ETR

DOI: 10.14744/etr.2025.44154
Eur Transplant Res 2025;1(1):19–24

EUROPEAN TRANSPLANT RESEARCH

REVIEW

Nursing approaches in immunosuppressive medication adherence

Büşra Selma Saha,[1] Yaprak Sarıgöl Ordin[2]

[1]Institute of Health Sciences, Dokuz Eylul University, Balçova/İnciraltı, Izmir, Turkiye
[2]Department of Surgical Nursing, Faculty of Nursing, Dokuz Eylul University, Balçova/İnciraltı, Izmir, Turkiye

Abstract

Organ transplant recipients must continue immunosuppressive therapy throughout their lives, and adherence to these medications is critical for long-term graft survival. Multiple factors influence adherence, including socioeconomic status, treatment-related variables, patient characteristics, disease-related factors, and components associated with the healthcare system and team. Addressing these multifactorial challenges requires the integration of educational, cognitive, behavioral, psychological, and emotional strategies. As integral members of the multidisciplinary healthcare team, nurses play a central role in identifying barriers to adherence, utilizing appropriate assessment tools, and implementing evidence-based, patient-centered interventions. This review highlights nurses' responsibilities and contributions in promoting adherence and supporting transplant recipients throughout their post-transplant journey.

Keywords: Immunosuppressive therapy, medication adherence, nursing care, organ transplantation, patient adherence.

In solid organ transplantation, immunosuppressive therapy is administered to suppress the immune response in the early post-transplant period, maintain long-term immune control, and prevent rejection. This therapy is critical not only for graft survival but also for the overall survival of the recipient. Oral administration is the most common route for long-term immunosuppressive therapy in transplant recipients. Although systemic administration routes (such as oral and intravenous) offer convenience, they may require high doses, carry a risk of adverse effects, and result in variability in drug efficacy. Due to their complex regimens and side-effect profiles, immunosuppressive medications are often associated with poor treatment adherence [1]. Non-adherence to an immunosuppressive regimen is one of the most significant challenges following organ transplantation.

Medication adherence is defined by the EMERGE (ESPACOMP Medication Adherence Reporting Guideline) framework as the process by which patients take their medications as prescribed, structured into three distinct phases: initiation (when the patient takes the first dose), implementation (the extent to which a patient's actual dosing corresponds to the prescribed regimen), and persistence (the time from initiation until the eventual discontinuation of therapy). This framework provides a standardized approach for measuring and reporting medication adherence in both research and clinical practice [2].

ETR **Cite this article as:** Saha BS, Sarıgöl Ordin Y. Nursing approaches in immunosuppressive medication adherence. Eur Transplant Res 2025;1(1):19–24.

Correspondence: Büşra Selma Saha. Institute of Health Sciences, Dokuz Eylul University, Balçova/İnciraltı, Izmir, Turkiye
E-mail: busraselmasaha@gmail.com
Submitted Date: 12.03.2025 **Revised Date:** 20.05.2025 **Accepted Date:** 29.08.2025 **Available Online Date:** 02.09.2025

Non-adherence to immunosuppressive therapy has been associated with severe complications across all types of organ transplants, leading to serious clinical consequences such as acute and chronic rejection, graft loss, hospital readmissions, and even mortality [1]. Compared with other transplant populations, non-adherence is particularly high among kidney transplant recipients, with reported prevalence ranging widely from 2% to 89% [3,4]. Rates of non-adherence in other organ transplant populations include 42.8% in adult heart transplant recipients [5], 49% in liver transplant recipients [6], and 27.4% in lung transplant recipients [7]. These outcomes underscore the importance of developing and implementing adherence-enhancing interventions—particularly those led by nurses—to reduce non-adherence and promote long-term transplant success.

With the onset of the COVID-19 pandemic, healthcare delivery models rapidly shifted toward digitalization, with remote monitoring and digital health applications gaining prominence in the management of chronic diseases [8]. However, the integration of these technologies into routine practice remains limited [9]. Healthcare professionals often have low levels of awareness regarding the usability and applicability of digital technologies, and insufficient knowledge about available resources contributes to difficulties in adoption [10]. Importantly, there remain significant gaps in the literature regarding the integration of digital health applications into nursing practice and the evaluation of their effectiveness.

This review explores nursing approaches to immunosuppressive medication adherence, drawing upon the current literature.

Causes of Medication Non-adherence

Medication non-adherence can be classified into two categories: intentional and unintentional. Intentional non-adherence occurs when a patient consciously decides not to follow their prescribed regimen, whereas unintentional non-adherence typically results from external factors such as transportation issues, financial difficulties, or lack of access to medications [11].

The World Health Organization (WHO) categorizes the factors influencing medication adherence into five domains: socioeconomic factors, treatment-related factors, patient-related factors, disease-related factors, and health system and healthcare team-related factors [12]. Specific risk factors for non-adherence include being female, younger age, multiple chronic conditions, polypharmacy, inadequate health literacy, lack of information, adverse drug effects, doubts about the importance of immunosuppressive medications, high treatment costs, limited appointment availability, and restricted access to healthcare [4].

Highlights

- Nurse-led interventions play a critical role in improving adherence to lifelong immunosuppressive therapy in transplant recipients
- Multifactorial barriers to adherence can be addressed through educational, behavioral, psychological, and technology-based strategies
- Integration of digital health tools into nursing practice offers promising support for sustained medication adherence

Conversely, protective factors have also been identified. A qualitative study with liver transplant patients revealed that confidence in medications, consistently carrying medications, and receiving family support positively impacted adherence [13]. Similarly, studies with kidney transplant recipients indicated that changes in daily routines were perceived as barriers to medication use [14,15]. Identifying the factors that influence adaptation behaviors is crucial for designing targeted nursing interventions. In particular, recognizing modifiable factors provides the basis for individualized and effective nursing practices [16]. While adherence is often perceived as the sole responsibility of patients, it can be significantly improved through coordinated support from physicians, clinical nurses, pharmacists, and other healthcare professionals.

Assessment and Nursing Approaches in Immunosuppressive Medication Non-adherence

Adherence to immunosuppressive therapy involves not only taking medications but also taking them at the correct dose and time. The first and most critical step in addressing non-adherence is accurate assessment and patient follow-up. Because poor adherence can lead to severe consequences such as organ rejection and increased infection risk, valid and reliable evaluation methods are essential.

A variety of assessment tools have been described, but there is no universal consensus on a standardized approach [11,17]. Methods are generally divided into direct and indirect approaches [12]. Direct methods include directly observed therapy and therapeutic drug monitoring [17]. Although objective and accurate, these methods are limited by cost and feasibility issues [18]. Indirect methods include pill counts, patient self-reports, medication diaries, prescription refill records, and electronic monitoring devices [17]. While easier to apply, indirect approaches may be less reliable [18].

Recently, electronic medication monitoring has become more widespread and is considered a potential gold standard [19]. Tools include electronic pill bottles, smart inhalers, smart blister packs, ingestible sensors, video-observed therapy, electronic medication management systems, mobile health applications, and smartwatches [20]. These technologies enable real-time monitoring and immediate feedback, thereby enhancing adherence. Nonetheless, patient self-reports remain the most widely used method due to their low cost and ease of use [17]. Therefore, a multi-method approach is recommended, as combining different strategies increases accuracy and reliability [12,17,18].

Despite the availability of numerous tools, many healthcare professionals—particularly nurses—report insufficient training in medication adherence assessment [21]. Training programs have been shown to improve nurses' knowledge and evaluation skills in this area [22]. Accurate assessment enables the development of targeted interventions. For example, electronic monitoring has been shown to positively affect adherence to immunosuppressive therapy [23]. Moreover, a meta-analysis demonstrated that multicomponent interventions, particularly those combining electronic monitoring with self-reports, improve patients' knowledge, increase regular participation in follow-up visits, strengthen medication-taking behaviors, and highlight the effectiveness of reminder systems [24].

These findings emphasize the importance of integrating technology-supported monitoring tools into nursing practice to enhance medication adherence in transplant recipients.

The Role of Nursing Interventions in Immunosuppressive Medication Adherence

Nurses are in a unique position to understand patients' daily needs and the challenges they encounter, making them key contributors to clinical decision-making processes [25]. However, they face multiple challenges in improving medication adherence, such as providing patient education, involving caregivers in the educational process, and monitoring medication side effects. Despite these challenges, nurses—who are involved in all stages of healthcare and responsible for delivering holistic care—should play an active role in planning, implementing, and evaluating interventions designed to improve adherence [26]. By identifying the causes of non-adherence, nurses can develop personalized, patient-centered strategies tailored to individual needs and preferences.

In recent years, growing scientific evidence has demonstrated the positive impact of nurse-led interventions on medication adherence [27]. These interventions have been shown to mitigate the adverse consequences of low adherence rates and underscore the critical role of nurses in ensuring patient safety [28]. A large-scale study among European nurses (n=4888) reported that nurses routinely engage in monitoring therapeutic effects and side effects of medications, assessing adherence, managing prescriptions, and providing patient education as integral aspects of their clinical practice [29].

Among the strategies to improve adherence, patient education remains fundamental and should be incorporated into routine clinical practice [30]. Most centers implement structured education programs prior to discharge, covering correct medication use, side effects, the importance of immunosuppressive drugs, diet, weight, blood pressure and temperature monitoring, physical activity, early warning signs of complications, health screenings, and infection prevention. Ideally, education should be reinforced at regular intervals, as single-session education has limited long-term effects [31].

Interventions designed to improve adherence include educational and cognitive approaches, behavioral strategies, psychological and emotional support, financial assistance, electronic monitoring with feedback, and the use of medication reminders [16]. Systematic reviews have shown that psycho-educational programs, outpatient clinic interviews, remote video consultations, structured instructions for medication-taking behaviors, goal setting with action plans, provision of reliable information, health outcome education, feedback, social support, reminder tools, and problem-solving approaches all positively affect adherence [3,32].

A systematic review of randomized controlled trials in transplant recipients found that the most common interventions focused on providing information about health outcomes (78%) and behavior modification (30%) [9]. Psycho-educational interventions are usually delivered by multidisciplinary teams, addressing underlying causes of non-adherence and providing lifestyle guidance. One review highlighted their positive impact on adherence in heart transplant recipients [33]. Although it is difficult to identify the single most effective intervention, evidence suggests that a combination of approaches tailored to patient-specific factors and healthcare contexts is the most successful strategy [3,32]. Given that adherence in chronic disease management is lifelong, nurse-led interventions

should also be designed for long-term implementation. Nonetheless, evidence indicates that adherence often declines over time; for example, De Geest et al. (2014) reported a steady rise in non-adherence between 6 months and 3 years post-transplant [35]. Therefore, sustained monitoring and long-term adherence support are recommended [24].

Despite their central role, many nurses still report gaps in their educational competence. De Baetselier et al. found that 63.4% of nurses did not feel adequately prepared to provide patient education [29]. Strengthening nurses' knowledge and educational skills is therefore essential for improving adherence outcomes. Education not only helps patients recognize potential side effects and seek timely professional support but also shifts the focus from simply remembering to take medications to understanding their critical importance. Evidence suggests that behavioral interventions are often more effective than purely cognitive approaches in improving adherence [36].

Patient motivation is another determinant of adherence, reflecting the willingness to modify behaviors and thought patterns. Motivational interviewing has emerged as an effective strategy for fostering collaboration, setting shared goals, and facilitating behavioral change [37]. Moreover, interprofessional communication and teamwork can further enhance adherence by providing a holistic and consistent approach to medication management.

In recent years, digital health technologies have been increasingly integrated into adherence support. These tools provide significant advantages, including remote monitoring of medication intake, blood pressure, and glucose levels, as well as offering reminders, educational support, and direct communication [30]. Mobile health interventions, in particular, are strongly recommended for optimizing immunosuppressive regimens [24]. Meta-analyses of electronic monitoring interventions have demonstrated significant improvements in adherence [38]. Mobile applications and wearable devices, such as smartwatches, not only deliver reminders but also increase disease awareness, provide education on side effects and drug interactions, and thereby contribute to improved adherence and health outcomes [39].

A Cochrane review assessing interventions to improve immunosuppressive medication adherence in transplant recipients concluded that behavioral strategies, patient education, and digital health applications can be effective. Notably, multicomponent interventions showed the most consistent improvements, although the methodological quality of available studies remains variable [40]. These findings underscore the growing importance of integrating digital health into nursing practice, particularly in managing complex regimens such as lifelong immunosuppressive therapy.

Conclusion

Given that transplant recipients must take immunosuppressive medications throughout their lives, nurses play a pivotal role as the primary link between patients and the healthcare team, especially in education and awareness-raising. Nurse-led, individualized interventions have been shown to improve adherence and, consequently, long-term health outcomes. Strengthening nurses' competencies in adherence assessment through standardized tools, and implementing appropriate interventions in cases of non-adherence, is essential.

Future research should compare nursing interventions across different transplant populations and evaluate the effectiveness of digital solutions. Such studies would provide valuable evidence for refining adherence strategies and advancing nursing practice in the care of organ transplant recipients.

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: BSS, YSO; Design: YSO; Supervision: YSO; Resource: BSS; Materials: BSS; Data Collection and/or Processing: BSS; Analysis and/or Interpretation: BSS; Literature Search: BSS; Writing: BSS; Critical Reviews: BSS, YSO.

Conflict of Interest: None declared.

Use of AI for Writing Assistance: Not declared.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Hussain Y, Khan H. Immunosuppressive drugs. In: Encyclopedia of Infection and Immunity. 2022:726–40.
2. De Geest S, Zullig LL, Dunbar-Jacob J, Hughes D, Wilson IB, Vrijens B. Improving medication adherence research reporting: ESPACOMP Medication Adherence Reporting Guideline (EMERGE). Eur J Cardiovasc Nurs. 2019;18(4):258–9.
3. Gokoel SRM, Gombert-Handoko KB, Zwart TC, van der Boog PJM, Moes DJAR, de Fijter JW. Medication non-adherence after kidney transplantation: a critical appraisal and systematic review. Transplant Rev (Orlando). 2020;34(1):100511.
4. Corr M, Walker A, Maxwell AP, McKay GJ. Non-adherence to immunosuppressive medications in kidney transplant recipients: a systematic scoping review. Transplant Rev (Orlando). 2025;39(1):100900.
5. Kankaya EA, Ordin YS, Kayıhan D, Engin Ç, Kahraman Ü.

Evaluating the relationship between medication adherence, dietary practices, and physical activity in heart transplant recipients. Clin Transplant. 2025;39(3):e70125.
6. Becker JH, Shemesh E, Shenoy A, et al. The utility of a pre-transplant psychosocial evaluation in predicting post-liver transplant outcomes. Prog Transplant. 2021;31(1):4–12.
7. Drick N, Seeliger B, Fuge J, et al. Self-reported non-adherence to immunosuppressive medication in adult lung transplant recipients: a single-center cross-sectional study. Clin Transplant. 2018;32(4):e13214.
8. Baudier P, Kondrateva G, Ammi C, Chang V, Schiavone F. Digital transformation of healthcare during the COVID-19 pandemic: patients' teleconsultation acceptance and trusting beliefs. Technovation. 2023;120:102547.
9. Kostalova B, Janette R, Fabienne D, et al. Medication adherence interventions in transplantation: a systematic review. Transplant Rev (Orlando). 2022;36(1):100671.
10. van Boven JFM, Tsiligianni I, Potočnjak I, Mihajlović J, Dima AL, Nabergoj Makovec U, et al. European Network to Advance Best Practices and Technology on Medication Adherence: mission statement. Front Pharmacol. 2021;12:748702.
11. Basu S, Garg S, Sharma N, Singh MM. Improving the assessment of medication adherence: challenges and considerations with a focus on low-resource settings. Ci Ji Yi Xue Za Zhi. 2019;31(2):73–80.
12. Sabaté E. Adherence to long-term therapies: evidence for action. Geneva: World Health Organization; 2003.
13. Özdemir Köken Z, Sezer Ceren RE, Karahan S, Abbasoglu O. Factors affecting immunosuppressive medication adherence in liver transplant recipients with poor adherence: a qualitative study. Patient Prefer Adherence. 2023;17:983–93.
14. Cossart AR, Staatz CE, Campbell SB, Isbel NM, Cottrell WN. Investigating barriers to immunosuppressant medication adherence in renal transplant patients. Nephrology (Carlton). 2019;24(1):102–10.
15. Balakrishnan A, Weinmeyer R, Serper M, Bailey SC, Kaiser K, Wolf M. Navigating medication-taking after kidney transplant. Res Social Adm Pharm. 2022;18(10):3846–54.
16. Berben L, Dobbels F, Engberg S, Hill MN, De Geest S. An ecological perspective on medication adherence. West J Nurs Res. 2012;34(5):635–53.
17. Stirratt MJ, Curtis JR, Danila MI, Hansen R, Miller MJ, Gakumo CA. Advancing the science and practice of medication adherence. J Gen Intern Med. 2018;33(2):216–22.
18. De Geest S, Ribaut J, Denhaerynck K, Dobbels F. Adherence management in transplantation. In: Daniel C, Scott DC, Paul LK, editors. Psychosocial aspects of chronic kidney disease. Academic Press; 2021:409–48.
19. Belaiche S, Decaudin B, Dharancy S, Noel C, Odou P, Hazzan M. Factors relevant to medication non-adherence in kidney transplant: a systematic review. Int J Clin Pharmacol. 2017;39:582–93.
20. Mason M, Cho Y, Rayo J, Gong Y, Harris M, Jiang Y. Technologies for medication adherence monitoring and technology assessment criteria: narrative review. JMIR Mhealth Uhealth. 2022;10(3):e35157.
21. Moon SJ, Lee WY, Hwang JS, Hong YP, Morisky DE. Accuracy of a screening tool for medication adherence: a systematic review and meta-analysis of the Morisky Medication Adherence Scale-8. PLoS One. 2017;12(11):e0187139.
22. McDermott J, Granger BB, Thompson S, et al. Improving advanced practice provider knowledge and assessment of medication adherence in cardiovascular patients. J Nurse Pract. 2022;18(1):86–91.
23. Dobbels F, De Bleser L, Berben L, et al. Efficacy of a medication adherence enhancing intervention in transplantation: the MAESTRO-Tx trial. J Heart Lung Transplant. 2017;36(5):499–508.
24. Shi YX, Liu CX, Liu F, et al. Efficacy of adherence-enhancing interventions for immunosuppressive therapy in solid organ transplant recipients: a systematic review and meta-analysis. Front Pharmacol. 2020;11:578887.
25. World Health Organization. Global strategic directions for nursing and midwifery 2021–2025. Geneva: World Health Organization; 2021.
26. Bokhour BG, Fix GM, Mueller NM, et al. How can healthcare organizations implement patient-centered care? Examining a large-scale cultural transformation. BMC Health Serv Res. 2018;18(1):168.
27. Mardani A, Griffiths P, Vaismoradi M. The role of the nurse in the management of medicines during transitional care: a systematic review. J Multidiscip Healthc. 2020;13:1347–61.
28. Choo J, Hutchinson A, Bucknall T. Nurses' role in medication safety. J Nurs Manag. 2010;18(7):853–61.
29. De Baetselier E, Van Rompaey B, Batalha LM, et al. EUPRON: nurses' practice in interprofessional pharmaceutical care in Europe. A cross-sectional survey in 17 countries. BMJ Open. 2020;10(6):e036269.
30. Myaskovsky L, Jesse MT, Kuntz K, et al. Report from the American Society of Transplantation Psychosocial Community of Practice Adherence Task Force: real-world options for promoting adherence in adult recipients. Clin Transplant. 2018;32(9):e13353.
31. Kuypers DRJ. From nonadherence to adherence. Transplantation. 2020;104(7):1330–40.
32. Bond Z, Scanlon T, Judah G. Systematic review of RCTs assessing the effectiveness of mHealth interventions to improve statin medication adherence: using the behaviour-change technique taxonomy to identify the techniques that improve adherence. Healthcare (Basel). 2021;9(10):1282.
33. Marcelino CA, Diaz LJ, Da Cruz DM. The effectiveness of interventions in managing treatment adherence in adult heart transplant patients: a systematic review. JBI Database Syst Rev Implement Rep. 2015;13(9):279–308.
34. Yang C, Lee DTF, Wang X, Chair SY. Effects of a nurse-led medication self-management intervention on medication adherence and health outcomes in older people with multimorbidity: a randomised controlled trial. Int J Nurs Stud.

2022;134:104314.
35. De Geest S, Burkhalter H, Bogert L, Berben L, Glass TR, Denhaerynck K. Describing the evolution of medication nonadherence from pretransplant until 3 years post-transplant: the Swiss Transplant Cohort Study. Transpl Int. 2014;27(7):657–66.
36. Conna VS, Ruppar TM, Enriquez M, Cooper P. Medication adherence interventions that target subjects with adherence problems: systematic review and meta-analysis. Res Social Adm Pharm. 2016;12(2):218–26.
37. Temedda MN, Haesebaert J, Viprey M, et al. Motivational interviewing to support medication adherence in older patients: barriers and facilitators for implementation in hospital settings. Patient Educ Couns. 2024;124:108253.
38. Chan AHY, Foot H, Pearce CJ, Horne R, Foster JM, Harrison J. Effect of electronic adherence monitoring on adherence and outcomes in chronic conditions: a systematic review and meta-analysis. PLoS One. 2022;17(3):e0265715.
39. Jacob C, Sezgin E, Sanchez-Vazquez A, Ivory C. Sociotechnical factors affecting patients' adoption of mobile health tools: systematic literature review and narrative synthesis. JMIR Mhealth Uhealth. 2022;10(5):e36284.
40. Mellon L, McCormack J, Ryder S, et al. Interventions for increasing immunosuppressant medication adherence in solid organ transplant recipients. Cochrane Database Syst Rev. 2022;9(9):CD013226.