



Received on 09 January 2025; received in revised form, 20 May 2025; accepted, 22 May 2025; published 01 June 2025

IMPACT OF PHARMACIST INTERVENTION IN ENHANCING MEDICATION ADHERENCE AMONG HEMODIALYSIS PATIENTS

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Keywords:

Chronic kidney disease, Hemodialysis, Medication adherence, Pharmacist-led intervention, Patient education, Polypharmacy, Medication knowledge

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ABSTRACT: Background: Chronic Kidney Disease (CKD) is a progressive condition associated with high rates of morbidity and mortality, often leading to end-stage renal disease (ESRD), cardiovascular events, and a reduced quality of life. Effective medication adherence is critical for preventing adverse outcomes and improving long-term survival. **Objective:** The primary objective of this study was to assess the effectiveness of a pharmacist-led patient education program in improving medication adherence and enhancing medication knowledge in hemodialysis patients. Secondary objectives included examining the relationship between adherence and demographic factors. **Methods:** A prospective interventional study was conducted on 109 hemodialysis patients. Medication adherence was assessed using the General Medication Adherence Scale (GMAS), and patient medication knowledge was evaluated through the Patient Medication Knowledge Assessment (PMKA). Statistical analysis was performed to evaluate the significance of changes in adherence and knowledge. **Results:** Among the 109 participants, the pharmacist-led intervention resulted in a highly significant improvement in medication adherence, as measured by GMAS ($p < 0.001$). Patient knowledge, assessed through PMKA, also showed a statistically significant increase ($p < 0.001$). However, no significant correlation was found between occupational status and adherence ($p = 0.326$). **Conclusion:** This study demonstrates that a pharmacist-led patient education program significantly improves medication adherence and knowledge among hemodialysis patients. The findings suggest that integrating pharmacists into the multidisciplinary care team for CKD patients can optimize medication management and improve long-term health outcomes.

INTRODUCTION: Chronic Kidney Disease (CKD) is a significant global health concern, with millions affected worldwide ¹. This condition often leads to serious complications such as kidney failure, cardiovascular disease, and premature death, placing immense pressure on healthcare systems. The kidneys play a vital role in filtering waste and eliminating medications and their byproducts from the body.

In patients with CKD, impaired kidney function disrupts this process, leading to altered drug metabolism and excretion, which increases the risk of adverse drug reactions, particularly in the elderly population ². These patients are especially vulnerable to drug-related complications due to age-related physiological changes, making careful management of medications essential.

Hemodialysis, a life-saving treatment for end-stage renal disease (ESRD), helps address the severe imbalances caused by CKD, including fluid overload, electrolyte disturbances, and metabolic acidosis ³. However, CKD patients, especially those on hemodialysis, often suffer from a variety of comorbidities, including hypertension, diabetes,

QUICK RESPONSE CODE  DOI link: https://doi.org/10.13040/IJPSR.0975-8232.16(6).1711-16	DOI: 10.13040/IJPSR.0975-8232.16(6).1711-16 This article can be accessed online on www.ijpsr.com
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anemia, and infections, which require complex treatment regimens. Managing these conditions effectively demands the use of multiple medications, creating a significant challenge known as polypharmacy⁴.

This, in turn, raises the risk of medication errors, adverse effects, and non-adherence. Pharmacists play a crucial role in managing CKD patients' medication regimens. Their expertise in pharmacotherapy allows them to optimize treatment, resolve drug-related problems, and provide essential education to patients about their medications⁵. By ensuring appropriate medication use, pharmacists can help reduce the risk of adverse drug events and improve overall treatment outcomes. Beyond dispensing medications, pharmacists actively monitor patient progress, adjust drug dosages according to kidney function, and collaborate with other healthcare providers to achieve therapeutic goals⁶.

Despite the critical role of pharmacotherapy in managing CKD, medication adherence remains a major challenge, especially for patients on hemodialysis. Factors such as high pill burden, regimen complexity, unpleasant side effects, and forgetfulness often contribute to poor adherence. Socioeconomic challenges, limited access to healthcare, and low health literacy further complicate the situation⁷. Many patients struggle to fully understand the importance of medication adherence, which leads to suboptimal clinical outcomes and an increased risk of hospitalization. Addressing these barriers is essential for improving patient outcomes⁸.

MATERIALS AND METHODS: A prospective interventional study was carried out after obtaining Institutional Human Ethics Committee approval (PSG/IHEC/2024Appr/FB/020).A total of 109 patients who aged 18 years and older, receiving hemodialysis for at least six months and willing to participate in the study were included after obtaining informed consent. The sample size was calculated based on RAO software with a 5% margin of error and a 95% confidence interval. A data collection form was used to gather relevant demographic and clinical information. The General Medication Adherence Scale (GMAS) questionnaire and the Patient Medication

Knowledge Assessment (PMKA) questionnaire were administered to evaluate medication adherence levels and patient knowledge. Statistical analysis was performed using SPSS version 25.0.

RESULTS:
Demographics Data of Study Participants: While assessing demographic data **Table 1**, the study population had a diverse age range with 61% over 60 years and 21% aged between40 to 59.65%). Out of 109 participants, the majority were males (65%). Education levels of study participants were varied, with 28% completed primary and tertiary education each. Occupation status showed majority were self-employed and working in private sector. hypertension was the common comorbidity found in study population whereas diabetes, anemia and CAD were the other leading comorbidities found in study population. The majority of study participants were prescribed with 4-10 medications.

TABLE 1: DEMOGRAPHIC AND CLINICAL CHARACTERISTICS OF THE STUDY PARTICIPANTS	
Variables	Number (Percentage)
Age (Years)	
19-39	20 (18)
40-59	23 (21)
Above 60	66 (61)
Gender	
Male	71 (65)
Female	38 (35)
Level of Education	
No formal education	2 (2)
Primary education	31 (28)
Secondary education	18 (17)
Post secondary education	27 (25)
Tertiary education	31 (28)
Occupation	
Government sector	15 (14)
Private sector	31 (28)
Self employed	32 (29)
Unemployed	23 (21)
Retired	8 (7)
Co-morbidities	
Hypertension	105 (96)
Diabetes	58 (53)
Anemia	44 (40)
Hyperlipidemic disease	18 (17)
CAD	30 (28)
Thyroid disorders	16 (15)
Pulmonary disorders	31 (28)
Number of Medications Per Prescription	
4 to 10	76 (70)
More than 10	33 (30)

Assessment of Medication Adherence: Medication adherence was assessed using GMAS questionnaires during initial and follow-up **Table 2**. During initial 21 participants had poor adherence score, while in follow up number of patients was decreased to 15. Similarly, number of patients in low adherence and partial adherence were dropped significantly from 30 to 11 and 26 to 19 respectively. Notably, participants with good adherence increased from 24 to 30 and dramatic rise from 8 to 34 participants in high adherence. This overall improvement in adherence was statistically significant with a p-value of less than 0.001.

Assessment of Medication Knowledge using PMKA Scale: While assessing patient medication knowledge using PMKA Scale, there was a significant improvement during follow up **Table 2**. Initially, 62 participants had poor knowledge about their medication, which dropped dramatically to 28 during follow-up. Whereas, the number of patients with good knowledge increased slightly from 34 to 38. There was increase in number of participants (13 to 43) in the excellent knowledge score, this shows a notable change due to patient counselling. This improvement was statistically significant, with a p-value of less than 0.001, indicating a real and substantial improvement in patient understanding.

TABLE 2: COMPARISON OF MEDICATION ADHERENCE AND KNOWLEDGE SCORES BEFORE AND AFTER PHARMACIST INTERVENTION

Scoring	No of Population (N=109)		Percentage (%) of the Population		P-value (p<0.05)
	Initial	Follow UP	Initial	Follow UP	
General Medication Adherence					
Poor (less than 10)	21	15	19.26	13.76	<0.001
Low (11 to 16)	30	11	27.52	10.09	
Partial (17 to 26)	26	19	23.85	17.43	
Good (27 to 29)	24	30	22.01	27.52	
High (30 to 33)	8	34	0.73	31.19	
Patient Medication Knowledge Assessment					
Poor (0 to 5)	62	28	56.88	25.68	<0.001
Good (5 to 7)	34	38	31.19	34.86	
Excellent (7 to 10)	13	43	11.92	39.44	

Influence of Variables on Medication Adherence: The study examined the relationship between the level of medication adherence and variables such as education, occupation, and number of medications prescribed **Table 3**. Education level influences adherence rate with significant p-value of <0.001. However, occupation

did not significantly affect adherence, indicated by a p-value of 0.326. Patients prescribed 4 to 10 medications had higher adherence scores (p<0.001) compared to those on more than 10 medications, which highlighting the impact of medication complexity on adherence.

TABLE 3: ASSOCIATION OF EDUCATION, OCCUPATION, AND NUMBER OF MEDICATIONS WITH MEDICATION ADHERENCE SCORES

Medication Adherence Scores		
Variables	Gmas Score	P value (p<0.05)
Level of Education		
No formal education	21	<0.001
Primary education	30	
Secondary education	26	
Post secondary education	24	
Tertiary education	8	
Occupation		
Government sector	21	0.326
Private sector	30	
Self employed	26	
Unemployed	24	
Retired	8	
Number of Medications Per Prescription		
4 to 10	31	<0.001
More than 10	23	

DISCUSSION: Our study, included 109 patients, comprised 71 male patients and 38 female patients, indicating a higher occurrence of the condition among men. This gender difference might be attributable to biological, environmental, or behavioural factors that influence health outcomes. In patients with chronic kidney disease (CKD), the decline in kidney function tends to progress more rapidly in men than in women, regardless of differences in blood pressure or cholesterol levels. Apart from inherent genetic differences in kidney structure and function between the sexes, sex hormones may play a direct role in influencing the mechanisms involved in the progression of kidney disease⁹. Majority of the study population were over 60 years of age. This age distribution suggests that CKD prevalence increases with advancing age, as aging is a well-known risk factor due to natural declines in kidney function, the presence of comorbidities, and prolonged exposure to risk factors. These findings underscore the need for targeted interventions in older population¹⁰.

On examining the education levels of the patients, majority had completed primary education, and tertiary education. A notable population had post-secondary education, while a few had no formal education. Educational attainment can affect health literacy, disease management, and access to healthcare, particularly in chronic conditions like CKD. Patients with higher education levels may be more knowledgeable about their health and better equipped to manage their condition, while those with lower education levels may face greater challenges in accessing and understanding healthcare, potentially leading to poor outcomes¹¹.

In terms of employment status, the largest group of patients was self-employed, followed by population working in the private sector. Unemployment affected majority of the patients, and some were retired. Employment status can influence a patient's ability to access healthcare, obtain insurance, and afford necessary treatments, which is especially relevant for chronic conditions like CKD. Those who are self-employed or unemployed may encounter more barriers to consistent healthcare access. Retired or unemployed individuals could be at higher risk due to reduced income and age-related health challenges¹². This data consistent with the other studies, where largest proportion of

patients were self-employed followed by those working in the private sector and unemployment being prevalent^{13, 14}.

Hypertension being the most common comorbid, followed by diabetes and anaemia. These are primary causes of CKD, while anaemia and cardiovascular disease add further complexity to patient care, heightening morbidity and mortality risks¹⁵. Polypharmacy was common among the study population. The majority of patients prescribed 4 to 10 medications, and a notable population prescribed with more than 10 medications. Careful management of medications and regular reviews are essential to minimize risks and optimize treatment outcomes for these patients¹⁶. The patterns observed regarding polypharmacy in CKD patients closely mirror those reported in similar studies, reinforcing the importance of medication management in this population^{17, 18}. Our findings suggests that polypharmacy may negatively affect medication adherence, likely due to the complexity, side effects, and burden of managing numerous medications. Reducing the number of medications could possibly improve adherence, particularly in managing chronic conditions like CKD and among patients undergoing hemodialysis¹⁹.

The most patients had low or partial adherence and knowledge before counselling, whereas a significant increase in knowledge and adherence were observed after pharmacist intervention. Patient education is crucial in CKD which significantly improves patients' understanding of their medication, treatment adherence, better disease management, and overall health outcomes^(19, 20). Medication adherence score was compared across age groups and revealed significant differences. Younger patients exhibited the highest adherence score compared to other age groups. Factors such as cognitive decline and the complexity of medication regimens in older patients may contribute to lower adherence rates²⁰. The relationship between education level and medication adherence represented a statistically significant difference. Patients with no formal education had lowest adherence scores, while those with tertiary education achieved highest score. These results highlight the impact of education on health literacy and medication adherence,

emphasizing the need for tailored interventions for patients with lower education levels²¹. Regarding occupational status and medication adherence, there was no statistically significant difference found among the groups. Despite variations in adherence across occupational groups, the results suggest that occupation may not be a major determinant of medication adherence in this study²². Finally, the study revealed a statistically significant difference between the number of medications prescribed and GMAS scores. Patients taking 4 to 10 medications had higher adherence scores compared to those on more than 10 medications. This finding suggests that polypharmacy may negatively affect medication adherence, likely due to the complexity, side effects, and burden of managing numerous medications. Reducing the number of medications where possible could improve adherence, particularly in managing chronic conditions like CKD and among patients undergoing hemodialysis^{23, 24}.

CONCLUSION: In conclusion, our study highlights several important factors influencing the management of chronic kidney disease (CKD), including gender, age, education, employment status, comorbidities, and polypharmacy. The findings indicate a higher prevalence of CKD among male and older patients, with aging being a significant risk factor. Education emerged as a critical determinant of medication adherence and health literacy, with higher educational attainment linked to better self-management and outcomes. While occupation did not significantly impact adherence, comorbid conditions such as hypertension, diabetes, cardiovascular diseases and complicated treatment regimens were prevalent.

Polypharmacy, though necessary for managing multiple conditions, posed challenges to adherence, especially for patients taking more than 10 medications. However, targeted interventions like patient education, counselling, and regular follow-ups significantly improved both medication adherence and knowledge. These interventions were particularly effective across age and education groups, underscoring their importance in chronic disease management. The study emphasizes the need for tailored healthcare strategies, particularly for older, less-educated, and polypharmacy

patients, to optimize treatment adherence and better outcomes in CKD. By addressing these key factors, healthcare providers can improve patient care and mitigate the progression of CKD, ultimately enhancing quality of life for hemodialysis patients.

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How to cite this article:

Subadradevi J, Priyadharshini SC, Jafferson SAS and John JV: Impact of pharmacist intervention in enhancing medication adherence among hemodialysis patients. Int J Pharm Sci & Res 2025; 16(6): 1711-16. doi: 10.13040/IJPSR.0975-8232.16(6).1711-16.

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