in the last 3 months of transplantation. Responses to the items are scored as follows: the response 0% corresponds to 3 points, the responses 0%-20% to 2 points, the responses 21%-50% to 1 point, and the responses >50% to zero point. The total score for the scale ranges from 0 to 12. Increased scores indicate increased adherence to IST.^{28,29}

Data Collection

Data were gathered in the general surgery outpatient clinic and in nephrology outpatient clinic at a university hospital between February and July in 2015, at face-to-face interviews, by the researcher. It took 10-15 minutes to fill in the tools. Patient records were also utilized to obtain data.

Data Analysis

Data were analyzed with the Statistical Package for Social Sciences version 15.0 (IBM Corp., Armonk, NY, USA). The results were evaluated based on the confidence interval of 95% and the significance level of $P < .05$. Data about sociodemographic and clinical characteristics were expressed in numbers and percentages. Mann-Whitney U test, Fisher's exact, and Chi-square tests were used for data analysis. Univariate logistic regression analysis was performed to examine the factors affecting adherence.

Ethical Considerations

The patients who would participate in the study were informed about the aim of the study and their oral and written informed consent was obtained. Permission was obtained from Bayhan through email, who adapted ITAS into Turkish, to be able to use the scale in this study. Ethical approval was obtained from the noninterventional clinical research ethical committee of Dokuz Eylül University and written permission was taken from Ege University Hospital administration to conduct the study in the transplantation outpatient clinics (approval number: 2014/38-08).

Results

The organ transplant recipients participating in the study were aged 18-75 years with a mean of 47.26 ± 12.61 years. Of all the organ transplant recipients, 65.20% were male, 57.40% were primary school graduates, 77.10% were married, 99% had a health insurance, 76.50% had an income equal to their expenses, and 79% were unemployed.

The time elapsing after transplantation ranged from 6 months to 318 months with a mean of 84.54 ± 60.19 months. The total number of immunosuppressive medications and other medications used varied from 1 to 12 with a mean of 5.69 ± 2.25 . Regarding the type of donors, 56.50% of the recipients had a live donor and 62.90% of them had kidney transplantation and 37.10% of them had liver transplantation. The cause of liver transplantation was chronic liver failure (alcoholism) in 88.70% of the liver transplant recipients and the cause of kidney transplantation was idiopathic conditions in 35.40% of the kidney transplant recipients. Concerning IST, 55.80% of the recipients received tacrolimus (monotherapy, dual therapy, and triple therapy). A total of 60.30% of the recipients received education about IST, 90.40% of them received the education in the general surgery clinic, and 54.00% of the recipients received the education from a nurse (Table 1).

ITAS scores of the recipients ranged between 7 and 12 with a mean of 11.34 ± 0.81 . The recipients missed their immunosuppressive medications at most 40 times in the last 3 months with a mean of 0.82 ± 2.91 times since they forgot to take them. The recipients took their medications at the wrong time or in the wrong dose at most 75 times with a mean of 2.21 ± 6.04 times in the last 3 months. The recipients did not take their medications at most 90 times with a mean of 0.42 ± 5.26 times in the last 3 months since they felt bad due to side effects of the medications. The recipients did not take their medications at most 15 times with a mean of 0.08 ± 0.89 in the last 3 months due to external factors (Table 2).

Regarding the mean scores on the subscales of SF-36 Quality of Life Scale, the recipients had 84.76 ± 15.26 for physical functioning, 75.89 ± 41.04 for role-physical, 14.17 ± 23.08 for bodily pain, 48.6 ± 13.01 for perceived general health, 50.1 ± 14.73 for vitality, 39.3 ± 5.13 for social functioning, 71.08 ± 38.56 for role-mental, and 54.57 ± 10.99

Table 1. Sociodemographic and Clinical Characteristics of the Organ Transplant Recipients (n=310)	
Sociodemographic Characteristics	$\bar{X} \pm SD$ (min-max) n (%)
Age (years)	47.26 \pm 12.61 (18-75)
Gender	
Female	108 (34.8)
Male	202 (65.2)
Education	
Primary school	178 (57.4)
High school	71 (22.9)
University and a higher level of education	61 (19.7)
Marital status	
Married	239 (77.1)
Single	71 (22.9)
Health insurance	
Yes	307 (99.0)
No	3 (1.0)
Perceived financial status	
Income higher than expenses	6 (1.9)
Income equal to expenses	237 (76.5)
Income lower than expenses	67 (21.6)
Employment status	
Employed	65 (21.0)
Unemployed	245 (79.0)
Clinical characteristics	$\bar{X} \pm SD$ (min-max)
Time elapsing after transplantation (months)	84.54 \pm 60.19 (6-318)
The total number of medications used	5.69 \pm 2.25 (1-12) n (%)
Type of donors	
Live	175 (56.5)
Deceased	135 (43.5)
Type of organ transplantation	
Liver	115 (37.1)
Kidney	195 (62.9)
Causes of liver transplantation (n: 115)	
Acute liver failure	2 (1.7)
Chronic liver failure (alcoholism)	102 (88.7)
Metabolic diseases	5 (4.4)

(Continued)

Table 1. Sociodemographic and Clinical Characteristics of the Organ Transplant Recipients (n=310) (Continued)	
Sociodemographic Characteristics	$\bar{X} \pm SD$ (min-max)
Malignancy	3 (2.6)
Others	3 (2.6)
Causes of kidney transplantation (n=195)	
Diabetes nephropathy	11 (5.6)
Hypertension	39 (20.0)
Glomerulonephritis	26 (13.3)
Cystic renal disease	9 (4.6)
Urological diseases	12 (6.2)
Others	29 (14.9)
Idiopathic	69 (35.4)
Immunosuppressive medications used	
Cyclosporine (mono, dual, and triple)	77 (24.8)
Tacrolimus (mono, dual, and triple)	173 (55.8)
Everolimus-sirolimus (mono, dual, and triple)	30 (9.7)
Other combinations (mono, dual, and triple)	30 (9.7)
Receiving education about medication use	
Yes	187 (60.3)
No	123 (39.7)
The place of education (n: 187)	
General surgery clinic	169 (90.4)
General surgery outpatient clinic	12 (6.4)
Others	6 (3.2)
The person offering education (n=187)	
Doctor	63 (33.7)
Nurse	101 (54.0)
Doctor and nurse	23 (12.3)

SD, standard deviation.

for mental health. The mean physical component summary score was 41.38 \pm 5.21, and the mean mental component summary score was 39.52 \pm 6.70 (Table 3).

According to the results of the univariate logistic regression analysis, age, time elapsing after transplantation, the total number of the medications used, receiving education about medication use, and the mental component summary score were found to affect adherence to IST. An increase in age by 0.021 units created an increase in adherence by 1.021-fold ($P = .025$) (CI of 95%; 1.003-1.039). An increase in time elapsing after transplantation by 0.005 units caused a decrease in adherence by 0.995-fold ($P = 0.011$) (CI of 95%; 0.991-0.999). An

Table 2. The Distribution of ITAS Scores of the Organ Transplant Recipients (n=310)

Total	$\bar{X} \pm SD$ (min-max)
ITAS score	11.34 ± 0.81 (7-12)
How many times have you forgotten to take the medications preventing organ rejection in the last 3 months?	0.82 ± 2.91 (0-40)
How many times have you taken the medications preventing organ rejection in the wrong dose and at the wrong time in the last three months?	2.21 ± 6.04 (0-75)
How many times have you not taken the medications preventing organ rejection in the last three months since you felt bad due to their side effects?	0.42 ± 5.26 (0-90)
How many times have you not taken the medications preventing organ rejection for a reason not related to you in the last 3 months (medical report and chemist's etc.)?	0.08 ± 0.89 (0-15)

SD, standard deviation.

increase in the total number of the medications used by 0.165 produced a rise in adherence by 1.180-fold ($P=0.002$) [CI of 95%; 1.063-1.310]. An increase in receiving education about medication use by 0.580 resulted in a rise in adherence by 0.560-fold ($P=.013$) [CI of 95%; 0.353-0.887]. An increase in the mental component summary score by 0.047 led to a rise in adherence by 1.048-fold ($P=.008$) [CI of 95%; 1.012-1.085]. The other variables analyzed did not affect adherence to IST ($P > .05$) (Table 4).

Discussion

In the present study, ITAS score was found to be considerably high at a mean of 11.34 ± 0.81 out of 12. Consistent with this finding, in

Table 3. The Distribution of the Scores on SF-36 Quality of Life Scale and Its Subscales and Physical and Mental Components Summary Scores (n=310)

Subscales	$\bar{X} \pm SD$ (min-max)
Physical functioning	84.76 ± 15.26 (20-100)
Role-physical	75.89 ± 41.04 (0-100)
Bodily pain	14.17 ± 23.08 (0-100)
Perceived general health	48.6 ± 13.01 (10-95)
Vitality	50.1 ± 14.73 (10-100)
Social functioning	39.3 ± 5.13 (0-60)
Role-mental	71.08 ± 38.56 (0-100)
Mental health	54.57 ± 10.99 (16-88)
Physical component summary score	41.38 ± 5.21 (18.55-64.08)
Mental component summary score	39.52 ± 6.70 (17.9-59.13)

SD, standard deviation.

their studies about adherence of Turkish kidney transplant recipients, Ören and Dağ¹⁶ reported that the recipients received ITAS score of 11.49 (2020) and Karayurt et al¹⁵ also revealed (2015) that the recipients received ITAS score of 11.18. In studies from other countries, Promraj et al (2016)¹² showed that 82.6%, 16.3%, and 1.2% of the liver transplant recipients had ITAS scores of 12, 10-11, and 0-9, respectively, and Weng et al (2013)¹³ found that 59.1%, 26.6%, and 14.3% of the kidney transplant recipients had ITAS scores of 12, 10-11, and 0-9, respectively. In the present study, ITAS scores of 0-11 indicated non-adherence and ITAS score of 12 indicated adherence as described by Chisholm et al, who developed ITAS in their study in 2005. Therefore, 49% of the patients (n=152), who received ITAS scores of <12, were considered nonadherent to IST and 51% of the patients (n: 158), who received ITAS score of 12, were considered adherent to IST.

Studies on the effects of age on adherence to IST have yielded conflicting results. Consistent with the present study, several studies have shown that as age increased so did adherence to IST.^{16,17,19,22,30,31} However, other studies have revealed that age did not affect adherence to IST^{7,9,10,32} or even decreased adherence.^{25,33}

Young patients can be less adherent to IST since they experience difficulties due to activities in their occupational and social lives, think they will never become ill, do not care about their treatment, forget to take their medications with them when they go out, stay up and wake up late, take alcohol, and display aggressive behavior.³¹ However, it is stated that increased age leads to such diseases as dementia and Alzheimer's disease, which disrupt cognitive function and that older patients more frequently forget to take their medications. In addition, it has been reported that due to visual and hearing problems, memory loss, and additional diseases, older patients can have less adherence to IST.³²

Studies on the effects of gender on adherence to IST have provided different results. Some studies have shown that gender is not effective in adherence.^{12,17,30,32,34} While several studies have revealed that male patients are less adherent,^{6,7,16,18,19} 1 study has shown exactly the opposite.⁹ In the current study, age was shown to have no impact on adherence to IST, which is consistent with the results of some studies.^{12,17,30,32,34} In Turkish culture, responsibilities of men (breadwinner) and women (housework and motherhood) in the family might have affected adherence differently.

In some studies, patients with a low education level have been found to have lower adherence.^{15,18} Hedayati et al⁹ reported that a high education level was an important factor in enhancing adherence. However, Ören and Dağ¹⁶ found that university graduates had lower adherence. Congruent with the results of some studies,^{17,30,34} the present study revealed that education did not affect adherence to IST. This can be explained by the fact that both patients with a low education level and those with a high education level experienced the side effects of IST like infections, increased appetite, depression, and mood changes and believed that immunosuppressants can be harmful.

Studies examining the effect of marital status on adherence to IST have shown discrepant findings. Some studies have revealed that married patients have lower adherence.^{9,16,18} It is stated in the literature that lack of satisfaction with marriage and not taking familial responsibilities are the factors reducing adherence.¹⁸ However, Muduma et al

Table 4. Factors Affecting Immunosuppressive Therapy in the Organ Transplant Recipients (n=310)

	B*	SD**	P***	OR****	CI of 95%	
					Lower Bound	Upper Bound
Age (years)	0.021	0.009	.025	1.021	1.003	1.039
Gender	-0.054	0.239	.820	0.947	0.593	1.512
Education						
Primary school (reference)			.385			
High school	0.210	0.282	.457	1.234	0.709	2.146
University and a higher level of education	-0.275	0.298	.356	0.759	0.423	1.362
Marital status	-0.160	0.271	.554	0.852	0.501	1.448
Perceived financial status						
Income higher than expenses (reference)			.285			
Income equal to expenses	1.702	1.103	.123	5.487	0.631	47.677
Income lower than expenses	1.580	1.122	.159	4.853	0.538	43.789
Employment status	-0.322	0.280	.250	0.724	0.418	1.255
Time elapsing after transplantation (months)	-0.005	0.002	.011	0.995	0.991	0.999
The total number of medications used	0.165	0.053	.002	1.180	1.063	1.310
Type of donors	-0.042	0.229	.853	0.959	0.612	1.502
Type of organ transplantation	0.255	0.236	.278	1.291	0.814	2.049
Receiving education about medication use	0.580	0.235	.013	0.560	0.353	0.887
Physical component summary score	-0.043	0.023	.060	0.958	0.917	1.002
Mental component summary score	0.047	0.018	.008	1.048	1.012	1.085

*Regression coefficient, **Standard deviation, ***Significance level $P < .05$ ****Odds. SD, standard deviation.

(2016)³¹ reported that middle-aged patients receiving social support from their spouses had higher adherence to IST. One study by Germani et al²⁴ revealed that divorced and widowed patients had lower adherence. Several studies have demonstrated that marital status does not affect adherence to IST,^{7,17,30,34} which is compatible with the results of the present study. The lack of an effect of marital status on adherence to IST in this study can be explained by the fact that married patients have more responsibilities than single patients (parental and spousal roles) and that single patients lack spousal support.

It is reported in the literature that low-income patients have a tendency to miss some doses of their medications and have higher nonadherence to IST. This is ascribed with the healthcare systems of the countries and costs of the medications.¹³ Chisholm et al in their study in 2005 showed that the organ transplant recipients with high socioeconomic status had higher adherence to IST. However, Ören and Dağ¹⁶ revealed that the recipients with a high income had lower adherence. Moradi et al¹⁰ found out that income did not affect adherence. Similarly, Chisholm et al in their study in 2012 showed that income was ineffective in adherence. Consistent with the findings reported by Moradi et al¹⁰ and Chisholm et al, the present study revealed that income did not affect adherence. This can be attributed to the fact that organ transplant recipients are provided with immunosuppressive medications free of charge in our country.

In the present study, employment status had no impact on adherence to IST, which is compatible with the findings from several studies.^{17,30,34} However, Obi et al¹⁹ found out that the organ transplant recipients who were housewives or unemployed had higher adherence. Germani et al²⁴ noted that retired organ transplant recipients had low adherence to IST, and Chisholm et al and Ören and Dağ found in their studies that the recipients continuing to work after transplantation had low adherence.^{16,18}

While time elapsing after transplantation has been reported to have no effect on adherence to IST in some studies,^{17,32,34} longer time elapsing after transplantation has been shown to reduce it in other studies,^{1,9,12,19,22-24,30,35} which is consistent with the present study. Massey et al³⁰ (2013) reported that the rate of nonadherence was 17% six months after transplantation and 27% when the time elapsing after transplantation was over six months. Massey et al²³ (2015) found that the rate of adherence to IST was lower over 18 months after transplantation compared to that of 2 weeks and 6 months after transplantation. Hamedan and Aliha²² also mentioned that the rate of adherence to IST was high 1 year after transplantation but decreased 16-21 years after transplantation. Ören and Dağ (2020)¹⁶ reported low adherence rates 11 years and longer time after transplantation. The decrease in adherence rates with prolonged time after transplantation in the present study can be attributed to reluctance, weariness,

negligence, and carelessness resulting from long-term use of immunosuppressive medications.

It has been shown in the literature that high doses of drugs, short intervals between doses, and using other multiple medications in addition to IST cause low adherence rates.^{6,9,18,19} However, 1 study revealed that the patients taking fewer than 4 immunosuppressants had lower adherence, but those taking 7 or more immunosuppressants had high adherence,¹⁶ which is congruent with the current study. Taking a high number of drugs was found to create a favorable effect on adherence to IST in the current study. The patients taking multiple medications might have shown more care and interest about IST.

One study showed that the rate of adherence was higher among the patients undergoing organ transplantation from live donors.¹⁹ However, it has been noted in the literature that transplantation from a live donor creates risk for adherence and result in lower adherence compared to transplantation from a deceased donor.¹⁶ However, several studies have shown that the type of donors produces no effects on adherence to IST, which is compatible with the present study.

The results of the studies about the effect of the type of organ transplantation (liver–kidney) on adherence to IST have not been consistent.^{6,24,33} The present study showed that kidney transplant recipients and liver transplant recipients were similar in their adherence to IST, which is congruent with the findings published by Gorevski et al.³³ Lower adherence rates in liver transplant recipients have been explained by their higher rates of alcohol intake, smoking, and diabetes mellitus after transplantation compared to kidney transplant recipients. Lower adherence rates in kidney transplant recipients have been explained by their opportunity to survive through dialyses in case of organ rejections and depression due to prednisone use.^{6,24,33}

In the current study, the organ transplant recipients not receiving education about and not knowing the effects of immunosuppressants were less adherent to these medications, which is consistent with the results presented by Ören and Dağ.¹⁶ Promraj et al¹² also reported that education and counseling about IST enhanced adherence to this therapy. The reason for the high adherence rate in the recipients receiving education about IST in the present study can be explained by the fact that these recipients and their families were informed about how to use immunosuppressants, their side effects, and laboratory results, became aware of the importance of IST and became involved in the treatment process.

Regarding the role of the quality of life in adherence to IST, it has been noted in the literature that organ transplant recipients with a high quality of life have high adherence to IST while the recipients with a low quality of life and depression have low adherence.^{7,13,17,18,22,33} According to the results of a study by Ganjali et al (2019),⁷ the relation between the quality of life and adherence to IST was significant. They reported that the kidney transplant recipients with a high quality of life followed their therapy better. Gorevski et al (2013)³³ reported that physical functioning in the quality of life scale significantly affected adherence to IST and that every 1 point increase in the physical functioning score improved adherence by 4%. In the present study, the recipients having a high mental component summary score were found to have high adherence to IST. It may be that the recipients with good mental health used immunosuppressants regularly and carefully.

Limitations of the Study

The limitation of the study is that data were collected in 1 organ transplantation center.

Conclusion

The present study, directed toward examining the factors affecting adherence to IST after liver and kidney transplantations, showed that increased age, short time elapsing after transplantation, the increased number of the medications used, receiving education about IST, and the high mental component summary score had a positive effect on adherence to IST. Gender, education, marital status, financial status, employment status, type of donors, type of organ transplantation, and the physical component summary score were found to be ineffective. It can be recommended that nurses evaluate adherence to IST by using the valid and reliable scale ITAS, provide cognitive, behavioral, and emotional interventions likely to enhance adherence by taking account of the factors likely to cause nonadherence (age, time elapsing after transplantation, the total number of the medications used, receiving education, and the quality of life), and offer education and counseling services to the organ transplant recipients and their parents on the phone, through the Internet and at home visits after transplantation. In addition, qualitative studies should be conducted to perform an in-depth examination of the factors likely to be effective in adherence to IST.

Ethics Committee Approval: Ethics committee approval was received from the Noninterventional Clinical Research Ethics Committee of Dokuz Eylül University Faculty of Nursing (Approval date: 25.12.2014, protocol no: 2014/38-08).

Informed Consent: Written and verbal consent was obtained from the patients who would participate in the study.

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