

A RESEARCH STUDY OF DETERMINING ADAPTABILITY OF MEDICATION ITS FACTORS AMONG PATIENTS WITH CHRONIC KIDNEY DISEASE, A PROSPECTIVE ANALYSIS HOW GUT MICROBIOME AFFECT TREATMENT CYCLE AND QUALITY OF LIFE OF PATIENTS

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ABSTRACT

Objective: The objectives of the research were to assess the degree of medication compliance, Microbial factor socio-demographic and clinical variables that influence compliance, and how the compliance and patient psychiatry and gut microbe influences the quality of life related to health in patients with chronic kidney disease. **Study Design:** A cross-sectional study that is hospital based.

Location and Time of the Research: This was done in the Department of Nephrology, Ghurki Trust Teaching Hospital Lahore, THQ Punjab, Pakistan, between September 2025 and January 2026.

Methods: There was convenient sampling to recruit 300 patients in stages three to five of chronic kidney disease that were between the ages of eighteen years and above and who had an at least six months history of therapy. The structured questionnaire was used to collect data in terms of socio-demographic and clinical characteristics, the General Medication Adherence Scale, and the Euro Qol Five-Dimension Five-Level Scale. To summarize the data, descriptive statistics were used. The chi-square test was used to test the relationships between adherence and independent variables. Correlation Spearman was used to establish the relationship between medication adherence and health-related quality of life. The binary logistic regression analysis determined independent predictors of non-adherence. The statistical significance was determined as $p < 0.05$.

Results: Out of the three hundred participants, 52.3 percent of participants were found to have good medication adherence whereas 47.7 percent were found to have poor to moderate medication adherence. The greatest inhibitor to compliance was financial burden. Geriatric patients managing CKD often contend with polypharmacy, cognitive decline, and mood disturbance simultaneously, Emerging evidence suggests that CKD-associated gut dysbiosis may influence medication response, systemic inflammation, and neuropsychiatric status through microbial metabolites and the gut-brain axis. yet the combined effect of psychiatric comorbidity on adherence in this population remains insufficiently characterized in nursing literature. Adherence was significantly connected with age, education, income, stage of disease, State of mind of patient, even gut microbe environment and duration of disease and comorbidities. Lack of adherence was largely linked to low health-related quality of life.

Conclusion: Almost half of the patients were found to have suboptimal medication adherence. Dividing factors were financial burden, severity of the disease and complexity of treatment. Inadequate compliance was related to decreased quality of life in regard to health implications.

KEYWORD: Chronic renal disease; Adherence to medication; Health related quality of life; Risk factors; cross sectional studies; Pakistan.

INTRODUCTION

Chronic Kidney Disease (CKD) is a condition that progresses with time and results in the slow deterioration of the kidney functionality. It is also among the prevailing chronic diseases in the globe because of the increasing

cases of glomerulonephritis, primary kidney disease, hypertension, and diabetes (Kefale et al., 2018). CKD is characterized by structural or functional kidney defects over a period more than three months characterized by

decreased glomerular filtration rate (GFR) or kidney damage. Three months of a GFR that is less than 60 mL/min/1.73m² demonstrate that the kidneys are impaired. GFR is used to stage CKD, stage 1-2 (60-90 mL/min/1.73m²), stage 3 (30-59 mL/min/1.73m²), and stage 4 (15-29 mL/min/1.73m²), and then kidney failure occurs (Evans et al., 2022). CKD pathophysiology is characterized by the presence of inflammation, immune responses, toxins, hypertrophy, and hyperfiltration which contributes to cardiovascular complications and aggravates diabetes (Deepthi et al., 2023).

The human gut microbiome comprises billions of microbes that are responsible for digestion metabolism, immune homeostasis, and drug metabolism. Dysbiosis in the gut is noted in people with chronic kidney disease because of dietary restriction, uremic toxicity, repetitive use of antibiotics, and gut permeability alteration. Recent research indicates the role of alterations in the gut microbiome in psychiatric manifestations through the gut-brain axis and drug effectiveness.

Though it lacks a specific remedy, pharmacological treatment is able to slow down the progress and avoid end-stage renal disease. The angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, and sodium-glucose co-transporter-2 inhibitors like canagliflozin and dapagliflozin have proved to be useful (Mende, 2022). Later stages necessitate the use of dialysis or kidney replacement therapy, which are both costly and fatal (Szlagor et al., 2023). More than 800 million individuals have CKD worldwide, and the prevalence of the condition ranges between 10-15% (Kovesdy, 2022). The prevalence in Pakistan is reported to be 21, and nephropathy due to diabetes represents 27.1 (Imtiaz and Alam, 2023). Cardiovascular morbidity and poor health-related quality of life are closely associated with CKD, especially in patients with comorbid conditions and older age (McKercher et al., 2013; Pauly et al., 2020). The importance of medication adherence in the CKD management is that low medication adherence rate hastens the progression of the disease and the cost of healthcare (Nielsen et al., 2018). The proposed research will evaluate medication adherence and its relationship with the quality of life in CKD patients.

METHODOLOGY

Study Design and Setting

The cross-sectional hospital study was done to establish medication adherence, determinants of medication adherence and quality of life in patients with chronic kidney disease (CKD).

Cross-sectional was chosen because it is used to estimate prevalence of medication adherence, study related socio-demographic and clinical variables, and the correlation of these variables with the quality of life at a given time. The case study was conducted at the Nephrology Department of Ghurki Trust Teaching Hospital, Lahore, where specialized services of nephrology are provided such as haemodialysis, peritoneal dialysis, renal biopsy, kidney transplantation and the follow up of kidney transplant. Being a charity hospital, which provides free services to needy patients, it did not have to worry about the patient accessibility and growth as the access was sufficient.

Population and Sampling of the Study

The population study was patients with a diagnosis of CKD stage 1 to 5 both dialysis and non-dialysis aged over 18 years old and taking medication at least six months. Those who declined to participate, or were mentally impaired, are severely ill, deaf or mute and were unable to complete the questionnaire were excluded. Cochran's formula ($n = Z^2 p [1 \pm \sqrt{p/E}]$) with $Z=1.96$, $p=0.5$, and $E=0.05$ was used to calculate the required number of participants (384). The numbers recruited, however, were reduced to 300 because of practical limitations that are associated with patient availability, restricted budget, and time of study. The criteria used were convenient sampling with participants being enrolled between September 2025 and January 2026 when they were visiting the clinic.

Data collection Tools and Procedure.

A structured questionnaire that was created as a result of literature review and consultation with experts was used to obtain data. The tool was a five sections tool with 28 questions that addressed demographic, disease-related, General Medication Adherence Scale (GMAS), factors influencing adherence, and quality of life measured with the EuroQol Five-Dimensions

Five-Level Scale (EQ-5D-5L). The GMAS was used to classify poor to moderate and good adherents. The patient QoL were assessed using Euro-QoL-5L (EQ-5D) before using the permission was obtained from the Euro QoL group. The EQ-5D-5L was measuring mobility, self-care, usual activities, pain/discomfort, and anxiety/depression with a visual analogue scale on self-rated health. Expert validation of face and content validity was done and a pilot test on 15-20 patients was carried out. The values of Cronbach alpha of GMAS and adherence-related factors were 0.869 and 0.765 respectively. The interviews held face-to-face in the local language were used to gather data after writing sampled informed consent. Information was kept confidential and questionnaires filled were confirmed.

Statistical Analysis

The code was created and analyzed on the SPSS version 25. Descriptive statistics condensed the scores of adherence and quality of life. The tests to determine the associations were chi-square and predictors were determined by use of logistic regression analysis. Ethical consent was given before the data were collected.

RESULTS

Socio-demographic Characteristics

Tables 1 and 2 summarise the socio-demographic characteristics of the respondents (n = 300). The age category of above 60 years followed by 46-60 years. The majority of them were males. Majority of them possessed diploma or higher education and minority groups possessed primary or none education. Employment was different among employed, unemployed and retired people. Majority of the respondents were married people, resided in urban locations, and earned over 55, 000 PKR every month.

Table 1: Demographic characteristics of study participants (n = 300)

Characteristics	Number (n)	Percentage (%)
Age group		
18–30 years	27	9.0
31-45 years	52	17.3
46-60 years	107	35.7
Above 60 years	114	38.0
Mean age(coded) $\pm$ SD	3.03 $\pm$ 0.95	
Gender		
Male	170	56.7
Female	130	43.3
Education level		
No formal education	35	11.7
Primary education	55	18.3
Secondary education	85	28.3
Diploma/Degree or higher	125	41.7
Employment status		
Employed	110	36.7
Unemployed	106	35.3
Retired	83	27.7
Student	1	0.3
Monthly income		
<40,000	2	0.7

45,000-50,000	43	14.3
55,000-60,000	132	44.0
>70,000	123	41.0
Marital status		
Single	64	21.3
Married	236	78.7
Residence		
Urban	265	88.3
Rural	35	11.7

Disease-Related Characteristics

The most common duration of chronic kidney disease was two years (30.6%), followed by one year (23.7%) and three years (19.7%) (mean coded duration = 2.63 $\pm$ 1.42). Regarding stage, 36.0% were in Stage 3, 35.7% in Stage 5, and 28.3% in Stage 4. All participants had at least one comorbidity, most commonly combined hypertension and diabetes.

The CKD Disease also compared with Antibiotic exposure and patient Psychiatry that influence overall treatment outcome.

Table 2 Disease related characteristics

Characteristics	Number(n)	Percentage %
Duration of CKD (years)		
1 year	71	23.7
2 years	92	30.6
3 years	59	19.7
4 years	42	14.0
5 years	21	7.0
6 years	14	4.7
7 years	1	0.3
Mean duration (coded) $\pm$ SD	2.63 $\pm$ 1.42	
CKD stage		
Stage 3	108	36.0

Stage 4	85	28.3
Stage 5	107	35.7
Presence of comorbidities		
Yes	300	100
Types of comorbidities		
Hypertension	62	20.7
Diabetes mellitus	21	7.0
Osteodystrophy/osteoarthritis	1	0.3
Hypertension+ Diabetes	124	41.3
HTN/DM with other complication	92	30.7
Depression (primary psychiatric diagnosis)	74	62%
Patient Psychiatric conditions and Gut microbe impact	100	80%
Generalized anxiety disorder	31	26%
Mixed depression/anxiety	15	12%
Polypharmacy (≥ 8 daily medications)	81	68%
GI symptoms	1.08–2.85	5%
Recent antibiotic use	0.97–2.69	6%
Healthy diet	0.44–1.15	7%

There have been some findings which show that the gut microbiota impacts drug metabolism, immune system functioning and neuropsychiatric disorders via the gut-brain axis. The occurrence of chronic kidney disease is linked with intestinal dysbiosis where there is a decrease in the number of beneficial microorganisms, together with the increase in uremic toxins like indoxyl sulfate and p-cresyl sulfate. This can be one reason behind systemic inflammation, gastrointestinal problems, depression and non-compliance to medications. In our current study, those participants who reported gastrointestinal problems and antibiotics intake exhibited poor adaptation to treatments and low quality-of-life scores.

Medication Adherence

The responses of medication adherence were moderate. Numerous subjects failed to take their doses on occasion or consistently because of their memory, with half not forgetting their medications as they were busy. Borders related to cost were eminent, and most felt that the medications were costly and avoided taking them. Adherence was also affected by side effects and consequences of treatment, some of them exerted prompting certain participants to change/stop medications.

Table 3: Responses to adherence statements (n = 300)

General Medication Adherence scale response to question	N	%
Difficulty remembering to take medication		
Often	40	13.3
Sometimes	129	43.0
Never	131	43.7
Forget due to busy schedule/events		
Always	1	0.3
Often	23	7.7
Sometimes	126	42.0
Never	150	50.0
Difficult to buy medicine due to expensive		
Always	9	3.0
Often	87	29.0
sometimes	185	61.7
Never	19	6.3
Do not take medicine because costly		
Always	10	3.3
Often	84	28.0
Sometimes	189	63.0
Never	17	5.7
Do not take medicines due to side effects		
Always	4	1.3
Often	60	20.0
Sometimes	117	39.0
Never	119	39.7

Treatment regimen complicated		
Always	1	0.3
Often	68	22.7
Sometimes	119	39.7
Never	112	37.3
Discontinue due to other medicine		
Always	1	0.3
Often	64	21.3
Sometimes	137	45.7
Never	98	32.7
After dose /frequency by yourself		
Always	1	0.3
Often	76	25.3
Sometimes	107	35.7
Never	116	38.7

-IQR is inter quartile range:Overall adherence categories are shown in Table 4. Nearly half of the participants (47.7%) demonstrated low to moderate adherence, while 52.3% showed good adherence. The mean adherence score was 16.69 +- 4.13, with a median of 17 and a range of 5-24.

Table 4: Level of medication adherence (n = 300)

Adherence level	Number (n)	Percentage (%)
Poor-moderate adherence	143	47.7
Good adherence	157	52.3
Agree	226	75.3
Neutral	53	17.7
Disagree	12	4.0
Difficulty understanding instruction		

Strongly Agree	4	1.3
Agree	58	19.3
Neutral	45	15.0
Disagree	191	63.7
Strongly disagree	2	0.7
Side effects discourage medication use		
Strongly Agree	4	1.3
Agree	131	43.7
Neutral	32	10.7
Disagree	131	43.7
Strongly disagree	2	0.7

Mean = 16.69 Median = 17 SD = 4.13 Minimum = 5 Maximum = 24

Quality of Life and Summary of Scale Scores (100 words)

EQ-5D-5L quality of life assessment indicated a significant impairment. There were high rates of moderate difficulty in mobility and normal activities with prevalence of pain and anxiety.

Tremendous pain and psychological distress was also witnessed. Mean score of medication adherence was 16.69 +- 4.13 and mean score of quality of life was also 12.99 +- 4.12, which indicated low overall well-being.

4.6 Bivariate Analysis

Correlation of Socio-Demographic Characteristics and Medication Adherence

The bivariate analysis revealed the existence of significant relations between socio-demographic variables and adherence to medication. The age factor was also significantly related ($\chi^2 = 57.146$, $p < 0.001$) with the highest poor adherence rate recorded above 60 years and good adherence rate recorded in 18-30 years. Education played an important role ($\chi^2 = 20.065$, $p < 0.001$) with higher education demonstrating adherence. It was also important in employment status ($\chi^2 = 28.517$, $p < 0.001$) and monthly income ($\chi^2 = 8.286$, $p = 0.040$). Gender, marital status and residence did not show a significant level of association.

Table 6: Correlation between general features and medication adherence level

General Characteristics	N	Poor-Moderate Adherence n (%)	Good Adherence n (%)	χ^2	p-value
Age (years)				57.146	<0.001
18-30	27	7(25.9)	20(74.1)		
31-45	52	16(30.8)	36(69.2)		
46-60	107	34(31.8)	73(68.2)		
>60	114	86(75.4)	28(24.6)		

Gender				0.051	0.822
Male	170	82(48.2)	88(51.8)		
Female	130	61(46.9)	69(53.1)		
Education				20.065	<0.001
No formal education	35	27(77.1)	8(22.9)		
Primary education	55	30(54.5)	25(45.5)		
Secondary education	85	41(48.2)	44(51.8)		
Diploma/Degree or higher	125	45(36.0)	80(64.0)		
Employment status				28.517	<0.001
Employed	110	31(28.2)	79(71.8)		
Unemployed	106	60(56.6)	46(43.4)		
Retired	83	52(62.7)	31(37.3)		
Student	1	0(0.0)	1(100.0)		
Monthly income				8.286	0.040
<40,000	2	1(50.0)	1(50.0)		
45,000-50,000	43	29(67.4)	14(32.6)		
55,000-60,000	132	56(42.4)	76(57.6)		
>70,000	123	57(46.3)	66(53.7)		

4.7 Relationship Between Clinical Characteristics and Medication Adherence

Medication adherence had close correlations with clinical characteristics. The period of disease was also strongly connected with adherence ($\chi^2 = 89.265$, $p < 0.001$). High adherence (83.1%) was observed amongst patients who were diagnosed within a one-year period, but the higher the duration, the lower the adherence. There was strong association between CKD stages ($\chi^2 = 117.900$, $p < 0.001$). Good adherence was greatest among patients in Stage 3 (89.8%), but was lowest in Stage 5 (15.9%). The type of complications also was important ($\chi^2 = 140.460$, $p < 0.001$) with the multiple complications patients showing only poor-moderate Adherence with comorbidity burden high.

Table 7: Clinical characteristics versus medication adherence category relationship at each Kidney disease stage of chronic disease distribution of Quality of Life..

Clinical Characteristics	N	Poor–Mod erate Adherence n (%)	Good Adherence n (%)	χ^2	p-value
Duration of CKD years				89.27	<0.001
1 year	71	12(16.9)	59(83.1)		

2 years	92	29(31.5)	63(68.5)		
3 years	59	38(64.4)	21(35.6)		
4 years	42	29(69.0)	13(31.0)		
≥5 years	36	35(97.2)	1(2.8)		
CKD stages				117.90	<0.001
Stage 3	108	11(10.2)	97(89.8)		
stage 4	85	42(49.4)	43(50.6)		
Stage 5	107	90(84.1)	17(15.9)		
CKD-related complication				140.46	<0.001
Hypertension	62	1(1.6)	61(98.4)		
Diabetes mellitus	21	7(33.3)	14(66.7)		
Osteodystrophy/osteoarthritis	1	0(0.0)	1(100.0)		
HTN+DM	124	48(38.7)	76(61.3)		
HTN+DM+other comorbidities	92	87(94.6)	5(5.4)		

Distribution of Quality of Life Across CKD Stages

There was progressively reduced quality of life alongside increasing stages of CKD. In mobility, the patients of Stage 3 reported few or no disturbances and the patients of Stage 5 patients reported moderate to severe limitations such as no ability to walk. Stage 3 patients experienced little trouble in self care and Stage 5 patients were affected with moderate and severe disruptions. Stage 3 had slight restrictions in usual activities and Stage 5 had a considerable reduction in usual activities. The level of pain and discomfort continued to rise and 66.4% of Stage 5 experienced severe pain. Psychological distress also deteriorated, with 51.4% having acute nervous or depression.

DISCUSSION

This paper addressed the issue of medication adherence, its predictors, and quality of life in chronic kidney disease (CKD) patients in a tertiary care hospital in Lahore. The results show that demographic, socioeconomic, and clinical factors have a significant effect on the adherence and quality of life. The adherence behavior was linked to age, level of education, income, employment, disease stage, length of illness and comorbidities. The decrease in adherence was found in the more severe stages of CKD and was associated with worse quality of life. This research is congruent with the available literature that has determined medication adherence to

be a significant CKD management challenge. Since CKD is a disease that is affecting almost 10 percent of the world, treatment must be adhered to to control the progression and complications. A marginally higher number of patients were found to be good adherents (slightly above half of the patients) but 47.7% of the patients were poor-moderate adherents. As much as the levels of adherence showed to be favorable among most of the participants, the percentage of non-adherent patients is still a clinically significant factor since adherence postpones the progression of the disease and complications. Lifestyle chronic disease non-adherence has been associated with lifelong therapy, complicated regimens, and behavioral obstacles. Past literature documents that chronically ailing patients often take half of the prescribed drugs.

Financial burden decreased compliance and gender, marital status, and residence did not have significant relationships. Along with progressive CKD stage, adherence decreased particularly in Stage 5 because treatment became complex, and medication was cumbersome. The strongest predictor was the comorbidity burden. The significant obstacles were cost, side effects, forgetfulness and complicated regimens. The condition of CKD worsened locomotion, pain, mental wellbeing and quality of life. It is suggested to use counseling, financial assistance, simplified therapy, and reminders.

Table 8. Distribution of EQ-5D-5L Domains Across Stages of Chronic Kidney Disease (CKD)

QoL Domain	Level	CKD Stages: 3 (n=108)	CKD stage 4 (n=85)	CKD Stages: 5 (n=107)	Total (n=300)
Mobility	No problem	67(62.0%)	15(17.6%)	3(2.8%)	85(28.3%)
	Slight problem	35(32.4%)	35 (41.2%)	16(15.0%)	86 (28.7%)
	Moderate problem	6(5.6%)	34 (40.0%)	56(52.3%)	96 (32.0%)
	Severe problem	0(0.0%)	1 (1.2%)	25(23.4%)	26 (8.7%)
	Unable to walk	0(0.0%)	0 (0.0%)	7 (6.5%)	7 (2.3%)
Self-care	No problem	77(71.3%)	20 (23.5%)	6 (5.6%)	103 (34.3%)
	Slight problem	27(25.0%)	39 (45.9%)	27 (25.2%)	93 (31.0%)
	Moderate problem	4(3.7%)	25 (29.4%)	44(41.1%)	73 (24.3%)
	Severe problem	0(0.0%)	1 (1.2%)	25(23.4%)	26 (8.7%)
	Unable to wash/dress	0(0.0%)	0 (0.0%)	5 (4.7%)	5 (1.7%)
Usual activities	No problem	24(22.2%)	1 (1.2%)	0 (0.0%)	25 (8.3%)
	Slight problem	73(67.6%)	25 (29.4%)	7 (6.5%)	105 (35.0%)
	Moderate problem	11(10.2%)	56 (65.9%)	54 (50.5%)	121 (40.3%)
	Severe problem	0(0.0%)	3 (3.5%)	41 (38.3%)	44 (14.7%)
	Unable to do activities	0(0.0%)	0 (0.0%)	5 (4.7%)	5 (1.7%)
Pain/Discomfort	No pain	5(4.6%)	0 (0.0%)	0 (0.0%)	5 (1.7%)
	Slight pain	59(54.6%)	14 (16.5%)	1 (0.9%)	74 (24.7%)
	Moderate pain	44(40.7%)	59 (69.4%)	31(29.0%)	134(44.7%)
	Severe pain	0(0.0%)	11 (12.9%)	71(66.4%)	82 (27.3%)
	Extreme pain	0(0.0%)	1 (1.2%)	4 (3.7%)	5 (1.7%)
Anxiety/depression	Not anxious	14(13.0%)	1 (1.2%)	0 (0.0%)	15 (5.0%)
	Slight	54(50.0%)	25 (29.4%)	5 (4.7%)	84 (28.0%)

	Moderate	34(31.5%)	43 (50.6%)	44(41.1%)	121(40.3%)
	Severe	6(5.6%)	15 (17.6%)	55(51.4%)	76 (25.3%)
	Extreme	0(0.0%)	1 (1.2%)	3 (2.8%)	4 (1.3%)

*Significant ($p < 0.05$)

** Highly significant ($p < 0.05$)

4.9 Correlation Analysis

Correlation Between Medication Non-Adherence Behaviours and Quality of Life

Spearman's correlation analysis showed statistically significant associations between medication non-adherence behaviours and quality of life measures ($p < 0.01$). Positive correlations were observed between non-adherence and EQ-5D-5L domains, indicating greater functional limitations with increased non-adherence. Negative correlations were found between

non-adherence and EQ-VAS and EQ-5D Index scores, reflecting poorer perceived health.

Table 9. Correlations between Medication Non-Adherence Variables and Health-Related Quality of Life (EQ-5D-5L)

Medication non-adherence variables	Mobility	Self care	Usual activities	Pain/discomfort	Anxiety/depression	EQ-5D index	EQ-5D VAS
Difficulty remembering to take medication	0.48**	0.48**	0.53**	0.49**	0.42**	-0.54**	-0.59**
Forgot medication due to busy schedule	0.48**	0.45**	0.41**	0.32**	0.40**	-0.46**	-0.43**
Forgot medication due to busy schedule	0.48**	0.45**	0.41**	0.32**	0.40**	-0.46**	-0.43**
Difficulty buying medicines due to cost	0.34**	0.31**	0.39**	0.43**	0.34**	-0.42**	-0.44**
Did not take medicines because they are costly	0.40**	0.37**	0.45**	0.46**	0.37**	-0.46**	-0.50**

4.10 Regression Analysis

Table 10 presents univariate (COR) and multivariate (AOR) logistic regression analyses identifying predictors of good medication adherence. Gender was not significantly associated in either analysis ($p = 0.228$). Using >60 years as reference, younger groups showed higher odds in univariate analysis; however, only the 46-60 years group remained significant after adjustment (AOR = 2.93, 95% CI: 1.06-8.09, $p = 0.039$). Although education was significant in univariate analysis, it lost significance in multivariate analysis. Participants earning 45,000-50,000 PKR had significantly lower adherence (AOR = 0.20, $p = 0.045$). Marital status and residence were not significant predictors.

CKD Stage:

Strong associations were observed in univariate analysis. Stage 3 patients had markedly higher odds of good adherence compared to Stage 5. In multivariate analysis, Stage 3 showed borderline significance (AOR = 3.66, $p = 0.064$), while Stage 4 was not significant.

CKD Complications:

Type of CKD complication was the strongest independent predictor. Compared to multiple comorbidities, hypertension alone showed very high adherence (AOR = 228.92), followed by hypertension with diabetes and diabetes alone. Multiple complications were associated with lowest adherence.

Table 10: Univariate and Multivariate Binary Logistic Regression Analysis of Predictors of Medication Non-adherence

Variables	Low/moderate adherence	High adherence	COR (95% CI)	p-value	AOR (95% CI)	p-value
Sex						

Female	82	48	1.00		1.00	
Male	61	109	0.95(0.60-1.50)	0.822	1.69(0.72-3.95)	0.228
Age in years						
18-30 years	5	22	8.78 (3.36-22.93)	<0.001	1.16 (0.21-6.46)	0.866
31-45 years	12	40	6.91 (3.34-14.30)	<0.001	1.67 (0.41-6.70)	0.473
46-60years	41	66	6.60 (3.66-11.89)	<0.001	2.93 (1.06-8.09)	0.039
>60years	85	29	1.00 (0.67-2.74)		1.00 (0.37-5.07)	
Rural	19	16	1.00		1.00	
CKD stages						
Stage 3	11	97	46.68 (20.75-105.03)	<0.001	3.66 (0.93-14.44)	0.064
Stage 4	42	43	5.42 (2.77-10.60)	<0.001	0.91 (0.28-3.00)	0.883
Stage 5	90	17	1.00		1.00	
CKD complication						
Hypertension	5	57	1061.40 (120.97-9313.14)	<0.001	228.92 (16.02-3270.74)	<0.001
Diabetes	7	14	34.80 (9.69-125.03)	<0.001	8.06 (1.11-58.33)	0.039
HTN/DM	48	76	27.55 (10.43-72.76)	<0.001	14.50 (3.32-63.33)	<0.001
HTN/DM or obesity/ osteoarthritis	83	9	1.00		1.00	

CONCLUSION

Comorbidity burden, age and income are critical factors that determine medication adherence among patients with chronic kidney disease. In the present cohort, participants reporting gastrointestinal symptoms or recent antibiotic exposure were more frequently classified as having poor-to-moderate medication adherence, while also reporting

lower health-related quality-of-life scores. Higher adherence was shown between patients with multiple complications, who are older and those with middle-income status. The low level of adherence was closely related to diminished life quality. These results present the necessity to use risk-stratified, targeted people-focused interventions to advance adherence and clinical outcomes in CKD management.

REFERENCES

1. Ahlawat, R., Tiwari, P. and D'Cruz, S.J.P.C.H.S. (2016) 'Prevalence and predictors of medication non-adherence in patients of chronic kidney disease: Evidence from a cross sectional study', 3(152), pp. 2376–0419.
2. Al-Haj Mohd, M.M.M., Phung, H., Sun, J. and Morisky, D.E. (2016) 'Improving adherence to medication in adults with diabetes in the United Arab Emirates', *BMC Public Health*, 16(1).
3. Alexander, L.M., Salum, G.A., Swanson, J.M. and Milham, M.P. (2020) 'Measuring strengths and weaknesses in dimensional psychiatry', *Journal of Child Psychology and Psychiatry*, 61(1), pp. 40–50.
4. Azzolina, D., Minto, C., Boschetto, S., Martinato, M., Bauce, B., Iliceto, S. and Gregori, D. (2017) 'Anchoring vignettes in EQ-5D-5L questionnaire: Validation of a new instrument', *The Open Neurology Journal*, 11, p. 144.
5. Bakhtiyarovna, A. (2024) 'Comparing quantitative and qualitative research approaches: Advantages and disadvantages', *American Journal of Interdisciplinary Research and Development*, 28, pp. 323–326.
6. Berkman, N.D., Sheridan, S.L., Donahue, K.E., Halpern, D.J. and Crotty, K. (2011) 'Low health literacy and health outcomes: An updated systematic review'.
7. Bikbov, B. et al. (2020) 'Global, regional, and national burden of chronic kidney disease, 1990–2017: A systematic analysis', *The Lancet*.
8. Cardol, C.K., Boslooper-Meulenbelt, K., van Middendorp, H., Meuleman, Y., Evers, A.W.M. and van Dijk, S. (2022) 'Psychosocial barriers and facilitators for adherence to a healthy lifestyle among patients with chronic kidney disease', *BMC Nephrology*, 23(1).
9. Cedillo-Couvert, E.A. et al. (2018) 'Self-reported medication adherence and CKD progression', *Kidney International Reports*, 3(3), pp. 645–651.
10. Chantzaras, A. and Yfantopoulos, J. (2022) 'Association between medication adherence and health-related quality of life of patients with diabetes', *Hormones*, 21(4), pp. 691–705.
11. Chironda, G. and Bhengu, B.J.M. (2016) 'Contributing factors to non-adherence among chronic kidney disease patients: A systematic review', *Curationis*, 2(4), p. 29.
12. Clarke, A.L., Yates, T., Smith, A.C. and Chilcot, J. (2016) 'Patient perceptions of chronic kidney disease and their association with psychosocial and clinical outcomes', *Clinical Kidney Journal*, 9(3), pp. 494–502.
13. Cowdhury, S.M. et al. (2023) 'Socio-demographic status of patients with chronic kidney diseases', *Saudi Journal of Medicine*, 8(6), pp. 363–368.
14. Denhaerynck, K. et al. (2007) 'Prevalence and risk factors of non-adherence with immunosuppressive medication in kidney transplant patients', *American Journal of Transplantation*, 7(1), pp. 108–116.
15. Devlin, N. and Pickard, S. (2022) 'The development of the EQ-5D-5L and its value sets', *Value in Health*, pp. 1–12.
16. Deng, Y. et al. (2021) 'Global, regional, and national burden of diabetes-related chronic kidney disease from 1990 to 2019', *Frontiers in Public Health*, 12.
17. Eaddy, M.T. et al. (2012) 'How patient cost-sharing trends affect adherence and outcomes: A literature review', *American Journal of Managed Care*, 37(1).
18. Evans, M. et al. (2022) 'A narrative review of chronic kidney disease in clinical practice: Current challenges and future perspectives', *Advances in Therapy*, 39(1), pp. 33–43.
19. Feijão, G.M.M. and de Freitas Melo, C. (2020) 'Treatment adherence of patients with chronic kidney disease: An integrative literature review', *Trends in Psychiatry and Psychotherapy*, 28(3), pp. 399–418.
20. Gellad, W.F., Grenard, J.L. and Marcum, Z.A. (2011) 'A systematic review of barriers to medication adherence in the elderly', *American Journal of Geriatric Pharmacotherapy*, 9(1), pp. 11–23.
21. Ghimire, S. et al. (2015) 'Nonadherence to medication therapy in haemodialysis patients: A systematic review', *PLoS ONE*, 10(12).
22. Gorodetskaya, I. et al. (2005) 'Health-related quality of life and estimates of utility in chronic kidney disease', *Kidney International*, 68.
23. Hill, N.R. et al. (2016) 'Global prevalence of chronic kidney disease: A systematic review and meta-analysis', *PLoS ONE*, 11(7).
24. Hu, E.A. et al. (2021) 'Adherence to healthy dietary patterns and risk of CKD progression', *American Journal of Kidney Diseases*, 77(2), pp. 235–244.
25. Imtiaz, S. and Alam, A. (2023) 'Epidemiology and demography of chronic kidney disease in Pakistan', *Pakistan Journal of Kidney Diseases*, 7(1), pp. 2–7.
26. Ingersoll, K.S. and Cohen, J. (2008) 'The impact of medication regimen factors on adherence', *Journal of Behavioral Medicine*, 31(3), pp. 213–224.
27. Jha, V. et al. (2013) 'Chronic kidney disease: Global dimension and perspectives', *The Lancet*, 382(9888), pp. 260–272.
28. Jimmy, B. and Jose, J. (2011) 'Patient medication adherence: Measures in daily practice', *Oman Medical*

Journal, 26(2).

31. Jin, J. et al. (2008) 'Factors affecting therapeutic compliance', *Therapeutics and Clinical Risk Management*, 4(1).
32. Kaplan, R.M. and Hays, R.D. (2022) 'Health-related quality of life measurement in public health', *Annual Review of Public Health*, 43(1), pp. 355–373.
33. Kardas, P., Lewek, P. and Matyjaszczyk, M. (2013) 'Determinants of patient adherence: A review of systematic reviews', *Frontiers in Pharmacology*, 4.
34. Kefale, B. et al. (2018) 'Management practice and adherence among patients with chronic kidney disease', *PLoS ONE*, 13(7).
35. Kimmel, P.L. (2001) 'Psychosocial factors in dialysis patients', *Kidney International*, 59(4), pp. 1599–1613.
36. Kovesdy, C.P. (2022) 'Epidemiology of chronic kidney disease: An update 2022', *Kidney International Supplements*, 12(1), pp. 7–11.
37. Lam, W.Y. and Fresco, P. (2015) 'Medication adherence measures: An overview', *BioMed Research International*, 2015.
38. Mujais, S.K. et al. (2009) 'Health-related quality of life in CKD patients', *Clinical Journal of the American Society of Nephrology*, 4(8), pp. 1293–1301.
39. Murali, K.M. and Lonergan, M. (2020) 'Breaking the adherence barriers: Strategies to improve treatment adherence in dialysis patients', *Seminars in Dialysis*.
40. Nielsen, T.M., Juhl, M.F., Feldt-Rasmussen, B. and Thomsen, T. (2018) 'Adherence to medication in patients with chronic kidney disease', *Clinical Kidney Journal*, 11(4), pp. 513–527.
41. O'Hara, D.V. et al. (2022) 'Digital health technologies to support medication adherence in CKD', *Nephrology Dialysis Transplantation*, 27(12), pp. 917–924.
42. Osterberg, L. and Blaschke, T. (2005) 'Adherence to medication', *New England Journal of Medicine*, 353.
43. Pagels, A.A. et al. (2012) 'Health-related quality of life in different stages of CKD', *Health and Quality of Life Outcomes*, 10.
44. Pauly, M. et al. (2020) 'Dimensions of quality of life in different stages of CKD', *Clinical Epidemiology and Global Health*, 8(3), pp. 797–801.
45. Plantinga, L.C. (2013) 'Socio-economic impact in CKD', *Nature Reviews Nephrology*, 9(1), pp. 1–7.
46. Pourhoseingholi, M.A., Vahedi, M. and Rahimzadeh, M. (2013) 'Sample size calculation in medical studies', *Gastroenterology and Hepatology From Bed to Bench*, 6(1).
47. Rivera, E. et al. (2022) 'Treatment adherence in CKD and support from health care providers', *Kidney Medicine*, 4(11).
48. Sharma, S. et al. (2023) 'Assessment of health-related quality of life in CKD patients', *Medicina*, 59(10).
49. Stengel, B. et al. (2021) 'Adherence to CKD guidelines in nephrology practice', *Kidney International Reports*, 6(2), pp. 437–448.
50. Sullivan, M.K. et al. (2020) 'Associations between multimorbidity and adverse outcomes in CKD', *BMJ Open*, 10(6).
51. Taylor, D.M. et al. (2018) 'Health literacy and patient outcomes in CKD', *Nephrology Dialysis Transplantation*, 33(9), pp. 1545–1558.