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Evaluating the Impact of Clinical Pharmacist Interventions on Medication Adherence and Clinical Outcomes among Heart Failure Patients in Cardiology Practice

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Abstract

Background: Clinical pharmacist treatments have shown the ability to enhance clinical outcomes and medication adherence in patients with heart failure.

Objective: To evaluate the impact of clinical pharmacist-led interventions on medication adherence and clinical outcomes among heart failure patients in a cardiology practice.

Methodology: This prospective, randomized, interventional study was conducted at the Department of Cardiology, Pakistan Institute of Medical Science (PIMS), Islamabad, from August 2024 to July 2025. The intervention group (n = 110) received systematic clinical pharmacist counseling and follow-up, while the control group (n = 110) received conventional treatment. A total of 220 adult heart failure patients were recruited and randomly allocated to either group. The Morisky Medication Adherence Scale (MMAS-8) was used to measure medication adherence at baseline, three months, and six months. During the 6-month follow-up, clinical

outcomes such as hospitalization frequency and NYHA functional class were tracked. Multivariate logistic regression, independent t-tests, and chi-square tests were used to examine the data.
Results: Baseline characteristics were comparable between groups. At 6 months, 88 patients (80.0%) in the intervention group achieved ≥1-point improvement in MMAS-8 scores compared to 49 patients (44.55%) in the control group ($p < 0.001$). Functional improvement of ≥1 NYHA class was observed in 72 patients (65.45%) versus 41 patients (37.27%) in controls ($p < 0.001$). Hospitalizations occurred in 21 patients (19.09%) in the intervention group and 43 patients (39.09%) in the control group ($p=0.001$). Multivariate analysis identified pharmacist-led intervention, higher baseline adherence, and attendance of ≥3 counseling sessions as significant predictors of improved outcomes.
Conclusion: Clinical pharmacist interventions significantly enhance medication adherence, functional status, and reduce hospitalizations in heart failure patients.

Introduction

The incapacity of the heart to pump enough blood to fulfill the body's metabolic needs is the hallmark of heart failure (HF), a complicated and progressive cardiovascular disease [1]. It affects more than 64 million people globally and contributes significantly to morbidity, death, and healthcare expenses, making it an increasing global health burden [2]. Due to rising incidence of ischemic heart disease, diabetes mellitus, hypertension, and an aging population, heart failure is becoming more common in Pakistan and other developing nations [3]. Pharmacological medication, lifestyle changes, and careful clinical monitoring are all essential components of an effective HF management strategy that aims to stop the disease's development and hospital readmissions [4].

In order to maximize the results of heart failure, medication adherence is essential [5]. Nonetheless, inadequate compliance with recommended medication continues to be a significant obstacle, resulting in inadequate symptom management, recurrent flare-ups, and a rise in hospitalizations [6]. According to studies, complicated medication schedules, poor patient education, side effects, and a lack of knowledge about the disease process are some of the reasons why over half of HF patients show some level of nonadherence [7]. With their specialized interventions to encourage responsible medication use, improve patient education, and increase adherence to evidence-based treatment recommendations, clinical pharmacists are becoming essential members of multidisciplinary cardiology teams in this environment [8].

Medication adherence and clinical outcomes have been shown to be improved by clinical pharmacist treatments, including medication reconciliation, personalized counseling, adverse drug reaction monitoring, and follow-up consultations, for a variety of chronic illnesses [9,10]. Their participation in the treatment of heart failure has shown encouraging outcomes in terms of lowering readmissions to hospitals, boosting quality of life, and improving symptom control [11]. However, despite mounting global evidence in favor of pharmacist-led therapies, these approaches are still neglected in many Pakistani cardiology practices, where little is known about their clinical and practical advantages [12].

In light of this disparity, assessing how clinical pharmacists might enhance medication compliance and clinical results in heart failure patients is crucial for developing multidisciplinary teamwork in cardiac practice and guiding patient-centered care strategies.

Research Objective

To evaluate the impact of clinical pharmacist interventions on medication adherence and clinical outcomes among heart failure patients in cardiology practice.

Methodology

Study Design and Setting

This research was a prospective, randomized, interventional, comparative investigation undertaken at the Department of Cardiology, Pakistan Institute of Medical Science (PIMS), Islamabad. The research was conducted between August 2024 and July 2025. To assess the effect of clinical pharmacist interventions on medication adherence and clinical outcomes, heart failure patients who were seen in both outpatient and inpatient cardiology units were recruited and monitored.

Inclusion and Exclusion Criteria

Adult patients who were 18 years of age or older and had a verified diagnosis of heart failure, as defined by the American Heart Association (AHA) and European Society of Cardiology (ESC), were included in the research. The participants gave written informed permission and agreed to attend follow-up appointments after receiving conventional pharmaceutical treatment for heart failure for at least one month previous to participation. The study excluded patients who had severe comorbidities, such as end-stage renal or hepatic disease or advanced cancer, were pregnant or nursing, had cognitive impairment or psychiatric disorders that affected their ability to understand or manage their medications, or were unwilling or unable to participate in counseling or follow-up evaluations.

Sample Size

A non-probability sequential sampling method was used to enroll 220 patients in total. Utilizing a computer-generated basic randomization sequence, participants were divided into two groups at random. The allocation process was kept secret by utilizing opaque, sealed envelopes. While the control group (n = 110) got conventional cardiology treatment without any extra pharmacist participation, the intervention group (n = 110) received clinical pharmacist-led interventions in addition to routine medical care. Taking into consideration a 15% attrition rate, the sample size was determined to detect a 20% increase in medication adherence (from 50% to 70%) with 80% power and a 5% level of significance.

Clinical Pharmacist Interventions

To maximize medication adherence and therapeutic results, the clinical pharmacist carried out planned, patient-centered interventions. Medication reconciliation, personalized drug administration counseling, adverse effect management, dosage optimization, and education on lifestyle adjustment were some of these treatments. In order to strengthen adherence and address medication-related concerns, follow-up contacts were kept at 1, 3, and 6 months, either in person or over the phone. To provide uniformity and quality control, all interventions were recorded in patient records.

Data Collection

A systematic proforma was used to collect baseline clinical and demographic information, such as age, gender, comorbidities, NYHA class, drug profile, and pertinent laboratory values. The Morisky Medication Adherence Scale (MMAS-8) was used to assess medication adherence at baseline and during follow-up. During the follow-up period, clinical outcomes such as symptom management, NYHA functional class, and hospitalization frequency were tracked.

Follow-up and Outcome Assessment
Following recruitment, participants in both groups were monitored for six months. Clinical outcomes, including changes in NYHA functional class, hospitalization frequency, and overall symptom improvement, were documented at each visit, and adherence was reviewed using MMAS-8 at three and six months. Electronic medical records were used to verify hospitalization data, and trained study personnel blinded to group assignment performed all outcome evaluations. Improved medication adherence was the study's main result, with lower hospitalization rates, an improvement in NYHA class, and improved symptom management as secondary outcomes.

Data Management and Quality Control
Trained research assistants put all obtained data into a password-protected database. To reduce mistakes, regular validation checks and double data input were carried out. In order to maintain the advantages of randomization, missing data were addressed using an intention-to-treat strategy. Throughout the trial period, the research team and clinical pharmacists met on a regular basis to guarantee data integrity and intervention fidelity.

Statistical Analysis
SPSS version 26.0 was used for the analysis of all the data. Whereas categorical data were shown as frequencies and percentages, continuous variables were represented as mean ± standard deviation (SD). Independent t-tests for continuous variables and chi-square tests for categorical variables were used for between-group comparisons. P-values below 0.05 were regarded as statistically significant. To find independent determinants of drug adherence and clinical improvement, multivariate logistic regression analysis was used.

Ethical Approval
The Pakistan Institute of Medical Science (PIMS) in Islamabad's Ethical Review Board examined and approved the research protocol. Prior to enrollment, all individuals provided written informed consent. Throughout the research, patient information was kept private, and all procedures followed the Declaration of Helsinki's ethical guidelines.

Results
At baseline, the intervention (n = 110) and control (n = 110) groups were comparable across demographic and clinical parameters (table 1). The mean age was 59.84 ± 10.23 years in the intervention group and 60.47 ± 9.96 years in controls (p = 0.63). Gender distribution was similar, with males comprising 62.73% vs. 64.55% (p = 0.77). Prevalence of hypertension (75.45% vs. 73.64%, p = 0.75), diabetes mellitus (60.91% vs. 59.09%, p = 0.78), and ischemic heart disease (52.73% vs. 55.45%, p = 0.69) showed no significant differences. Baseline NYHA class (2.83 ± 0.72 vs. 2.87 ± 0.69, p = 0.68), mean number of medications (6.12 ± 1.43 vs. 6.08 ± 1.37, p = 0.84), and MMAS-8 score (5.41 ± 1.09 vs. 5.46 ± 1.12, p = 0.73) were also similar, confirming successful randomization.

Table 1. Baseline Demographic and Clinical Characteristics of Study Participants

Category	Variable	Intervention Group	Control Group	Test Statistic	p-value
Demographic	Age (years,	59.84 ± 10.23	60.47 ±	t = 0.48	0.63

Characteristics	Mean ± SD)		9.96		
	Male, n (%)	69 (62.73)	71 (64.55)	χ^2 = 0.09	0.77
	Female, n (%)	41 (37.27)	39 (35.45)		
Clinical Characteristics	Hypertension, n (%)	83 (75.45)	81 (73.64)	χ^2 = 0.10	0.75
	Diabetes Mellitus, n (%)	67 (60.91)	65 (59.09)	χ^2 = 0.08	0.78
	Ischemic Heart Disease, n (%)	58 (52.73)	61 (55.45)	χ^2 = 0.16	0.69
	Mean NYHA Class (I–IV)	2.83 ± 0.72	2.87 ± 0.69	t = 0.41	0.68
Treatment-Related Characteristics	Average No. of Medications	6.12 ± 1.43	6.08 ± 1.37	t = 0.20	0.84
	Baseline MMAS-8 Score	5.41 ± 1.09	5.46 ± 1.12	t = 0.34	0.73
Note: No statistically significant baseline differences were observed between the two groups ($p > 0.05$)					

Medication adherence improved significantly in the intervention group compared to controls (figure 1). Baseline MMAS-8 scores were 5.41 ± 1.09 vs. 5.46 ± 1.12 ($p = 0.73$). At 3 months, adherence increased to 6.82 ± 0.94 in the intervention group versus 5.78 ± 1.06 in controls ($t = 7.58$, $p < 0.001$), and at 6 months, it reached 7.12 ± 0.81 vs. 5.91 ± 1.08 ($t = 9.86$, $p < 0.001$), demonstrating a marked benefit of pharmacist-led interventions

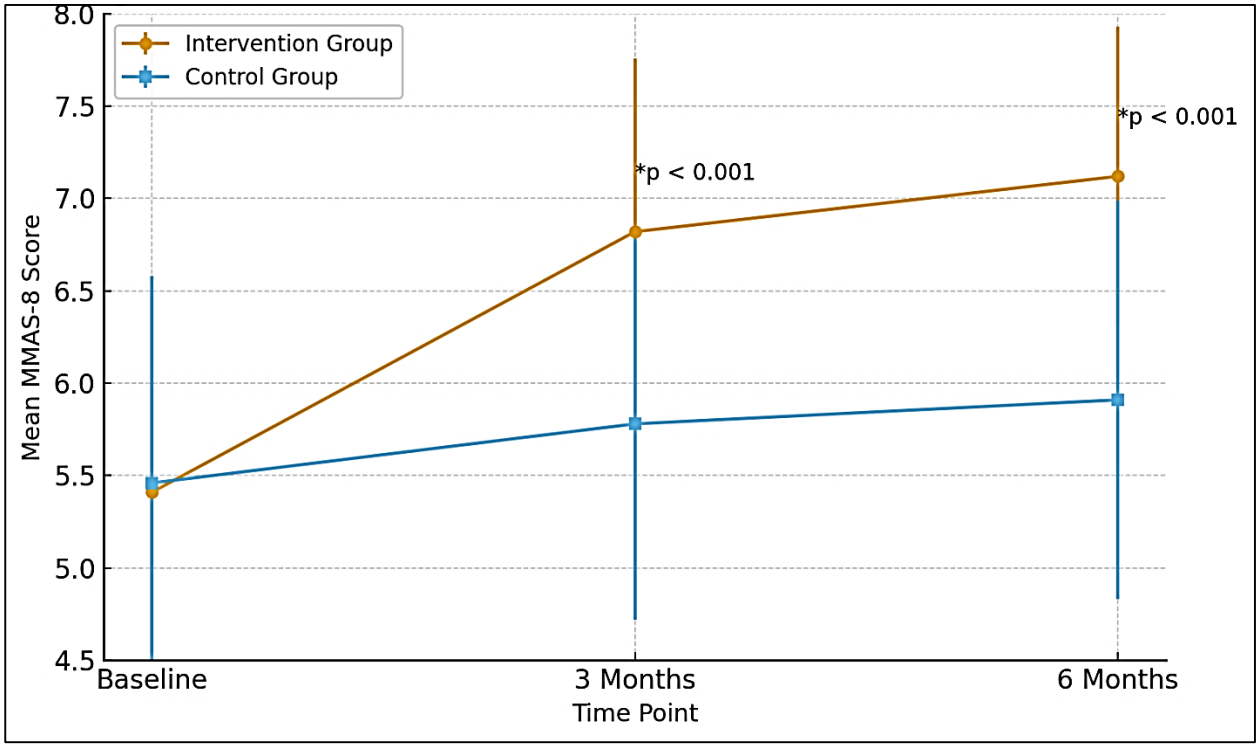


Figure 1. Changes in Medication Adherence (MMAS-8 Scores) at Baseline, 3 Months, and 6 Months

Functional improvement was significantly greater in the intervention group (table 2). At 6 months, 65.45% (n = 72) of intervention patients improved by ≥1 NYHA class compared to 37.27% (n = 41) of controls ($\chi^2 = 17.23$, $p < 0.001$). No change was observed in 29.09% vs. 50.91% ($\chi^2 = 9.49$, $p = 0.002$), and worsening occurred in 5.45% vs. 11.82% ($p = 0.09$), highlighting the positive impact of pharmacist interventions on functional status.

Table 2. Change in NYHA Functional Class from Baseline to 6-Month Follow-Up

NYHA Class Change	Intervention (n = 110)	Control (n = 110)	χ^2-value	p-value
Improved ≥1 Class, n (%)	72 (65.45)	41 (37.27)	17.23	<0.001
No Change, n (%)	32 (29.09)	56 (50.91)	9.49	0.002
Worsened, n (%)	6 (5.45)	13 (11.82)	2.86	0.09
Note: Significant functional improvement was observed in the intervention group.				

Hospitalizations were significantly lower in the intervention group. Only 19.09% (n = 21) of intervention patients were hospitalized versus 39.09% (n = 43) in the control group ($\chi^2 = 10.46$, $p = 0.001$), shown in table 3. Total hospitalizations were 27 vs. 58, with mean hospitalizations per patient of 0.25 ± 0.43 vs. 0.53 ± 0.61 ($t = 3.94$, $p < 0.001$). Average length of stay was shorter in the intervention group (3.41 ± 1.26 days vs. 5.02 ± 1.83 days, $t = 7.21$, $p < 0.001$).

Table 3. Comparison of Hospitalization Frequency During 6-Month Follow-Up

Variable	Intervention (n = 110)	Control (n = 110)	Test Statistic	p-value
Patients Hospitalized, n (%)	21 (19.09%)	43 (39.09%)	$\chi^2 = 10.46$	0.001
Total No. of Hospitalizations	27	58	—	—
Mean Hospitalizations per Patient	0.25 ± 0.43	0.53 ± 0.61	t = 3.94	<0.001
Average Length of Stay (days)	3.41 ± 1.26	5.02 ± 1.83	t = 7.21	<0.001
Note: "Total number of hospitalizations" represents the aggregate count across each group; therefore, no p-value is applicable. Statistical comparisons were performed using mean hospitalizations per patient and proportion of patients hospitalized.				

The primary outcome of MMAS-8 improvement ≥1 point was achieved in 80.00% of intervention patients vs. 44.55% of controls ($\chi^2 = 29.67$, $p < 0.001$), shown in table 4. Secondary outcomes also favored the intervention group, with improved NYHA class in 65.45% vs. 37.27% ($p < 0.001$), reduced hospitalizations in 19.09% vs. 39.09% ($p = 0.001$), and patient-reported symptom improvement in 77.27% vs. 50.91% ($p < 0.001$).

Table 4. Summary of Primary and Secondary Outcomes at 6 Months

Outcome Category	Specific Outcome	Intervention (n = 110)	Control (n = 110)	χ^2-value	p-value
Primary Outcome	MMAS-8 Improvement ≥1 Point, n (%)	88 (80.00)	49 (44.55)	29.67	<0.001
Secondary Outcomes	Improved NYHA Class, n (%)	72 (65.45)	41 (37.27)	17.23	<0.001
	Reduced Hospitalizations, n (%)	21 (19.09)	43 (39.09)	10.46	0.001
	Symptom Improvement (Patient-reported), n (%)	85 (77.27)	56 (50.91)	16.77	<0.001

Independent predictors of improved medication adherence included pharmacist-led intervention (AOR 3.42, 95% CI 1.96–5.96, $p < 0.001$), lower baseline NYHA class (AOR 0.73, $p = 0.03$), higher baseline MMAS-8 score (AOR 1.26, $p = 0.04$), absence of hospitalization during follow-up (AOR 0.48, $p = 0.02$), and attendance of ≥3 counseling sessions (AOR 2.75, $p = 0.001$), shown in table 5. Other variables, including age, gender, comorbidities, and number of medications, were not significant predictors. The model explained 38% of variance in adherence (Nagelkerke $R^2 = 0.38$).

Table 5. Multivariate Logistic Regression Analysis Identifying Independent Predictors of Medication Adherence and Clinical Improvement (n = 220)

Predictor Variable	Adjusted Odds Ratio (AOR)	95% Confidence Interval (CI)	p-value
Pharmacist-led Intervention (Yes vs. No)	3.42	1.96 – 5.96	<0.001
Age (per 10-year increase)	0.84	0.68 – 1.03	0.09
Male Gender (vs. Female)	1.12	0.65 – 1.93	0.68
Hypertension (Yes vs. No)	0.91	0.51 – 1.64	0.76
Diabetes Mellitus (Yes vs. No)	0.79	0.45 – 1.38	0.41
Baseline NYHA Class (per unit increase)	0.73	0.54 – 0.97	0.03*
Baseline MMAS-8 Score (per 1-point increase)	1.26	1.01 – 1.57	0.04*
Number of Medications (per drug increase)	0.89	0.75 – 1.06	0.18
Hospitalization During Follow-up (Yes vs. No)	0.48	0.26 – 0.89	0.02*
Patient Counseling Attendance ≥3 Sessions (Yes vs. No)	2.75	1.52 – 4.98	0.001*

Note: Model Summary: Nagelkerke $R^2 = 0.38$; Hosmer–Lemeshow $p = 0.41$.
Dependent Variable: Improved Medication Adherence (MMAS-8 Score Increase ≥1 Point)
Significant predictors ($p < 0.05$) are marked with an asterisk.

Discussion

The research showed that medication adherence among heart failure patients was considerably enhanced by clinical pharmacist interventions. The intervention and control groups' baseline scores on the MMAS-8 were comparable (5.41 ± 1.09 vs. 5.46 ± 1.12, $p = 0.73$). Nevertheless, after three months, the intervention group's adherence rate rose to 6.82 ± 0.94 from 5.78 ± 1.06 in the control group ($t = 7.58$, $p < 0.001$), and at six months, it was 7.12 ± 0.81 from 5.91 ± 1.08 ($t = 9.86$, $p < 0.001$). These results are consistent with other studies showing that pharmacist-led treatments may improve heart failure patients' adherence to their medication [13,14].

Improvements in functional status were also more noticeable in the intervention group. Compared to 37.27% in the control group, 65.45% of intervention patients had improved by at least one NYHA class at 6 months ($\chi^2 = 17.23$, $p < 0.001$). 29.09% vs. 50.91% showed no change ($\chi^2 = 9.49$, $p = 0.002$), whereas 5.45% vs. 11.82% showed deterioration ($p = 0.09$). This is in line with research that found that pharmacist treatments improved heart failure patients' functional status in a comparable way [15].

The intervention group's hospitalization rates were noticeably reduced. Compared to 39.09% in the control group, only 19.09% of intervention patients were admitted to the hospital ($\chi^2 = 10.46$, $p = 0.001$). The mean hospitalizations per patient were 0.25 ± 0.43 vs. 0.53 ± 0.61, and the total number of hospitalizations was 27 vs. 58 ($t = 3.94$, $p < 0.001$). These findings are consistent with prior research showing that pharmacist interventions lower hospitalization rates among individuals with heart failure [16].

Additionally, the study found independent predictors of better medication adherence, such as attending at least three counseling sessions (AOR 2.75, $p = 0.001$), not being hospitalized during follow-up (AOR 0.48, $p = 0.02$), having a lower baseline NYHA class (AOR 0.73, $p = 0.03$), having a higher baseline MMAS-8 score (AOR 1.26, $p = 0.04$), and having a pharmacist-led intervention (AOR 3.42, 95% CI 1.96–5.96, $p < 0.001$). These results are in line with other studies that found comparable variables affecting heart failure patients' adherence to their treatment [17].

The research concludes by endorsing the inclusion of clinical pharmacists in teams that treat heart failure. The potential advantages of pharmacist-led therapies in this patient population are highlighted by the notable increases in medication adherence, functional status, and hospitalization rates shown in the intervention group. These results add to the increasing amount of data supporting the use of clinical pharmacists in multidisciplinary heart failure patient care teams.

Study Strengths and Limitations

The prospective, randomized design of this trial, which included well-matched intervention and control groups, reduced selection bias and made it possible to clearly evaluate the effects of clinical pharmacist interventions on heart failure outcomes and medication adherence. The reliability of the results was improved by using proven instruments like the MMAS-8 for measuring adherence and objective clinical factors including hospitalization data and NYHA functional class. Accurate result monitoring and prompt reinforcement of therapies were guaranteed by routine follow-up at 1, 3, and 6 months. The single-center scenario is one of the constraints, however, since it could have an impact on the generalizability to different populations or healthcare systems. Potential reporting bias was introduced into the trial since it partially depended on patient self-reporting for adherence and symptom improvement. Furthermore, the six-month follow-up duration could not adequately capture long-term adherence and clinical outcomes, even if it is enough to identify short-term benefits.

Conclusion

The research shows that treatments guided by clinical pharmacists greatly increase medication adherence, improve functional status, and lower hospitalization rates among patients with heart failure. Better symptom management and overall therapeutic results are facilitated by structured counseling and routine clinical pharmacist follow-up. These results demonstrate the vital role that clinical pharmacists play as essential members of multidisciplinary cardiology teams, promoting better therapeutic outcomes and patient care in the treatment of heart failure.

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