Patient Preference and Adherence

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ORIGINAL RESEARCH

Evolving Medication Adherence in the Early Post-Kidney Transplant Period: Recipients' Lived Experiences from a Single-Center Qualitative Study in Taiwan

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Background: Medication non-adherence remains a common challenge among kidney transplantation recipients and is associated with graft dysfunction and loss. Although numerous interventions have been proposed, medication-taking is increasingly recognized as a dynamic process shaped by patients' daily experiences and changing perceptions after transplantation. This study explored how kidney transplant recipients experience and manage immunosuppressive medication adherence over time and identified factors that influence adherence behaviors during recovery.

Methods: This qualitative study used a phenomenology-informed thematic analysis to explore kidney transplant recipients' lived experiences of immunosuppressive medication adherence. Semi-structured face-to-face interviews were conducted with kidney transplant recipients at a medical center in Taiwan between March and July 2022. A dual-sampling strategy recruited participants in the early post-transplant period and recipients more than one-year post-transplant who had experienced adherence challenges. Participants were followed longitudinally beginning shortly after hospital discharge. Contextual information from a mobile communication application used for clinical follow-up was incorporated to support interpretation of adherence-related experiences. Interviews were audio-recorded, transcribed verbatim, and analyzed using data-driven thematic analysis with NVivo software. Reflexive and collaborative coding processes were applied to enhance analytical rigor.

Results: Twelve kidney transplant recipients participated in the study. Six themes described the evolving nature of medication adherence. Improved well-being after transplantation reinforced motivation to adhere, as recipients linked medication-taking with maintaining restored health and independence. However, persistent but mild side effects sometimes created uncertainty about treatment. Over time, vigilance toward medication-taking declined as perceived risk of graft rejection decreased. Daily routines and personal beliefs about medications also shaped adherence behaviors. Mobile-based consultation with healthcare professionals provided timely guidance and reassurance.

Conclusion: Medication adherence after kidney transplantation is dynamic and influenced by perceptions of health improvement, treatment burden, and evolving beliefs about medication necessity. Phase-specific and patient-centered strategies, including tailored education and accessible consultation support, may help sustain long-term adherence and optimize graft outcomes.

Keywords: adherence, kidney, pharmaceutical care, qualitative, time-evolving, transplantation

Introduction

Dialysis and kidney transplantation are life-sustaining treatments for more than 4.5 million individuals worldwide.[1] In Taiwan, more than 90,000 individuals receive dialysis, corresponding to a prevalence of approximately 3,800 per million population, the highest reported worldwide.[2] Registry-based studies report a 5-year survival rate of approximately

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56–60%,[3] with around one-third of patients surviving beyond 10 years after dialysis initiation.[4] Kidney transplantation therefore represents an important strategy for improving long-term survival and quality of life among individuals with end-stage kidney disease. Data from the Taiwan Organ Registry and Sharing Center show favorable kidney transplant outcomes, with 94% recipient survival at 1–3 years and about 80% graft survival at 10 years.[5] These outcomes highlight the clinical success of transplantation and emphasize the importance of maintaining long-term graft function and patient well-being after transplantation.

Sustaining graft survival requires kidney transplant recipients to adhere to lifelong immunosuppressive therapy. However, medication non-adherence remains a persistent concern in this population. Previous studies have reported that approximately 38%-55% of kidney transplant recipients demonstrate suboptimal adherence, with missed doses being the most commonly reported form of non-adherence.[6] Poor adherence to immunosuppressive therapy is associated with increased risks of graft dysfunction, rejection, and graft loss.[7] Importantly, unlike other forms of organ transplantation, loss of kidney graft function is not immediately life-threatening because patients can return to dialysis as an alternative treatment option.[6,8] This possibility may influence patients' perceptions of treatment necessity and the urgency of strict medication adherence.[9]

Adhering to lifelong immunosuppressive therapy can be challenging, particularly as patients transition from intensive post-transplant care back to everyday life. Previous research has identified multiple barriers to adherence among kidney transplant recipients, including personal and behavioral factors (eg., attitudes toward medication, forgetfulness, and self-management capacity), treatment-related characteristics, and broader social or healthcare system influences.[10–12] These findings suggest that medication adherence is not solely determined by individual motivation but is shaped by complex interactions among patients' beliefs, daily routines, and healthcare environments.

Various strategies have been developed to support medication adherence in transplant populations. These include behavioral tools such as date-labeled pillboxes and medication event monitoring systems,[7,13] as well as models of continuity of care that strengthen relationships between patients and healthcare professionals.[14] Intensive pharmaceutical care has also shown promise in improving treatment engagement, particularly among patients in the early period after transplantation.[15] Despite these efforts, the benefits of many adherence interventions tend to diminish over time.[16]

One reason for this limitation may lie in how medication adherence is commonly measured. Indicators such as knowledge test scores, immunosuppressant drug levels, and prescription refill records can provide useful information about short-term adherence, but they offer limited insight into how patients sustain medication-taking behaviors over the long term. Increasingly, medication adherence is recognized as a dynamic process shaped by demographic, psychosocial, and clinical factors, as well as by how patients incorporate treatment regimens into their everyday lives.[14,17]

From a patient-centered perspective, McCoy has suggested that adherence interventions should move beyond simply correcting non-adherent behaviors and instead support patients in integrating medication-taking into their daily self-management practices.[18] This perspective highlights the temporal dimension of adherence and emphasizes that medication-taking behaviors evolve as patients adjust to life after transplantation.[19] Although prior studies acknowledge that adherence may change over time, relatively few investigations have explored these temporal transitions from the lived experiences of transplant recipients.[20]

Medication adherence develops within the context of daily life and personal adaptation after transplantation and therefore cannot be fully understood through short-term clinical indicators alone.[21] Qualitative inquiry can provide valuable insights into how recipients interpret medication-taking, negotiate challenges, and gradually incorporate immunosuppressive therapy into their everyday routines.[22] A phenomenology-informed approach is particularly suited to exploring these lived experiences and capturing how adherence behaviors evolve over time.[23] Therefore, the present study aimed to explore the lived experiences of kidney transplant recipients during the early post-transplant period, with a focus on how they understand, experience, and manage medication adherence in daily life. By investigating how recipients adapt to lifelong immunosuppressive therapy over time, this study sought to provide deeper insights into the evolving nature of adherence and to inform the development of more patient-centered and sustainable strategies to support long-term medication use after kidney transplantation.

Materials and Methods

Study Design

This study used a qualitative design using thematic analysis informed by phenomenology to explore how kidney transplant recipients experience and manage medication adherence after transplantation. A phenomenology-informed approach was selected to capture how individuals interpret and integrate medication-taking into their everyday lives, focusing on the meanings they attribute to pharmacological treatment and adherence behaviors.[23] Semi-structured interviews were conducted to facilitate open-ended discussions about participants' experiences with medication management, including their perceptions, challenges, and strategies for maintaining adherence. An interview guide was developed to ensure coverage of key topics while allowing participants to describe their experiences in their own words.

To capture the evolving nature of adherence during the early recovery period, recipients in the early post-transplant phase were followed longitudinally beginning shortly after hospital discharge. A mobile application (app) was used to support communication and follow-up between clinic visits. Messages exchanged through the app were not analyzed as primary qualitative data; rather, they were used to summarize medication-related consultation topics and provide contextual understanding that informed subsequent interviews.

A dual-sampling strategy was adopted to provide complementary perspectives on medication adherence. Early post-transplant recipients were included to explore how adherence behaviors developed during the initial adjustment period after transplantation. In addition, later-stage recipients (beyond one-year post-transplant) who had documented adherence concerns were purposively included as negative cases to provide insight into challenges and potential breakdowns in adherence. The intention was not to compare groups statistically but to enrich understanding of adherence trajectories across different stages of the transplant experience.

Data Source and Collection

Participants were recruited using purposive sampling from a tertiary medical center in Taiwan. Eligible participants were adult kidney transplant recipients aged 20 years or older who were able to communicate in Mandarin or Taiwanese. Potential participants were identified through referrals from transplant surgeons and approached before transplantation to assess their willingness to participate in the study. Those who agreed were enrolled and subsequently interviewed after transplantation.

Two sampling pathways were implemented (Figure 1). In the early post-transplant group, recipients were recruited shortly after transplantation to explore how medication adherence developed over time. These participants were followed for up to six months after hospital discharge and interviewed repeatedly during routine outpatient visits. Each participant completed between four and eight interviews, depending on follow-up duration. In the later-stage non-adherence group, recipients who were more than one-year post-transplant were identified by clinicians based on documented adherence concerns. Inclusion criteria for this group included at least one of the following indicators: missing two or more scheduled clinic appointments, unstable immunosuppressant levels despite dose adjustments, clinician-identified adherence concerns, or hospitalization related to suspected graft rejection. Participants in this group completed a single in-depth interview lasting approximately 20–60 minutes.

Recruitment continued until thematic saturation was achieved, defined as the point at which no substantively new themes emerged from the data.[24] A total of 12 participants were included in the study, including eight participants in the early post-transplant group and four participants in the later-stage non-adherence group. Among the early post-transplant participants, one completed three months of follow-up due to scheduling constraints and two completed partial follow-up due to COVID-19-related disruptions.

All interviews were conducted in private consultation rooms at the outpatient clinic of National Taiwan University Hospital between March and July 2022. Interviews were audio-recorded with participants' permission and transcribed verbatim. Field notes documenting contextual observations and preliminary reflections were recorded after each interview and used to support interpretation during analysis. Interview transcripts served as the primary data source for the thematic analysis. App-based communications were not analyzed as primary qualitative data. Instead, they were used to facilitate follow-up discussions and to descriptively summarize medication-related consultation topics that emerged between interviews.

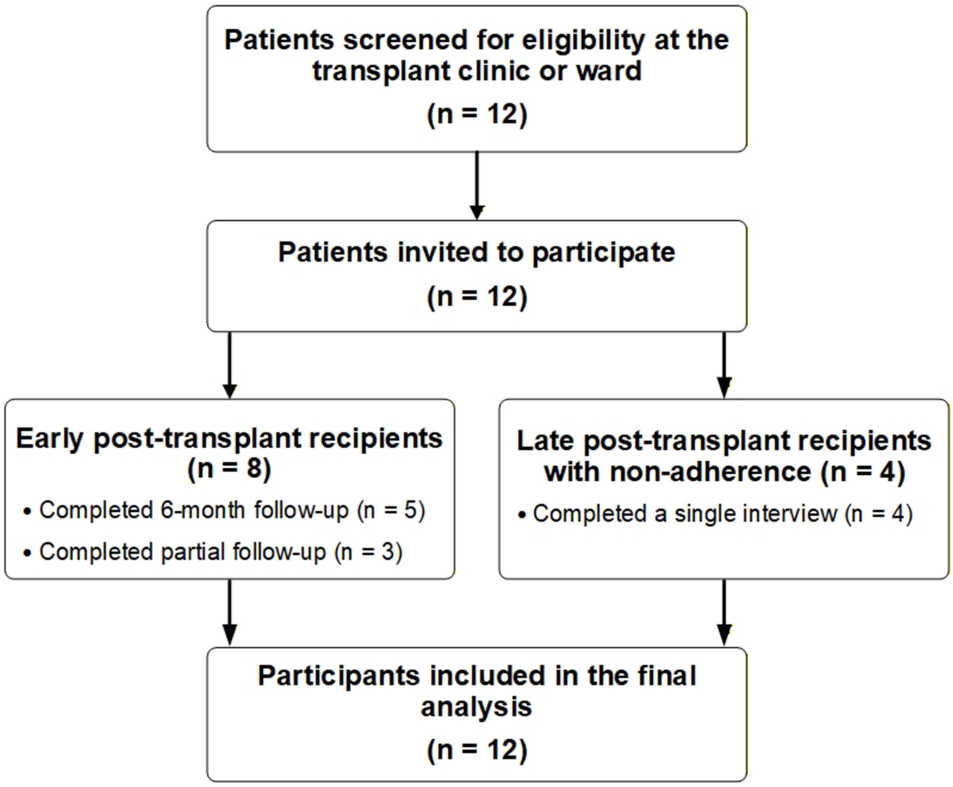

Figure 1 Participant recruitment and sampling flow. Purposive sampling identified eight early post-transplant recipients for longitudinal follow-up and four later-stage recipients with documented non-adherence as negative cases.

Data Analysis

The interview transcripts were analyzed using a data-driven thematic analysis informed by phenomenological principles to identify patterns and interpret participants' lived experiences of medication adherence.[25,26] NVivo qualitative analysis software (QSR International, Burlington MA, release 1.6.1) was used to organize transcripts, manage coding, and support the development of themes.

Analysis began with repeated reading of the transcripts to achieve immersion in the data. Initial coding was conducted by the primary interviewer, who generated 37 preliminary codes reflecting recurring concepts within the interviews. A second researcher independently reviewed the coding framework and transcripts to assess coding consistency and refine code definitions. Through an iterative process of constant comparison and team discussion, related codes were grouped into broader conceptual categories. These categories were further synthesized into six overarching themes that represented shared patterns in participants' experiences of medication adherence (Figure 2). Theme development occurred concurrently with data collection, allowing emerging insights to inform subsequent interviews and ensuring that analytic saturation was reached. Saturation was assessed across both sampling pathways and was determined when additional interviews did not produce substantively new conceptual categories.[24]

Reflexivity and Rigor

Reflexivity was maintained throughout the research process to acknowledge the potential influence of the researchers' professional backgrounds on data interpretation.[27] The primary interviewer is a clinical pharmacist with experience in transplantation care, which provided contextual insight but also the potential for interpretive bias. To reduce this influence, reflective memos were maintained during data collection and analysis, and bracketing discussions were conducted within the research team to support reflexivity and consistency in interpretation. Analytic rigor was further enhanced through investigator triangulation. A second researcher independently reviewed coding decisions and

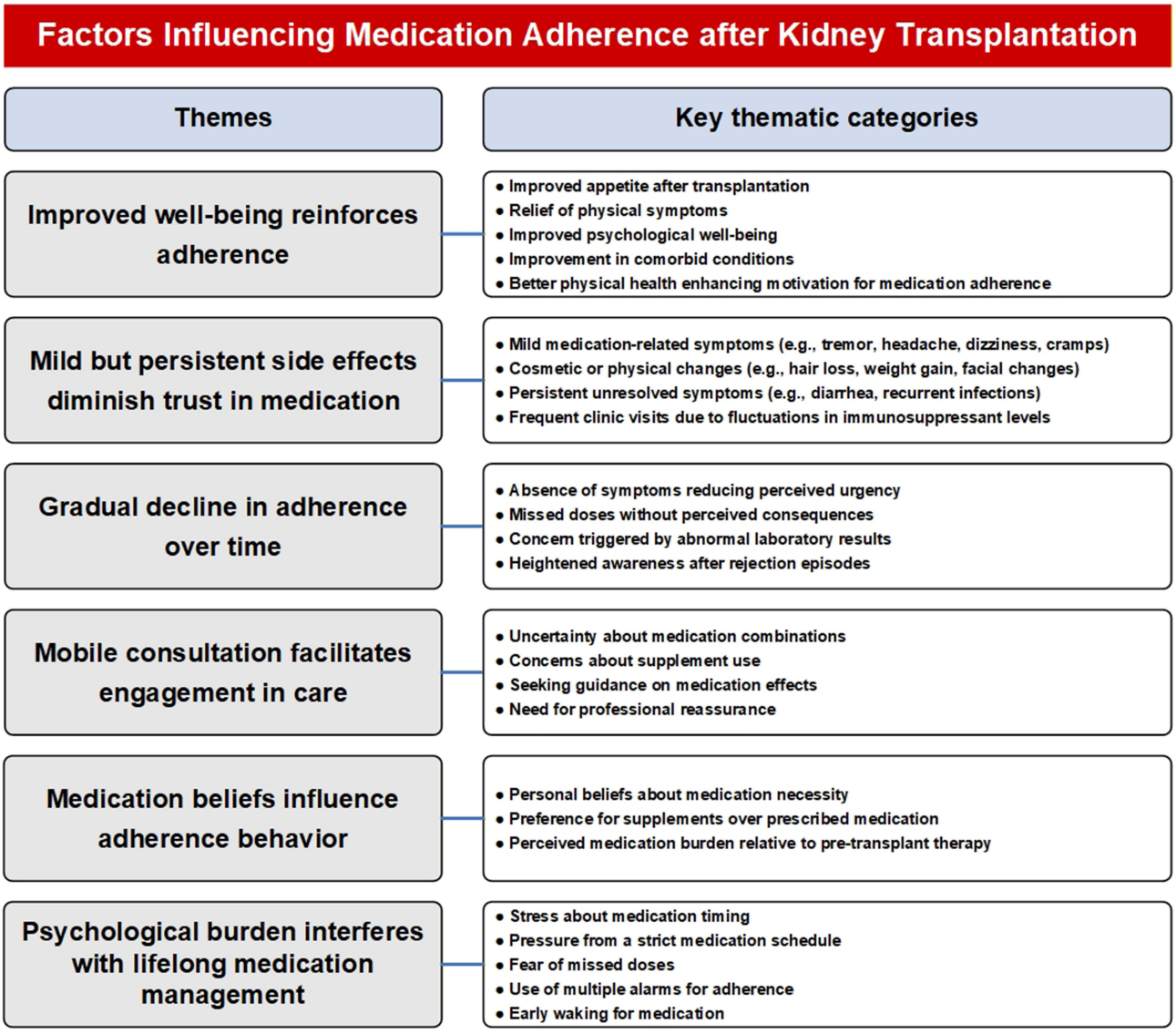

Figure 2 Thematic framework of the evolving factors influencing medication adherence after kidney transplantation. Thirty-seven initial codes were organized into categories and synthesized into six themes describing patients' evolving medication adherence experiences.

participated in discussions regarding theme development. Discrepancies were resolved through consensus, ensuring that interpretations remained grounded in participants' accounts rather than pre-existing clinical perspectives.

Ethical Considerations

Prior to participation, all individuals received oral and written information about the study purpose, procedures, voluntary nature of participation, and their right to withdraw at any time without affecting their medical care. Written informed consent was obtained from all participants prior to enrollment, including consent for the use of anonymized responses and direct quotations in publications. All interview data were pseudonymized, and identifying information was removed from transcripts to protect participant confidentiality. Data were securely stored on encrypted, access-controlled servers accessible only to members of the research team.

This study was approved by the Institutional Review Board of National Taiwan University Hospital (approval number: 202007132RINA) and conducted in accordance with the principles of the Declaration of Helsinki. Organ donation in Taiwan is regulated under the Human Organ Transplantation Act, which mandates voluntary written consent,

protects donor autonomy, and prohibits commercial donation and organ trafficking. All transplant procedures represented in this study complied with national legislation and the Declaration of Istanbul.

Results

A total of 12 kidney transplant recipients participated in the study. The mean age of participants was 41 years (ranging from 21–61 years old). More than half had attained a university-level education or higher, and most were employed at the time of the interviews. On average, participants had undergone dialysis for approximately 793.5 (SD: 663) days before transplantation. More than 80% of participants received kidneys from living donors. All participants were prescribed a protocol-based twice-daily tacrolimus regimen. Therefore, differences in adherence experiences observed in this study were not attributable to variations in dosing frequency between once-daily and twice-daily immunosuppressive regimens. Instead, participants more frequently described medication-related side effects, personal beliefs about treatment, and the burden of maintaining strict medication schedules as key factors influencing adherence behaviors. Detailed sociodemographic and clinical characteristics of participants are summarized in Table 1.

Thematic analysis identified six overarching themes describing participants' experiences with medication adherence after kidney transplantation. These themes collectively illustrate how medication adherence evolves over time and is shaped by the interplay between physical recovery, personal beliefs, daily routines, and healthcare support.

Improved Well-Being Reinforces Adherence

This theme describes how perceived improvements in health and quality of life after transplantation strengthened participants' motivation to adhere to immunosuppressive therapy. Participants frequently linked medication adherence to the preservation of their regained health and independence. Three subthemes were identified.

Relief from Dialysis-Related Burden

Some participants described substantial improvements in physical well-being following transplantation, particularly when compared with the symptoms and burdens experienced during dialysis. Participants reported resolution of fatigue, pruritus, poor appetite, and daytime sleepiness.

Table 1 Participant Demographic and Clinical Profiles (n = 12)

Variables	n (%)	Mean (SD)
Age (years)		41.0 (11.9)
Gender		
Female	4 (33.3)	
Male	8 (66.7)	
Educational attainment		
Junior high school	2 (16.7)	
Senior high school	1 (8.3)	
Associate degree	1 (8.3)	
University degree	6 (50.0)	
Master's degree or above	2 (16.7)	
Being employed	9 (75.0)	
Marital status		
Yes	9 (75.0)	
No	2 (16.7)	
Divorced	1 (8.3)	
Length of dialysis treatment (days)		793.5 (663.3)
Type of donor		
Living donor	10 (83.3)	
Cadaveric donor	2 (16.7)	

> During dialysis, I was always tired and felt slow in my thinking. I often fell asleep, my skin itched every day, and I didn't feel like eating. Sometimes I even dozed off during work meetings. Now, those problems are gone. (Participant 4)

For many participants, transplantation was perceived as a life-restoring event. This experience strengthened their commitment to maintaining strict adherence to their medication regimen.

> Honestly, I'd rather keep this kidney than win the lottery. My life has improved so much because of it. (Participant 9)

Restoration of Daily Function and Independence

Most of the participants expressed positive attitudes toward medication adherence in the early post-transplant period, attributing their motivation to improvements in physical functioning and independence.

> After the surgery, my quality of life has improved a lot. I'm able to do many things on my own now. The only thing that feels a bit complicated is the blood pressure medication, but overall taking my medicines is not a problem. (Participant 3)

Compared with their experiences during dialysis, participants generally perceived the twice-daily tacrolimus regimen as manageable and worthwhile.

> For kidney transplant patients like us, taking our medications is the most important thing. It's something you need to take seriously and make a priority in your daily life. (Participant 1)

Internalization of Adherence as a Health-Preserving Routine

For several participants, medication adherence gradually became integrated into their daily routines as a habitual behavior associated with protecting graft function. During this stage, medication-taking was not experienced as burdensome but rather as a meaningful and necessary action to maintain their restored quality of life.

> Now I take my medication at the scheduled time, even if my phone reminder doesn't go off. (Participant 5)

Mild but Persistent Side Effects Diminish Trust in Medication

Although most participants described medication side effects as mild, these symptoms nonetheless influenced how they perceived their medications and, in some cases, weakened trust in long-term pharmacological treatment. Three subthemes were identified.

Tolerable Symptoms but Growing Awareness of Bodily Change

Some participants reported experiencing symptoms, such as headaches, tremors, palpitations, or diarrhea. Although participants generally described these symptoms as manageable, the physical changes increased awareness of medication-related bodily effects.

> My hands tremble a bit more now, especially when I'm using chopsticks. When I try to screw something in, it's harder to line it up. It may be related to the medication, but it doesn't really bother me. (Participant 3)

Visible Physical Changes and Psychosocial Sensitivity

Visible physical changes, including facial swelling, weight gain, hair loss, and increased facial hair, were particularly distressing for some younger and female participants. Although these changes were medically expected, especially in relation to corticosteroid therapy, they raised concerns about body image and self-perception. While these concerns did not immediately lead to non-adherence, they introduced ambivalence and psychological resistance toward long-term medication use.

> I Want to Ask, if I Only Take One Steroid Pill, Will My Face Still Swell? (Participant 8)

> Even though I eat very little now, I still gain weight easily. It's frustrating because I don't know how to control it. (Participant 2)

Daily-Life Disruption and Emergent Self-Adjustment

For some participants, even mild symptoms became problematic when they interfered with work or daily activities. One participant described persistent diarrhea related to steroid therapy. Although clinicians reassured him that the symptom was not medically concerning, the practical difficulty of leaving his workstation created significant distress. Because he worked in a petrochemical factory where leaving the workstation was difficult, he began experimenting with modifying his medication schedule independently.

> There was a time when I had diarrhea and tried to ignore it at first. Then I thought that wasn't okay, so I adjusted the medication myself and took it once at night. When I didn't notice any difference, I later stopped taking it. (Participant 12)

This example illustrates how practical challenges in daily life may lead patients to make independent medication adjustments.

Gradual Decline in Adherence Over Time

This theme reflects the temporal evolution of adherence behaviors, highlighting how early vigilance gradually gave way to normalization and reduced perceived risk. Two subthemes emerged.

Shifting Risk Perception: From Vigilance to Normalization

Participants in the early post-transplant group described maintaining strict adherence and expressed strong concern about missing doses. When discussing "missed doses", they often referred to taking medications later than their intended schedule rather than skipping doses entirely. In contrast, participants who were more than one-year post-transplant described having missed multiple doses without experiencing immediate physical consequences.

> It's not that I refused to take the medication. I could always go back and get it, but honestly, I was just being lazy. For the past seven or eight years, I often forgot to take it. Because my lab results remained normal, it sometimes felt like skipping it didn't really matter. (Participant 9)

Because the protective effects of immunosuppressive therapy are not immediately perceptible, participants described difficulty recognizing the consequences of non-adherence. The absence of immediate symptoms created a disconnect between medication-taking behavior and perceived necessity.

> I don't notice much difference when I don't take the medication. I rarely feel any changes. It's only when I review my lab results during follow-up visits that I start to feel concerned. (Participant 11)

Delayed Consequences and Retrospective Regret

Some participants only reconsidered the importance of adherence when clinical indicators worsened or when graft dysfunction became imminent. These experiences highlight how the consequences of non-adherence may only become apparent after substantial clinical deterioration.

> I've already been through it once, and I don't feel I have the courage to go through it again. The treatment cost me a great deal of money. (Participant 11)

Mobile Consultation Facilitates Engagement in Care

Participants described the value of having access to consultation outside routine clinic visits. Many reported that the ability to contact healthcare professionals through phone calls or mobile apps helped them manage medication-related concerns, including side effects, missed doses, potential drug interactions, and acute symptoms. Despite differences in educational background, majority of the participants reported occasional missed doses during the first six months after transplantation, often due to social activities or logistical challenges such as delays in preparing pillboxes. Among participants who experienced rejection episodes, missed doses were sometimes associated with occupational stress or fatigue.

> There was one time when I went to a friend's house for dinner and realized I had forgotten to bring my medication. (Participant 5)

> I often missed to pick up my medication, and the longest period I've gone without it was over a month. It's because I worked in the evening, and I also tend to sleep in during the mornings. (Participant 9)

Consultation interactions recorded through the mobile apps were summarized descriptively based on consultation logs rather than analyzed as qualitative data. The frequency and types of consultation topics are summarized in Table 2.

Medication Beliefs Influence Adherence Behavior

Participants' beliefs about medications played an important role in shaping adherence behaviors. All participants received verbal counseling and written educational materials from pharmacists before discharge. However, personal beliefs and prior experiences sometimes influenced medication decisions. One participant vividly described the elaborate preparation of traditional Chinese herbal medicine, which he consumed annually as a form of "detoxification." Although he carefully followed the herbal regimen, he frequently forgot to take his prescribed immunosuppressive medications. Because his kidney failure had been attributed to hypertension, he believed that controlling blood pressure and cleansing accumulated toxins were more important than strict adherence to immunosuppressive therapy. This example illustrates how personal interpretations of illness and treatment can shape selective adherence behaviors.

> I knew my kidney problems were caused by high blood pressure, so I thought that even if I did not take the immunosuppressants, I should at least continue taking the blood pressure medication. (Participant 9)

Psychological Burden Interferes with Lifelong Medication Management

Finally, participants described the psychological burden associated with maintaining lifelong medication schedules. Strict dosing requirements, combined with fear of missing doses, created ongoing mental pressure for some individuals.

Table 2 Content and Frequency of Consultations via Mobile App

Content	Frequency	Exemplar Quotes
Side effect-related concerns	3	"I've been getting headaches these past few days. I'm wondering if it might be a side effect of the medication." (Participant 4) "Yesterday I took half of the orange pill and felt really dizzy afterward. Should I still continue taking it?" (Participant 7)
Immunosuppressant-related infections	2	"I had diarrhea several times yesterday and a low fever. Now I also have a runny nose and a mild cough. What should I do?" (Participant 1) "I noticed bumps on my face yesterday that look like chickenpox. I'm not sure if it might be herpes." (Participant 8)
Medication shortage	4	"I just noticed that my immunosuppressants are missing. I only have enough for two more days. What should I do?" (Participant 4) "Last time I couldn't see the doctor because I had a job interview, and I ran out of Cellcept®. Now that I have it again, should I still take it?" (Participant 5)
Drug-drug interactions	3	"If my headache continues, is it okay to take pain medicine?" (Participant 4) "I have a dental appointment for gum disease this Saturday. If the dentist gives me antibiotics, are there any medicines I should avoid?" (Participant 8)
Missed or delayed doses	8	"Last week I went to a party and didn't realize it would last past 8 PM, so I took my medicine around 10 PM." (Participant 1) "I used to depend on my phone reminders to take my medicine. But six months ago, I started working in a factory and often worked overtime. I only took my medicine two or three times a week. Sometimes I remembered in the morning, but by then I had already left the house" (Participant 12)

> Sometimes I worry that I won't be able to take my medications right when the alarm goes off. Even with an alarm, it's easy to forget, so I feel like I need another reminder to take it. (Participant 1)

One participant described setting five alarms in the morning to ensure adherence. These accounts highlight how adherence is not only a behavioral challenge but also an ongoing psychological responsibility embedded in daily life.

> It feels like being in the military, constantly having missions to complete. It's exhausting (Participant 8)

Discussion

Despite extensive efforts to improve medication adherence, no single intervention has consistently demonstrated sustained effectiveness in transplant populations.[28] The findings of the present study suggest that this limitation may partly arise from the dynamic nature of adherence following kidney transplantation. Rather than representing a fixed behavioral trait, medication adherence appears to evolve over time as patients adapt to recovery, experience medication effects, and negotiate the practical demands of everyday life.[29] In this study, some participants reported adjusting or discontinuing medications based on personal interpretations of symptoms or beliefs about treatment effectiveness. These observations resonate with Charmaz's perspective that patients actively construct their own understandings of illness and treatment, which may not always align with biomedical explanations.[30]

A key contribution of this study is the identification of the temporal evolution of medication adherence during the early post-transplant period. Through longitudinal engagement with participants, we observed that perceptions of medication necessity, side effects, and treatment risks were not static but changed as recipients moved further away from the transplantation event and gradually re-integrated into their daily routines. These shifting perceptions influenced how participants interpreted symptoms, prioritized medication-taking, and responded to challenges in treatment management. Synthesizing the six themes identified in this study, three higher-order domains emerged that may inform clinical interventions: sustaining motivation to maintain medication adherence, providing personalized medication guidance to reduce barriers to adherence, and ensuring accessible consultation services for medication-related concerns. These domains highlight the potential translational implications of our findings for supporting long-term adherence in clinical practice.

First, sustaining patient motivation appears central to maintaining long-term adherence. Many participants initially demonstrated strong commitment to medication-taking after transplantation, particularly when they experienced substantial improvements in physical well-being and quality of life. However, this motivation often weakened over time as patients adapted to their improved health status. Participants who were further removed from transplantation described more relaxed attitudes toward medication adherence, suggesting that the initial urgency associated with graft protection may diminish as daily life stabilizes. These findings reinforce the view that adherence is not a single decision but an ongoing behavioral process embedded within patients' daily routines and priorities.[31]

In several cases, participants reported occasionally missing doses without experiencing immediate symptoms, which gradually led them to perceive strict adherence as less critical. Others described discontinuing medications due to persistent but seemingly minor side effects, such as diarrhea or visible changes in physical appearance. When these discomforts continued despite treatment adjustments, trust in the medication regimen gradually declined. Similar patterns have been documented in previous research. For example, a systematic review by Tang et al reported that transplant recipients who feel physically well may underestimate their continued need for immunosuppressive therapy, particularly when graft function appears stable and missed doses do not produce immediate symptoms.[20] In such circumstances, the delayed onset of clinical consequences may further weaken patients' perceived necessity for strict adherence.

Donor type may also represent a contextual factor influencing adherence motivation. In the present study, most recipients received kidneys from living donors, which may have strengthened their sense of responsibility to preserve graft function. Previous research has suggested that recipients of living-donor transplants may experience stronger relational bonds or psychological pressure to protect the donated organ.[32,33] However, donor status alone is unlikely to fully explain adherence behavior.[12,34] In our findings, maintaining motivation appeared important regardless of donor type, although the donor-recipient relationship may represent a meaningful contextual influence that may need further investigation.

These observations suggest that motivation to adhere cannot be assumed to remain stable following hospital discharge. Early post-transplant education often emphasizes the long-term risks associated with immunosuppressive therapy, yet such messages may not fully address the evolving challenges patients encounter as they return to everyday life. As patients stabilize, insufficient reinforcement regarding the importance of adherence may contribute to disruptions in medication routines, particularly when competing demands such as work responsibilities, social activities, or medication side effects arise. Recognizing how daily living contexts interact with prescribed regimens is therefore essential for sustaining adherence over time.[35] Educational strategies that incorporate peer experiences, proactively address side effects, and provide practical guidance for managing missed doses may help reinforce long-term adherence.[36] Continuous support that assists patients in integrating medication-taking into their daily routines may further strengthen sustained engagement with treatment.

Second, the findings underscore the importance of personalized medication guidance in addressing barriers to adherence. Although participants received standardized education and medication instructions at hospital discharge, many reported difficulties recalling complex treatment regimens once they returned home. Consequently, medication-taking behaviors were often shaped by personal interpretations and beliefs about treatment necessity or safety. These findings are consistent with prior studies demonstrating that patients' beliefs about medicines strongly influence adherence behaviors and highlighting the importance of effective communication between healthcare providers and patients.[37,38] While transplant recipients are frequently expected to become "expert patients",[39] individuals differ substantially in lifestyle, health literacy, and perceptions of medication. Standardized educational approaches alone may therefore be insufficient to address the diverse needs of transplant recipients.[40] Instead, sustainable adherence may require personalized medication guidance that acknowledges patients' existing beliefs, daily routines, and practical constraints.

Importantly, increased knowledge does not necessarily translate into improved adherence.[41] Participants in this study described multiple challenges when attempting to incorporate medication regimens into their daily lives. Some encountered conflicts between medication side effects and occupational responsibilities, whereas others experienced psychological stress related to rigid dosing schedules or anxiety about missing doses. These challenges highlight the need for flexible and patient-centered medication management strategies. Adjusting dosing schedules to better align with individual routines, simplifying treatment regimens when clinically appropriate, and addressing adherence-related anxiety may help reduce treatment burden and support sustained adherence.[42]

Finally, consultation services for medication-related concerns emerged as an important support mechanism for patients navigating post-transplant self-management. Even participants with strong medication knowledge occasionally modified or interrupted their treatment regimens when they were uncertain about how to manage issues, such as medication shortages, potential drug interactions, or unexpected symptoms. These experiences stress the complexity of managing immunosuppressive therapy outside clinical settings. Previous research has shown that trusting, non-authoritarian relationships between patients and healthcare professionals facilitate open communication and encourage disclosure of medication-related concerns.[35] In the present study, continuous access to medication consultation, through phone calls or mobile communication, appeared to function as a supportive safety net during the early stages of self-management. By strengthening patient-provider connectivity, timely consultation services may help patients resolve uncertainties and potentially reduce the risk of medication discontinuation or non-adherence.[43,44]

Certain groups of patients appeared particularly vulnerable to adherence challenges, including individuals who had previously missed doses without experiencing immediate consequences, those experiencing persistent minor side effects, patients undergoing major life transitions, and those requiring frequent clinic visits for medication adjustments. Many of these individuals were hesitant to seek help and participated minimally in treatment-related decision-making. Encouraging patients to ask questions, report unusual symptoms, and discuss medication-related concerns at an early stage may therefore strengthen collaborative decision-making and support sustained adherence and long-term graft survival.[39,45]

Limitations

Several limitations should be considered when interpreting the findings of this study. The research was conducted at a single tertiary medical center in Taiwan, and transplant care practices and healthcare environments may differ across

institutions and countries. Although participants provided detailed accounts of their experiences, these contextual differences may limit the transferability of the findings to other healthcare settings or cultural contexts.

The sampling strategy targeted two groups: recipients in the early post-transplant period and individuals identified by clinicians as having adherence concerns. While this approach enabled exploration of both early adaptation and potential challenges in medication management, it may not fully reflect the experiences of stable long-term transplant recipients who maintain consistent adherence. Including a broader range of transplant recipients in future studies may provide a more comprehensive understanding of adherence trajectories across different stages of transplantation.

The study period also coincided with the COVID-19 pandemic, which affected clinic attendance and follow-up schedules for some participants. As a result, several individuals were unable to complete the full series of planned interviews. Although most participants contributed multiple interviews, these disruptions may have reduced the depth of longitudinal observations in some cases.

Despite these limitations, the study offers important insights into how medication adherence evolves following kidney transplantation and highlights factors that may influence patients' long-term engagement with immunosuppressive therapy. Future research involving multiple transplant centers and extended follow-up periods may further enhance understanding of adherence experiences and support the development of patient-centered strategies to promote sustained medication use.

Conclusions

This qualitative study indicates that medication adherence after kidney transplantation is shaped not only by patients' knowledge or routines but also by evolving perceptions of health, medication necessity, and everyday life demands. As recipients adjust to recovery and reintegrate into daily life, adherence behaviors may change over time. Supporting sustained adherence may therefore require patient-centered approaches that respond to patients' changing needs, including personalized medication guidance, proactive management of side effects, and accessible consultation services to help patients navigate medication-related challenges and maintain long-term engagement with immunosuppressive therapy.

Data Sharing Statement

The study materials and detailed analyses are available from the corresponding author upon reasonable request.

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Disclosure

The authors declare no conflicts of interest.

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