Immunosuppressive medication adherence and affecting factors in solid organ transplantation patients: a mixed-methods study

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ABSTRACT

Objectives: Transplantation is a form of treatment that requires long-term pharmacotherapy. After transplantation, patients may have difficulty adapting to medication use for various reasons, and this may result in rejection. The aim of this study is to determine participants' medication compliance and the factors affecting it.
Methods: The research was conducted with a sequential explanatory mixed method. In the study, quantitative data were collected using the Turkish Immunosuppressive Medication Adherence Scale, and qualitative data were collected using the In-Depth Individual Interview Guide. Quantitative data were analyzed using statistical methods, and qualitative data were examined according to Braun and Clarke's thematic analysis framework.
Results: In this study, 62.3% of the participants were male, 37.0% were 50 years old and over, 71.3% lived with their spouse, 54.0% had primary and secondary school education, and 42.0% could not work due to their current health condition. From a clinical perspective, it was determined that 78% of the transplants were kidney transplants, and 41.3% were more than 4 years after transplantation. 74.3% of the transplants were from living donors. The mean score of the immunosuppressive medication compliance scale was determined to be 40.91±4.09. In the qualitative data analysis of the study, factors affecting medication adherence were examined and the themes of "individual factors", "complexity of the regimen" and "social support resources" were obtained. The sub-themes of the individual factors theme are reluctance, hopelessness and addiction; Sub-themes of the complexity of the regimen theme are drug side effects and polypharmacy; The sub-themes of the social support resources theme are loneliness and family pressure.
Conclusions: The factors influencing medication adherence among organ transplant recipients have been investigated, revealing that adherence levels vary significantly depending on various factors. These findings underscore the importance of tailored care strategies and individualized support approaches.
Keywords: Transplantation, medication adherence, nursing, mixed-methods study

*A*dvances in surgical technique and perioperative care have gradually improved the outcomes of solid organ transplantation [1]. However, despite advances in short-term outcomes, long-term graft loss remains a significant problem [2]. Graft rejection is one of the main causes of graft loss

after transplantation; Therefore, understanding the factors that influence graft rejection is important to promote graft survival [3]. Additionally, rejection and the resulting increased burden of immunosuppression increase hospitalization rates, health care costs, and the risk of death from cardiovascular disease and cancer [4].

Immunosuppressive medications are still considered a critical component in the post-transplant care of patients [5]. Immunosuppressive drugs are critical to improve survival and quality of life of post-transplant patients [6]. Regular use of immunosuppressants has a crucial role in minimizing graft loss and maximizing health outcomes in solid organ transplant recipients; However, drug regimens are complex and difficult [7]. One of the most important and often underestimated modifiable factors that strongly influences graft fate is drug nonadherence [8]. Incompatibility is one of the three main causes of post-transplant organ failure, along with organ rejection and infection [9]. Treatment compliance is defined by the World Health Organization (WHO) as "the extent to which the patient's behavior matches clinical prescriptions" [10]. The fact that solid organ transplant patients have to use many medications for many years may cause patients to have difficulties in adapting to medication use [11]. The prevalence of discordance in solid organ transplant recipients is estimated to be between 15% and 30% (5). Non-adherence of patients to medication tends to increase as time passes after transplantation [12].

Knowing the reasons for medication noncompliance is important to increase adherence to medication therapy. A qualitative study reported that participants were nonadherent due to unintentional reasons such as forgetfulness, interference with lifestyle, being asleep at the time the medication was supposed to be taken, change in routine, and the impact of side effects [13]. There are many direct and indirect methods to determine medication non-compliance. Direct methods; directly observed therapy, drug administration visibly supervised by healthcare professionals or caregivers, swallowable sensor system embedded in pills, wireless observed therapy, therapeutic drug monitoring in which differences between expected and observed drug blood levels are investigated, indirect methods; Tracking pill counts, electronic monitoring, and self-report surveys are recommended [4].

In this context, it is important to determine immunosuppressive medication adherence and affecting factors in patients undergoing solid organ transplantation and to develop and implement effective strategies to increase medication adherence of patients after transplantation. Therefore, this study aims to determine medication adherence rates and factors affecting adherence in solid organ transplant patients in Turkey. The results of this study may help improve the health and quality of life of post-transplant patients by contributing to the planning and implementation of nursing interventions to reduce nonadherence.

METHODS

Research Type
This research is an explanatory sequential mixed methods research in which quantitative and qualitative research methods are used together and sequentially to determine immunosuppressive medication adherence and affecting factors in patients undergoing solid organ transplantation. In the first stage of the research, quantitative data was collected. After the analysis of the quantitative data was completed, qualitative interviews were conducted with patients with low scale scores.

Research Place and Time
The research sample consisted of patients who applied to the Akdeniz University organ transplantation clinic between May and November 2022 and met the admission criteria.

Research Population and Sample
Since the number of patients who applied to the outpatient clinic and met the inclusion criteria for the study was not known, the number of samples was calculated as at least 289 for a precision rate of 0.05 and a prevalence of 25% (95% confidence interval) with the formula used for prevalence research when the population was unknown [14]. The sample group was selected by the purposeful sampling method. Patients who had solid organ transplantation at least two months ago and were using immunosuppressive drugs, who could self-administer their medications, who were literate, who were 18 years of age or older, who had no communication problems, and who agreed to participate in the study were included in the study [11].

In the quantitative dimension of the research, the sample consisted of 300 patients and qualitative interviews were conducted with 11 of these patients with low *Turkish Immunosuppressive Medication Adherence Scale* scores. Although it is stated that qualitative research requires five to 25 participants [15] and a small sample group is generally selected [16], it is also stated that terminating the sample is a criterion when the data begins to repeat, in other words, when the data reaches saturation [17]. In this research, transcripts were made day by day and data saturation was checked. Since the research data began to repeat, the data collection process was stopped after the 11th patient.

In this study, the consolidated criteria for reporting qualitative research (COREQ) guidelines were followed.

Data Collection Method

Quantitative data of the study were collected using the Introductory Information Form and *Turkish Immunosuppressive Medication Adherence Scale (TIMAS),* and qualitative data were collected using the In-Depth Individual Interview Guide. Participants who applied to the Akdeniz University organ transplant clinic, met the inclusion criteria, and agreed to participate were informed about the study and gave their written consent. Participants were given the scales and instructed to complete them completely. They were also informed that they would be contacted for an individual interview and their contact information was collected. Due to the nature of the explanatory sequential mixed methods research, quantitative data were collected and analyzed first. Participants with the lowest TIMAS scores were then contacted and invited for qualitative interviews. Individual face-to-face interviews were conducted in a private room in the clinic at a time and date selected by the participants. All in-depth interviews were conducted by the same female researcher (PhD) and lasted between 20 and 40 minutes. With the patients' consent, both recording and note-taking techniques were used during the interviews.

Data Collection Tools
Introductory Information Form
This form was prepared by the researchers and consists of a total of 14 questions about organ transplantation, as well as demographic data such as the participants' age, gender, and education level.

Turkish Immunosuppressive Medication Adherence Scale
This scale, developed by Özdemir, Talas and Öztuna in 2015, consists of a total of 11 items and a single dimension. 5-point and 2-point Likert type rating is used in the scale scoring. 8 items in the scale require "never, rarely, sometimes, often, always" answers, and 3 items require "yes-no" answers. The scale includes 2 positive (4, 6) and 9 negative (1, 2, 3, 5, 7, 8, 9, 10, 11) attitude expressions. A 5-point Likert-type rating is used for positive items, from 1 to 5, and for negative items, from 5 to 1. The lowest score from the scale is 11 and the highest score is 55. The sum of the scores of each item in the scale constitutes the total score of the scale. It is interpreted that as the total score from the scale increases, adherence with medication use increases. The Cronbach alpha coefficient of the scale was calculated as 0.611 [11]. In this study, cronbach's alpha was found to be 0.60.

In-Depth Individual Interview Guide
The interview guide, developed by the researchers, consists of four questions designed to explore how participants define medication non-adherence and their perspectives on the factors influencing it.

Ethical Consideration
Ethics committee approvals were obtained from the Akdeniz University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee (decision no: 530 and date: 25.07.2018) and permission was obtained from the hospital where the research would be conducted. Written informed consent was also obtained from the participants of the study. The Declaration of Helsinki was adhered to throughout.

Statistical Analysis
When assessing immunosuppressant medication adherence and other quantitative data in this study, we used IBM SPSS Statistics (IBM Corp., Armonk, NY, USA) version 28.0 for comprehensive data analysis. It facilitated the thorough examination of both categorical and continuous variables pertinent to our research objectives. Categorical variables such as

gender, marital status, employment status, and type of organ transplanted were summarized using frequency distributions. Continuous variables, including adherence scores, were described using means and standard deviations, providing a quantitative measure of central tendency and variability. The normality of the variables was assessed using the Kolmogorov-Smirnov test and Q-Q plots. To explore relationships and differences within the data, we conducted non-parametric tests, such as Mann-Whitney U and Kruskal-Wallis tests, as appropriate. These analyses were particularly useful in assessing variations across different demographic groups, organ types, and other variables. We ensured the reliability of the TIMAS, by calculating Cronbach's alpha, which provided a measure of internal consistency. A P-value of less than .05 was considered statistically significant in our analyses, aligning with standard practices in research.

Braun and Clark's thematic analysis steps were used to analyze qualitative data. The researchers have received qualitative research training and have qualitative research experience. The audio recordings were transcribed verbatim by the researchers the same day, and participants were asked to check them when available [18].

RESULTS

Quantitative Findings
In this study, 62.3% of the participants were male, 37.0% were 50 years old and over, 71.3% lived with their spouse, 54.0% had primary and secondary school education, and 42.0% could not work due to their current health condition (Table 1).

From a clinical perspective, it was determined that 78% of the transplants were kidney transplants, and 41.3% were more than 4 years after transplantation. 74.3% of the transplants were from living donors, 24.3% from cadavers, and a small portion (1.3%) was from cross-transplantation. When the relationship with the donor was examined, 12.3% was from mothers, 9.0% was from fathers, 15.7% was from siblings, 18.7% was from other relatives, and 20.0% was from unrelated donors (Table 1).

Participants' satisfaction with the surgery outcomes was overwhelmingly positive, with 88.7% reporting being very satisfied. Only a small percentage

expressed moderate satisfaction (8.3%) or indecision (2.0%). Regarding post-transplant hospitalizations, 65% of the participants' had been hospitalized post-transplant, while 35% had not. Finally, the majority (97%) reported no difficulties with medication use, whereas a small portion (3%) faced challenges (Table 1).

Table 2 showcased the TIMAS distribution and scoring, shedding light on adherence patterns among this participant group. The descriptive statistics for the adherence to the immunosuppressive medication regimen revealed significant insights into the participants' adherence behaviours. The results indicated a generally high level of adherence, with some areas of concern that merit attention, as provided in the below:

A majority of the participants' reported a high level of adherence to their immunosuppressive medication regimen. The mean score for forgetting to take medication (S1) was 4.53±0.69, indicating that most participants' rarely forget to take their medication. Similarly, the mean score for stopping medication without consulting a doctor (S2) was 4.95±0.32, suggesting that participants' overwhelmingly adhere to their prescribed regimen (Table 2).

The influence of daily activities like school or work (S3) on medication adherence had a mean score of 4.74±0.53, reflecting that participants' generally do not miss their medication due to these activities. However, a lower mean score of 3.62±1.79 was observed for taking forgotten medication within 2-3 hours (S4), suggesting some delays in medication intake upon remembering (Table 2).

Participants' indicated a high level of vigilance in obtaining new supplies (S5) with a mean score of 4.66±1.04. Adjusting medication times according to meal times (S6) had a mean score of 3.98±1.63, implying moderate adherence to timing adjustments (Table 2).

The burden of taking multiple medications (S8) and the challenge posed by daily usage (S7) were rated highly, with mean scores of 4.93±0.31 and 4.90±0.40, respectively. This indicates that most participants' do not find the number of medications or daily usage challenging (Table 2).

In contrast, the responses to questions regarding the past two weeks' adherence patterns (S9, S10, and S11) reflected lower adherence. Participants' reported lower adherence to prescribed doses (1.28±1.02), skipping doses (1.36±1.14), and taking medication outside

Table 1. Overview of organ transplant patients' demographics, clinical profiles, and post-transplant outcomes

Variables		Median (Q1-Q3; min-max); Frequency (Percentage)
Gender	Female	113 (37.7%)
	Male	187 (62.3%)
Age range	18 – 35 years	94 (31.3%)
	36 – 49 years	95 (31.7%)
	50 years and above	111 (37.0%)
Age in years[*]		43.5 (32-55; 18-76)
Living arrangement	With spouse	214 (71.3%)
	Alone	86 (28.7%)
Education level	Illiterate	17 (5.7%)
	Primary & middle school	162 (54.0%)
	High school	78 (26.0%)
	University degree	43 (14.3%)
Employment status	Employed	74 (24.7%)
	Retired	100 (33.3%)
	Unable to work due to illness	126 (42.0%)
Transplanted organ	Kidney	234 (78%)
	Liver	66 (22.0%)
Post–diagnosis treatments	Medication therapy	189 (28.8%)
	Haemodialysis	151 (23.0%)
	Peritoneal dialysis	30 (4.57%)
	Underwent transplantation	283 (43.1%)
	Others	3 (0.5%)
Time since transplant	Less than 6 months	61 (20.3)
	7 – 12 months	40 (13.3%)
	13 month – 2 years	31 (10.3%)
	2 – 4 years	44 (14.7%)
	Over 4 years	124 (41.3%)
Donor type	Living donor	223 (74.3%)
	Cadaver	73 (24.3%)
	Cross–transplantation	4 (1.3%)
Donor relationship	Cadaver	73 (24.3%)
	Mother	37 (12.3%)
	Father	27 (9.0%)
	Sibling	47 (15.7%)
	Relative	56 (18.7%)
	Others	60 (20.0%)
Satisfaction with surgery outcome	Very satisfied	266 (88.7%)
	Moderately satisfied	25 (8.3%)
	Undecided	6 (2.0%)
	Not very satisfied	3 (1.0%)
Hospitalization post–transplant	No	105 (35.0%)
	Yes	195 (65.0%)
Difficulties with medication use	No	291 (97 %)
	Yes	9 (3%)

Median (Q1–Q3; min.-max.): The median represents the middle value of the dataset, while the interquartile range, delineated by the first quartile (Q1, 25th percentile) and the third quartile (Q3, 75th percentile), captures the middle 50% of the data, indicating its central spread. 'Minimum' denotes the smallest value recorded within the dataset, whereas 'Maximum' refers to the largest value observed

the usual time (1.96±1.71) (Table 2).

The findings suggest that while participants' generally show a high level of adherence to their immunosuppressive medication, with an overall mean score of 40.91±4.09, there are specific areas, particularly related to timely intake and adherence in the immediate past, where improvement is needed. These insights can inform targeted interventions to enhance medication adherence among organ transplant patients (Table 2).

Furthermore, the detailed examination of TIMAS scores across varied demographic and clinical parameters, as provided in Table 3, reveals key insights into medication adherence behaviours among organ transplant recipients. This comparative analysis, covering 300 participants, showcases the influence of factors such as gender, type of transplanted organ, donor char-

acteristics, and the duration since the transplantation on adherence levels. Our findings suggest that while adherence rates did not significantly differ between genders (with females displaying a mean score of 40.49 and males a slightly higher mean of 41.18, P=0.207), the type of transplanted organ did show variation in adherence, albeit not statistically significant (kidney transplant recipients had a mean score of 40.97 versus liver recipients with a mean of 40.74, P=0.530). This suggests that while there are observable differences in adherence behaviours among these groups, they do not reach a level of statistical significance (Table 3).

Notably, the analysis indicates a nuanced effect of donor type on adherence. Participants receiving organs from living donors, cadaver donors, and cross-trans-

Table 2. Descriptive statistics for adherence to immunosuppressive medication regimen and key adherence-related behaviours among patients (n=300).

Statements	Mean±SD
S1: Do you ever forget to take your immunosuppressive medication?	4.53±0.69
S2: Have you stopped taking your immunosuppressive medication without consulting your doctor when you feel well?	4.95±0.32
S3: Do daily activities (such as school or work) cause you to miss or delay the timing of your immunosuppressive medication?	4.74±0.53
S4: If you forget to take your immunosuppressive medication, do you take it as soon as you remember within 2-3 hours?	3.62±1.79
S5: Do you delay obtaining a new supply when your immunosuppressive medications run out?	4.66±1.04
S6: Do you adjust the times you take your immunosuppressive medication according to your meal times?	3.98±1.63
S7: Does the daily use of immunosuppressive medication pose a challenge for you, leading to missed doses?	4.90±0.40
S8: Does the burden of taking multiple immunosuppressive medications lead to missed doses?	4.93±0.31
S9: In the past two weeks, have you taken less than the prescribed dose of your immunosuppressive medication?	1.28±1.02
S10: In the past two weeks, have you missed or skipped doses of your immunosuppressive medication?	1.36±1.14
S11: In the past two weeks, have you taken your immunosuppressive medication a few hours earlier or later than the usual time?	1.96±1.71

This scale comprises 8 items using a 5-point Likert scale (ranging from "Never" to "Always") and 3 items requiring a binary "Yes-No" response. The scale includes 2 positively worded statements (S4 and S6) and 9 negatively worded statements (S1, S2, S3, S5, S7, S8, S9, S10, S11). For positively worded items, scoring is direct with 1 indicating the lowest level of agreement/adherence and 5 the highest. For negatively worded items, scoring is reversed with 5 indicating the lowest level and 1 the highest. For binary items (S9, S10 and S11), the "Yes" response is scored as 1 and "No" as 5. SD=standard deviation

plantation scenarios had mean adherence scores of 41.07, 40.32, and 43.50, respectively, with a near-significant P-value of 0.092, hinting at a potential trend worth further exploration. Furthermore, the adherence varied across donor relationships, showcasing a range of mean scores from 40.34 (cadaver donors) to 42.82 (father), although this variation did not achieve statistical significance (P=0.193). This diversity in adher-

Table 3. Comparative analysis of immunosuppressive drug adherence across different study groups (n=300)

Variables	Study groups		Median (Q1-Q3)	Mean±SD
Gender	Female (n=113)		41.0 (38.5-43.5)	40.49±3.78
	Male (n=187)		42.0 (39.5-44.5)	41.18±4.27
		Test	Z=-1.263	
		P value	0.207	
Transplanted organ	Kidney (n=234)		42.0 (39.5-44.5)	40.97±4.12
	Liver (n=66)		40.5 (38.0-43.0)	40.74±4.02
		Test	Z=-0.628	
		P value	0.530	
Donor type	Living donor (n=223)		42.0 (39.5-44.5)	41.07±4.18
	Cadaver (n=73)		40.0 (37.5-42.5)	40.32±3.74
	Cross-transplantation (n=4)		43.5 (39.25-47.75)	43.50±4.51
		Test	x^2=4.763	
		P value	**0.092**[*]	
Donor relationship	Cadaver (n=73)		40.0 (37.5-42.5)	40.34±3.74
	Mother (n=37)		42.0 (39.8-44.25)	41.08±3.85
	Father (n=27)		43.0 (38.5-47.5)	42.82±5.02
	Sibling (n=47)		41.0 (38.0-44.0)	41.11±3.63
	Relative (n=56)		42.0 (39.5-42.5)	40.73±4.32
	Others (n=60)		42.0 (39.5-42.5)	40.68±4.22
		Test	x^2=7.387	
		P value	0.193	
Time since transplant	Less than 6 months (n=61)		40.0 (37.5-42.5)	40.61±3.94
	7-12 months (n=41)		43.0 (39.2-46.8)	42.13±4.58
	13 month-2 years (n=31)		42.0 (39.0-45.0)	40.77±4.47
	2-4 years (n=44)		42.0 (39.2-44.8)	41.36±3.57
	Over 4 years (n=124)		41.0 (38.5-43.5)	40.55±4.06
		Test	x^2=4.308	
		P value	0.230	

Median (Q1-Q3)=The middle value (median) of the dataset and the range between the first quartile (Q1, 25th percentile) and the third quartile (Q3, 75th percentile), representing the central 50% of the data. Mean±SD=The average value (mean) of the data plus or minus the standard deviation (SD), which describes the spread of the data around the mean. The symbols *(P<0.05) denoted levels of statistical significance for differences or correlations, indicating the likelihood that the observed differences or relationships occurred by chance.

ence rates underscores the complexity of interpersonal relationships and their potential impact on medication adherence (Table 3).

The time elapsed since the transplant also played a role in adherence behaviours, with scores ranging from 40.55 (over 4 years post-transplant) to 42.13 (7-12 months post-transplant), though these differences were not statistically significant (P=0.230). This suggests that the time factor might influence adherence patterns, warranting further investigation to understand its implications fully (Table 3).

In summary, the analysis of the TIMAS scale underscores that while certain factors like gender, organ type, donor characteristics, and post-transplant duration offer insights into adherence behaviours, the statistical significance of these observations varies. These findings emphasize the need for personalized intervention strategies targeting specific demographic and clinical characteristics to enhance medication adherence and ultimately improve outcomes for organ transplant recipients.

Qualitative Findings

In the qualitative data analysis of the study, factors affecting medication adherence were examined and the themes of "individual factors", "complexity of the regimen" and "social support resources" were obtained. Under the theme of individual factors, patients expressed their reluctance, hopelessness and feelings of addiction towards drug use (Table 4).

In the participants' statements, it was determined that they were reluctant to use medication because they were tired of using medication, they were afraid of developing rejection due to repeated hospitalizations and medication side effects, and that they thought rejection would occur one day, and that they thought they were dependent because they were constantly in need of the hospital or someone else. In the theme of regimen complexity, participants reported that medication side effects and polypharmacy negatively affected adherence to medication use. In the theme of social support sources, participants stated that reasons such as loneliness and family pressure negatively affected their adherence to treatment (Table 4).

Tablo 4. Reasons for participants' non-adherence to medication use (n=11)

Main Theme	Sub-theme	Quotations
Individual factors	Reluctance	People get bored sometimes. You have been on dialysis for years, now medication, medication, medication. Sometimes I don't feel like doing anything (P*11).
	Hopelessness	I am in the hospital every month. No matter what I do, there is no peace for me. I'm fed up. What else can I do? (P4)
	Addiction	It's like you can't live your life, you always have to be in control. You're lucky, but sometimes you feel like rebelling (P5).
Complexity of the regimen	Drug side effects	Medications cause insomnia, you feel nauseous, you become disorganized. Sometimes people can't do everything they need to do. (P9).
	Polypharmacy	There are so many drugs. Even though I set a reminder, sometimes I still forget or get confused (P1).
Social support resources	Loneliness	My wife died. What should I ask from whom? That's what I do. My daughter says come to us, but I can't fit in with anyone, I can't take shelter in them (P10).
	Family pressure	Everyone is telling you something. It's like everyone knows better than you. I am tired. I feel like getting angry at them and not taking the medicine secretly. It's like they're constantly watching you. If you make a mistake they get mad at you like a child (P2).

The identities of the participants are stated as P1-11 for anonymity.

DISCUSSION

The descriptive analysis of the TIMAS reveals a generally high adherence level among organ transplant patients, with an overall mean score of 40.91±4.09. Key findings indicate strong adherence to medication schedules, with participants' rarely forgetting to take their medication or stopping it without consulting a doctor. Daily activities like work or school minimally impact medication adherence, underscoring a commitment to their regimen. However, the study highlights areas for improvement, notably in managing the timely intake of missed doses and handling multiple medications. The most significant concerns arise from the lower adherence observed in the past two weeks, particularly in maintaining prescribed doses and adhering to the medication schedule. In a study, the average TIMAS score of the participants was found to be 48.10±6.61 [19]. In another study, a statistically significant negative relationship was reported between TIMAS scores and time after transplantation, according to the results of Pearson correlation analysis. It was found that as the time passed after transplantation increased, the TIMAS scores of the participants decreased [19]. These findings underscore the need for targeted interventions to bolster adherence, especially in addressing short-term lapses. Enhancing patient education and support, particularly in managing complex medication schedules, could significantly improve treatment outcomes for organ transplant recipients. The literature reports that the prevalence of incompatibility in solid organ transplant recipients is between 15% and 30% [5]. A study reported that 16.47% of patients were non-compliant with treatment [20]. There are a limited number of studies reporting the non-compliance rate with immunosuppressive drug use in transplanted patients in Turkey [19]. In our study, it appears that the compliance rate with immunosuppressive drug therapy is low compared to other results [11, 19].

Furthermore, the findings from our analysis of the TIMAS offer valuable insights into the nuanced landscape of medication adherence among organ transplant recipients, as detailed in Table 3. The lack of statistically significant differences in adherence related to gender and the type of transplanted organ suggests that while these factors are important to consider, they may not be the primary determinants of adherence behaviour. However, the observed trends in adherence variations associated with donor type and the time since transplantation, despite not reaching statistical significance, highlight potential areas for targeted interventions. Particularly, the near-significant difference in adherence scores among recipients of organs from living donors, cadaver donors, and through cross-transplantation suggests that the source of the organ might influence participants' adherence to their immunosuppressive medication regimen. Additionally, the variation in adherence across different donor relationships and time intervals since transplantation underscores the complexity of factors influencing adherence. These findings point towards the importance of developing personalized, context-sensitive intervention strategies that address the specific needs and circumstances of individual participants'. Although existing literature has cited interventions such as support tools (e.g., reminder systems), monitoring strategies, and continuing education to improve adherence, studies have largely fallen short of providing conclusive evidence of their effectiveness [21]. By focusing on the multifaceted nature of medication adherence, healthcare providers can better support organ transplant recipients in achieving optimal outcomes through improved adherence to their prescribed medication regimens.

It has been reported that compliance can be affected by a wide variety of factors, both personal and environmental, and that the characteristics of the disease or regimen can also affect adherence [22]. In the qualitative data analysis of the research, the themes of individual factors, complexity of the regime and social support sources were obtained. Under the theme of individual factors, patients expressed their reluctance to use medication, their hopelessness, and their feelings of dependence on medication. Research suggests that having strong beliefs that a medication is needed does not necessarily lead to adherence to treatment unless combined with low concerns about taking the medication [23].

In the theme of Regimen Complexity, participants reported that medication side effects and polypharmacy negatively affected adherence to medication use. Having a disease that requires regular use of more than one medication is an important factor that makes medication compliance difficult for individuals [24]. Similarly, other studies have reported that polypharmacy negatively affects medication adherence [25, 26].

Regarding the theme of social support sources, participants stated that reasons such as loneliness and family pressure negatively affected their adherence to treatment. There is evidence that social support is associated with increased likelihood of engagement, particularly regarding the quality of support rather than the presence of other people [22]. One study reported that determinants of post-transplant medication adherence were medication-related factors such as inappropriate dosing, insufficient medication knowledge difficulty in remembering medication dosage and timing, and economic constraints in continuing medical treatment [20].

Limitations

This study reflects single center findings. Qualitative findings cannot be generalized due to their nature. Furthermore, just one of the researchers conducted the face-to-face interviews, which could have resulted in an unexpected social bias.

CONCLUSION

This study's detailed examination of the TIMAS offers crucial insights into the medication adherence behaviours of post-solid organ transplant patients. Contrary to initial expectations, the results suggest that adherence levels, while generally high, exhibit significant variability influenced by factors such as gender, type of transplanted organ, donor characteristics, and the duration since the transplant. This variability highlights the intricate dynamics of medication adherence within the post-transplant environment, stressing the need for customized care strategies. The study particularly illuminates the nuanced challenges that transplant recipients face, including the management of complex medication regimens and the adaptation of their daily routines to accommodate these schedules. Noteworthy are the observed adherence disparities across different demographic and clinical subgroups, pinpointing the necessity for individualized education and support strategies. These are especially critical for those newly post-transplant or those facing unique personal challenges.

In light of these findings, there is a clear directive for the development of targeted interventions and enhanced support mechanisms aimed at improving medication adherence for organ transplant recipients. Healthcare professionals are provided with a foundation to refine patient counselling approaches, tackle specific adherence obstacles, and ultimately, uplift the quality of life and clinical outcomes for this patient group. Future investigations should seek to overcome the current study's limitations by broadening the participant base and employing varied methodological designs. Such efforts are crucial to deepen our comprehension of adherence behaviours and to fine-tune intervention strategies for this essential patient demographic, ensuring they receive the most effective and personalized care possible.

In addition to the results of this study, methods such as reducing pill burden, educational-behavioral intervention, medication reminder intervention, and remote monitoring are among the ways to increase medication compliance in the literature. Because medication nonadherence after solid organ transplantation arises from a diverse set of partly dynamic causes and is predominantly unintentional, simple or general solutions are not available and therapeutic interventions require a persistent, holistic, individualized patient approach and a multidisciplinary support team.

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