



MEDICATION ADHERENCE PROFILE AMONG HEMODIALYSIS PATIENTS

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ABSTRACT

Medication adherence is an important component of long-term management among patients undergoing maintenance hemodialysis because complex medication regimens and chronic disease conditions may create challenges in maintaining optimal medication-taking behavior. Understanding medication adherence profiles is essential for identifying patients who may require additional support and improving comprehensive pharmaceutical care services. This study aimed to describe the medication adherence profile among maintenance hemodialysis patients at a referral hospital, Surakarta, Indonesia. A descriptive cross-sectional study was conducted involving 47 maintenance hemodialysis patients who met the inclusion criteria. Respondents were recruited using consecutive sampling. Data collection was conducted using a sociodemographic questionnaire and the validated Medication Adherence Report Scale-5 (MARS-5). Sociodemographic characteristics and medication adherence profiles were analyzed descriptively using frequencies and percentages. The findings showed that 59.6% of respondents had high medication adherence, 34.0% had moderate adherence, and 6.4% were categorized as non-adherent. Most participants were aged 45–60 years (66.0%), male (55.3%), had completed senior high school education (34.0%), were unemployed (80.9%), and had monthly incomes below the Solo Regional Minimum Wage (74.5%). Most respondents had undergone maintenance hemodialysis for 12–36 months (78.7%), and family assistance in medication management was reported by 66.0% of respondents. Medication adherence among maintenance hemodialysis patients at a referral hospital was generally favorable, with the majority of respondents demonstrating high adherence. However, a proportion of patients still showed moderate or poor adherence, indicating the need for continuous monitoring and targeted interventions.

Keywords: chronic kidney disease; MARS-5; maintenance hemodialysis; medication adherence

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INTRODUCTION

Chronic kidney disease (CKD) has emerged as a major global public health concern due to its increasing prevalence, progressive clinical course, and substantial contribution to morbidity, mortality, and healthcare burden. The global prevalence of CKD continues to rise, driven primarily by population aging and the increasing burden of metabolic disorders, particularly diabetes mellitus, hypertension, obesity, and cardiovascular diseases, which accelerate irreversible kidney function decline (Kovesdy, 2022). Patients who progress to end-stage kidney disease (ESKD) require lifelong kidney replacement therapy, including hemodialysis, peritoneal dialysis, or kidney transplantation, to maintain survival. Despite improvements in CKD detection and management strategies, the disease continues to impose significant physical, psychological, social, and economic burdens on patients and healthcare systems worldwide. Current international guidelines emphasize that CKD management should extend beyond delaying disease progression and should include optimization of medication management, prevention of treatment-related complications, and improvement of patient-centered outcomes through multidisciplinary care (Sagri et al., 2026).

Hemodialysis remains the most frequently utilized kidney replacement therapy among patients with ESKD, particularly in low- and middle-income countries where access to kidney transplantation remains limited (Furuto et al., 2026). Although hemodialysis effectively removes metabolic waste products and maintains fluid and electrolyte balance, it requires strict adherence to complex

treatment regimens. Patients undergoing maintenance hemodialysis must comply with regular dialysis schedules, dietary restrictions, fluid limitations, laboratory monitoring, and multiple pharmacological therapies (Grams & Melamed, 2025). The combination of intensive dialysis requirements and additional self-management responsibilities contributes to a substantial treatment burden, which may negatively influence patients' ability to consistently follow recommended therapies (Zheng et al., 2025).

Medication therapy represents a fundamental component of comprehensive hemodialysis management because many CKD-related complications cannot be fully controlled through dialysis alone. Patients receiving maintenance hemodialysis commonly use multiple medications, including phosphate binders, antihypertensive agents, erythropoiesis-stimulating agents, iron supplements, vitamin D analogues, calcium preparations, and cardiovascular medications (Naga et al., 2023). The resulting polypharmacy increases medication complexity and daily pill burden, potentially reducing patients' ability to maintain optimal medication-taking behaviors (Lavrador et al., 2023). Medication adherence, defined as the extent to which patients take medications according to healthcare professionals' recommendations regarding dose, timing, and duration, is therefore an essential determinant of treatment effectiveness. Poor adherence among CKD patients has been associated with inadequate control of hypertension, persistent hyperphosphatemia, worsening anemia, increased hospitalization, and poorer clinical outcomes (Cui & Yang, 2026).

Medication adherence among patients with CKD is influenced by multiple interacting factors, including treatment burden, adverse drug reactions, health literacy, socioeconomic status, psychological conditions, and social support systems (Tesfaye et al., 2024). An umbrella review of systematic reviews and meta-analyses reported that medication non-adherence remains prevalent across different stages of CKD and is shaped by both patient-related and healthcare-related determinants (Alfian et al., 2026). The review further indicated that interventions involving pharmacists, nurses, patient education, multidisciplinary care, and digital health technologies may improve adherence, although effectiveness varies depending on patient characteristics and healthcare environments. Therefore, medication adherence should be considered a dynamic behavioral process requiring continuous assessment rather than a single clinical measurement.

Accurate assessment of medication adherence is essential for identifying patients who require additional support and for evaluating the effectiveness of pharmaceutical care interventions. However, no universally accepted gold-standard method currently exists for measuring medication adherence among patients with CKD (Dunbar-Jacob & Zhao, 2025). Available approaches include pharmacy refill records, pill counts, electronic monitoring systems, medication possession ratios, and self-report questionnaires, each with specific advantages and limitations (Aliaga et al., 2025). Among these methods, self-report instruments remain widely used because they are practical, inexpensive, and capable of exploring behavioral patterns associated with intentional and unintentional non-adherence. The Medication Adherence Report Scale-5 (MARS-5) is one of the commonly applied instruments for assessing medication-taking behaviors, including forgetting medication, altering doses, skipping medication, and discontinuing treatment without professional advice. Previous studies have demonstrated acceptable validity and reliability of MARS-5 across various chronic disease populations, supporting its application in adherence research.

Indonesia has experienced a continuous increase in the number of patients requiring maintenance hemodialysis, largely associated with the growing prevalence of diabetes mellitus and hypertension (Hustrini et al., 2025). This increasing demand has created challenges for healthcare providers in ensuring sustainable renal replacement therapy and optimizing long-term medication management. Although several Indonesian studies have examined adherence to dietary restrictions, fluid management, and dialysis attendance, evidence specifically describing medication adherence profiles among maintenance hemodialysis patients remains limited (Safitri & Rahardjoputro, 2026).

Furthermore, differences in healthcare infrastructure, pharmaceutical services, socioeconomic conditions, and cultural characteristics may influence medication-taking behaviors; therefore, evidence generated from other countries cannot always be directly generalized to Indonesian clinical settings.

The increasing number of patients receiving maintenance hemodialysis highlights the importance of systematic evaluation of medication adherence as part of patient-centered pharmaceutical care. However, baseline information regarding medication adherence among hemodialysis patients in this hospital remains unavailable. Understanding the medication adherence profile within this healthcare setting may assist clinicians, pharmacists, and nurses in identifying patients at risk of non-adherence and developing targeted interventions, including medication counseling, adherence monitoring, and individualized education programs. Therefore, this study aimed to describe the medication adherence profile among patients undergoing maintenance hemodialysis at a referral hospital, Surakarta, using the Medication Adherence Report Scale-5 (MARS-5). The findings are expected to provide baseline evidence for strengthening pharmaceutical care services and improving long-term CKD management.

METHOD

This study employed a descriptive cross-sectional design to describe the medication adherence profile among patients undergoing maintenance hemodialysis at a referral hospital in Surakarta, Indonesia. This design was selected because it enables the assessment of medication adherence characteristics within a specific population at a particular period without examining causal relationships between variables (Pahleviannur et al., 2023). The study was conducted from August to December 2025 in the Hemodialysis Unit at a referral hospital in Central Java providing specialized renal replacement therapy services for patients with chronic kidney disease (CKD). The study population consisted of adult patients with CKD receiving routine maintenance hemodialysis during the study period. The study population was dynamic. Although 130 patients were registered at the study site, not all attended scheduled follow-up visits during the one-month study period. Therefore, consecutive sampling was used, whereby all eligible patients who met the inclusion criteria were recruited consecutively throughout the data collection period. A total of 47 patients were included in the final analysis. The inclusion criteria were patients aged ≥ 18 years, diagnosed with CKD, undergoing maintenance hemodialysis for at least six months, receiving hemodialysis at least twice weekly according to the prescribed treatment schedule, able to communicate effectively in Indonesian, and willing to participate by providing written informed consent. Patients were excluded if they experienced acute medical instability, had severe cognitive impairment or psychiatric disorders affecting communication, or were unable to complete the questionnaire. Medication adherence was assessed using the Medication Adherence Report Scale-5 (MARS-5), a validated self-report instrument used to evaluate medication-taking behaviors among patients with chronic diseases (Pahleviannur et al., 2023). The MARS-5 consists of five items scored on a five-point Likert scale from 1 (always) to 5 (never), with total scores ranging from 5–25; higher scores indicate better medication adherence. In this study, the MARS-5 was administered to 47 respondents and demonstrated good validity, with Corrected Item-Total Correlation values ranging from 0.639–0.944, and excellent reliability, with a Cronbach's Alpha of 0.944.

A structured socio-demographic questionnaire was administered to collect participants' characteristics, including age, sex, educational attainment, and employment status. Data collection was conducted during routine hemodialysis sessions, during which participants completed the questionnaires under the supervision of trained researchers to ensure standardized administration. Researchers provided clarification only when participants had difficulty understanding questionnaire items and refrained from influencing their responses. Completed questionnaires were reviewed for completeness, coded using anonymous identification numbers, and securely stored to maintain participant confidentiality. Data were analyzed using IBM SPSS Statistics version 27

through descriptive statistical methods. Categorical variables were presented as frequencies and percentages, whereas continuous variables were summarized using means and standard deviations where appropriate. Medication adherence was assessed using the Medication Adherence Report Scale-5 (MARS-5), and adherence levels were categorized to describe medication-taking behavior among maintenance hemodialysis patients. As the objective of this study was to describe the profile of medication adherence, no inferential statistical analyses were performed. Ethical approval was obtained from the Health Research Ethics Committee of Dr. Moewardi Regional General Hospital (Ethical Clearance No. 2.622/XII/HREC/2025) prior to data collection. All participants provided written informed consent before enrollment, and all research procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki to ensure the protection of participants' rights, privacy, dignity, and safety.

RESULT

Respondent Characteristics

A total of 47 maintenance hemodialysis patients participated in this study and completed the study questionnaire. All respondents fulfilled the inclusion criteria and were included in the final analysis, resulting in a response rate of 100%. The demographic and clinical characteristics of the respondents are presented in Table 1, including age, gender, educational level, employment status, economic status, duration of hemodialysis, and medication administration process. These characteristics provide a general overview of the study population and describe the background of patients undergoing maintenance hemodialysis at a referral hospital in Surakarta.

Table 1.

Demographic and Clinical Characteristics of Respondents (n = 47)

Variable	Category	f	%
Age (years)	18–44	9	19.1
	45–60	31	66.0
	>60	7	14.9
Gender	Male	26	55.3
	Female	21	44.7
Educational Level	Elementary School	14	29.8
	Junior High School	10	21.3
	Senior High School	16	34.0
	Diploma/Bachelor (D3/D4/S1)	7	14.9
Employment Status	Employed	9	19.1
	Unemployed	38	80.9
Economic Status	< Solo Regional Minimum Wage	35	74.5
	= Solo Regional Minimum Wage	1	2.1
	> Solo Regional Minimum Wage	11	23.4
Duration of Hemodialysis	<12 months	8	17.0
	12–36 months	37	78.7
	>36 months	2	4.3
Medication Administration Process	Self-administered	12	25.5
	Family-assisted	31	66.0
	Self-administered and family-assisted	4	8.5

Table 1, the respondents' ages ranged from 18 to 73 years. The largest proportion of respondents belonged to the 45–60-year age group, accounting for 66.0% (n = 31) of the study population. Respondents aged 18–44 years represented 19.1% (n = 9), while those aged over 60 years accounted for 14.9% (n = 7). Regarding gender distribution, the majority of respondents were male (55.3%, n = 26), whereas female respondents accounted for 44.7% (n = 21), indicating a slightly higher proportion of male patients undergoing hemodialysis in this study. In terms of educational attainment, Senior High School was the most frequently reported educational level, comprising 34.0% (n = 16) of respondents. This was followed by Elementary School (29.8%, n = 14), Junior High School (21.3%, n = 10), and Diploma/Bachelor degree (D3/D4/S1) (14.9%, n = 7). Regarding employment status, the majority of respondents were unemployed (80.9%, n = 38), while only 19.1% (n = 9) were employed. Similarly, most respondents reported having an income below the

Solo Regional Minimum Wage, accounting for 74.5% (n = 35). Meanwhile, 23.4% (n = 11) reported an income above the regional minimum wage, and only 2.1% (n = 1) had an income equivalent to the regional minimum wage.

The duration of maintenance hemodialysis varied among respondents. Most respondents had undergone hemodialysis therapy for 12–36 months, accounting for 78.7% (n = 37) of the study population. Respondents receiving hemodialysis for less than 12 months represented 17.0% (n = 8), while only 4.3% (n = 2) had undergone hemodialysis for more than 36 months. Regarding medication administration processes, the majority of respondents reported receiving assistance from family members in taking their medications (66.0%, n = 31). In comparison, 25.5% (n = 12) managed their medications independently, while 8.5% (n = 4) used both self-administration and family assistance. These findings provide an overview of the sociodemographic and clinical characteristics of hemodialysis patients included in this study and serve as an important foundation for further analysis of medication adherence outcomes.

Medication Adherence Profile

Medication adherence among maintenance hemodialysis patients was evaluated using the Medication Adherence Report Scale-5 (MARS-5). The instrument measures patients' self-reported medication-taking behavior and categorizes adherence into three levels based on the total MARS-5 score: high adherence, moderate adherence, and non-adherence. The distribution of medication adherence among the respondents is presented in Table 2.

Table 2.

Medication Adherence Profile Among Maintenance Hemodialysis Patients (n = 47)

Variable	Category	f	%
Medication Adherence	High adherence	28	59.6
	Moderate adherence	16	34.0
	Non-adherent	3	6.4

Table 2, more than half of the respondents (59.6%, n = 28) demonstrated high medication adherence, making it the most frequently observed adherence category in this study. A total of 16 respondents (34.0%) were classified as having moderate medication adherence, indicating that they generally followed their prescribed medication regimen but may still have experienced occasional difficulties or inconsistencies in medication-taking behavior. Meanwhile, only 3 respondents (6.4%) were categorized as non-adherent, representing the smallest proportion of the study population. When the adherence categories were combined, 44 respondents (93.6%) were classified within the high and moderate adherence groups, whereas only 6.4% (n = 3) were categorized as non-adherent. This distribution demonstrates that medication adherence was generally well maintained among hemodialysis patients included in this study. The proportion of patients with high adherence exceeded those with moderate adherence by 25.6 percentage points, indicating that high adherence was the predominant medication-taking pattern among the respondents. The medication adherence profile presented in this study provides an overview of self-reported medication-taking behavior among hemodialysis patients receiving treatment at a referral hospital in Surakarta. The findings illustrate the distribution of adherence levels across the study population and establish the baseline adherence profile for subsequent analyses. These descriptive results summarize the prevalence of each adherence category without inferring causal relationships or identifying factors associated with medication adherence, as such analyses require further statistical evaluation.

DISCUSSION

The present study demonstrated that the majority of maintenance hemodialysis patients at a referral hospital in Surakarta, exhibited high medication adherence (59.6%, n = 28), followed by moderate adherence (34.0%, n = 16) and non-adherence (6.4%, n = 3). These findings indicate that most respondents reported favorable medication-taking behavior despite the complexity of long-term pharmacological management required among patients with end-stage kidney disease. Patients

undergoing maintenance hemodialysis commonly require multiple medications to control various complications, including anemia, hypertension, chronic kidney disease–mineral and bone disorder (CKD-MBD), electrolyte imbalance, and cardiovascular-related conditions. The complexity of medication regimens may increase treatment burden and create challenges in maintaining consistent adherence. Previous studies have emphasized that medication adherence represents an important component of chronic kidney disease management because inadequate adherence may reduce treatment effectiveness and contribute to unfavorable clinical outcomes (Mirzaei-Alavijeh et al., 2023). Therefore, the predominance of high adherence observed in this study suggests that medication-taking behavior among the studied population was generally favorable.

The high proportion of patients with good medication adherence observed in this study may be related to the continuous interaction between patients and healthcare professionals during routine hemodialysis sessions. Patients receiving maintenance hemodialysis usually visit dialysis units several times per week, providing repeated opportunities for physicians, nurses, and pharmacists to deliver medication education, reinforce treatment recommendations, and monitor potential medication-related problems. Such regular healthcare contact may improve patients' understanding of their treatment regimen and support long-term adherence behavior (Situmorang et al., 2024). Previous research has reported that medication adherence among hemodialysis patients varies across healthcare settings due to differences in patient characteristics, healthcare accessibility, social support systems, and measurement approaches (Lina et al., 2025; Religioni et al., 2025). Thus, the relatively favorable adherence profile found in this study should be interpreted within the clinical context of patients receiving structured care at a referral hospital in Surakarta.

Although only a small proportion of respondents were categorized as non-adherent (6.4%), this finding remains clinically relevant. Even a limited number of patients with poor adherence may experience difficulties in achieving optimal disease management. Maintenance hemodialysis patients often face multiple barriers, including high pill burden, frequent medication changes, treatment fatigue, physical symptoms, and psychological stress associated with chronic illness. Previous studies have indicated that medication non-adherence among patients with end-stage kidney disease is associated with poorer disease control, increased hospitalization risk, and reduced treatment outcomes. In addition, symptom burden and patients' perceptions regarding medication necessity and concerns may influence adherence behavior (Cardol et al., 2022). Therefore, continuous medication adherence monitoring remains essential to identify patients requiring additional education and individualized support.

The sociodemographic characteristics of respondents provide additional context for interpreting medication adherence patterns. Most respondents in this study were aged 45–60 years (66.0%), representing the largest age group among maintenance hemodialysis patients. Middle-aged patients may have sufficient cognitive and functional abilities to participate actively in medication management; however, they may also experience increasing disease burden and treatment responsibilities. Medication adherence is a complex behavior influenced not only by age but also by health literacy, psychological condition, disease understanding, and available support systems. Therefore, demographic factors should be considered together with clinical and social factors when evaluating adherence behavior.

In this study, male respondents represented a slightly higher proportion than female respondents (55.3% vs. 44.7%). Differences in medication adherence based on gender have been inconsistently reported in previous studies, suggesting that gender alone may not determine adherence behavior. Instead, adherence is likely influenced by multiple interacting factors, including treatment perception, social support, healthcare communication, and individual coping strategies. Similarly, although most respondents had Senior High School education (34.0%), educational attainment

alone may not directly predict adherence because patients require continuous and understandable health information to effectively manage complex treatment regimens.

The socioeconomic characteristics of respondents showed that most patients were unemployed (80.9%) and had an income below the Solo Regional Minimum Wage (74.5%). Low socioeconomic status may potentially create challenges in managing chronic disease, including transportation costs, nutritional requirements, and medication-related expenses. However, despite these socioeconomic limitations, most respondents demonstrated high medication adherence. This finding may reflect the contribution of healthcare support provided through routine hemodialysis services and the involvement of family members in medication management. Previous studies have highlighted that socioeconomic conditions should be considered in adherence interventions because financial constraints may influence access to healthcare resources and self-management capacity.

The duration of hemodialysis therapy also provides important insight into medication adherence behavior. Most respondents had undergone maintenance hemodialysis for 12–36 months (78.7%), indicating that the majority had developed experience with long-term dialysis management. Patients with longer treatment experience may become more familiar with medication schedules, dialysis routines, and disease self-management strategies. However, prolonged treatment may also increase psychological burden, treatment fatigue, and medication burden, potentially affecting adherence over time. Previous research has suggested that the relationship between dialysis duration and medication adherence is multifactorial and influenced by clinical, psychological, and social conditions rather than treatment duration alone (Sułkowski et al., 2025).

An important finding in this study was that most respondents received family assistance in taking their medications (66.0%). Family support appears to play an important role in maintaining medication adherence among patients undergoing maintenance hemodialysis. Family members may assist patients through medication reminders, preparation of medications, accompaniment during healthcare visits, and emotional encouragement. Previous studies have demonstrated that stronger family and social support are associated with better medication adherence and improved self-management among patients with chronic kidney disease. Family-centered care approaches may therefore represent an important strategy to strengthen adherence and improve long-term treatment outcomes (Huang et al., 2024). Furthermore, collaboration between patients, families, physicians, nurses, and pharmacists, supported by validated adherence assessment instruments such as the MARS-5, may facilitate early identification of patients requiring additional intervention (Cardol et al., 2022).

The medication adherence pattern identified in this study provides important insight into the management of patients undergoing maintenance hemodialysis. Medication adherence is an essential component of long-term treatment, particularly because these patients often require multiple medications and complex therapeutic regimens. Although the majority of respondents demonstrated high medication adherence, the presence of patients with moderate or poor adherence indicates that medication-taking behavior remains an important aspect requiring attention. Medication adherence may also be related to broader treatment outcomes and quality of life, which can be influenced by various clinical, psychological, and social factors (Hoang et al., 2022; Mailani et al., 2024). Therefore, further analytical studies are needed to examine the relationship between medication adherence and quality of life among maintenance hemodialysis patients.

The findings of this study also have several implications for clinical practice. Although 59.6% of respondents demonstrated high medication adherence, 34.0% had moderate adherence and 6.4% were categorized as non-adherent, indicating that 40.4% of respondents may require additional support. Routine assessment of medication adherence using validated instruments, combined with medication counseling, patient education, medication reviews, and pharmacist involvement, may

help identify adherence problems and improve medication management. Previous evidence has also indicated that pharmacist-led interventions, including motivational interviewing and medication review, may help improve medication adherence and reduce medication-related problems among hemodialysis patients (Paneerselvam et al., 2024, 2025). Family involvement may also be considered, particularly for patients who experience difficulties in maintaining consistent medication-taking behavior.

This study has several limitations. The cross-sectional descriptive design limits the ability to determine causal relationships between patient characteristics and medication adherence. In addition, the use of self-reported medication adherence may be subject to recall bias and social desirability bias, as respondents may report medication-taking behaviors that differ from their actual practices. The relatively small sample size and single-center setting may also limit the generalizability of the findings to other maintenance hemodialysis populations. Future studies should involve larger samples, multicenter settings, and longitudinal designs to identify factors associated with medication adherence and to evaluate interventions aimed at improving adherence, quality of life, and clinical outcomes among maintenance hemodialysis patients.

CONCLUSION

This study provides an overview of medication adherence among maintenance hemodialysis patients at a referral hospital in Surakarta. The findings demonstrated that the majority of respondents exhibited high medication adherence (59.6%), followed by moderate adherence (34.0%), while only a small proportion were categorized as non-adherent (6.4%). These results indicate that medication-taking behavior among the studied population was generally favorable despite the complexity of long-term pharmacological therapy required for patients undergoing maintenance hemodialysis.

The study population was predominantly characterized by patients aged 45–60 years, male gender, Senior High School education level, unemployment status, income below the Solo Regional Minimum Wage, and a hemodialysis duration of 12–36 months. Furthermore, most respondents received family assistance in managing their medications, highlighting the potential importance of family involvement in supporting long-term medication management. Although the overall adherence profile was favorable, the presence of patients with moderate and poor adherence indicates the need for continuous monitoring and targeted interventions. Routine medication adherence assessment, patient education, medication counseling, and family-centered support strategies should be integrated into comprehensive hemodialysis care to optimize treatment outcomes. Future analytical and longitudinal studies with larger populations are recommended to identify determinants of medication adherence and evaluate interventions aimed at improving adherence, quality of life, and clinical outcomes among maintenance hemodialysis patients.

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