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IMPROVING PATIENT OUTCOMES IN DIABETES AND HYPERTENSION: THE ROLE OF PHARMACISTS IN PUBLIC HEALTH PROGRAMS

Original Article

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ABSTRACT

Background: Diabetes and hypertension are leading non-communicable diseases contributing to high morbidity and mortality worldwide. Poor disease control, often due to inadequate medication adherence and fragmented care, increases the risk of complications and hospital readmissions. Pharmacist-led interventions, involving medication optimization, patient education, and continuous monitoring, have demonstrated effectiveness in improving chronic disease outcomes. However, their role in inpatient settings remains underexplored, particularly in secondary care hospitals where healthcare resources are often constrained.

Objective: This study evaluates the impact of integrating pharmacists into chronic disease management programs for patients with type 2 diabetes mellitus (T2DM) and hypertension (HTN) in a secondary care hospital.

Methods: A prospective, interventional study was conducted over 12 months at a secondary care hospital, enrolling 210 patients with T2DM and HTN. A pharmacist was integrated into the healthcare team, providing medication therapy management, patient education, and follow-up care. Clinical parameters, including HbA1c, blood pressure, lipid profile, BMI, and medication adherence, were assessed at baseline and follow-up. Statistical analyses included paired t-tests and chi-square tests, with a significance threshold of $p < 0.05$.

Results: HbA1c levels significantly decreased from 8.5 ± 1.2% to 7.1 ± 1.3% ($p < 0.001$), while the percentage of patients achieving HbA1c <7% increased from 7.6% to 48.9% ($p < 0.001$). Systolic blood pressure reduced from 148 ± 18 mmHg to 135 ± 14 mmHg ($p < 0.001$), and diastolic blood pressure improved from 90 ± 11 mmHg to 85 ± 10 mmHg ($p = 0.002$). LDL cholesterol levels declined from 130 ± 35 mg/dL to 115 ± 28 mg/dL ($p < 0.001$), with target LDL levels achieved by 56.2% of patients ($p = 0.002$). Medication adherence increased by 36% ($p < 0.001$), and hospital readmissions for diabetes- and hypertension-related complications reduced by 22% ($p = 0.004$). Screening completion rates for diabetic foot and retinal exams improved by 39% ($p < 0.001$). Aspirin and ACE/ARB prescriptions increased by 48% and 22%, respectively ($p < 0.001$).

Conclusion: Pharmacist-led interventions significantly improved glycemic control, blood pressure regulation, medication adherence, and preventive care measures in hospitalized patients with diabetes and hypertension. These findings highlight the essential role of pharmacists in optimizing chronic disease management and reinforce the need for their integration into multidisciplinary healthcare teams.

Keywords: Chronic Disease Management, Diabetes Mellitus, Hypertension, Medication Adherence, Patient Education, Pharmacist Interventions, Public Health.

INTRODUCTION

Non-communicable diseases (NCDs), particularly diabetes and hypertension, are among the leading causes of morbidity and mortality worldwide, posing significant challenges to healthcare systems (1). According to the World Health Organization (WHO), NCDs account for approximately 74% of global deaths, with cardiovascular diseases and diabetes being major contributors (2). The increasing prevalence of these chronic conditions places immense pressure on healthcare infrastructure, necessitating more efficient and sustainable management strategies. Effective disease control requires a comprehensive approach encompassing medication adherence, patient education, lifestyle modifications, and continuous follow-up care (3). However, many healthcare systems struggle to achieve optimal disease management due to resource constraints, fragmented care delivery, and an over-reliance on physician-led models, which often lack the necessary support to ensure long-term disease control (4). Additionally, inadequate medication adherence, insufficient patient education, and inconsistent follow-up care further contribute to poor disease management outcomes (5). These challenges are particularly pronounced in secondary care hospitals, where resource limitations hinder the effectiveness of conventional physician-led treatment models in managing complex chronic conditions (6).

Pharmacists, as accessible and highly trained healthcare professionals, are well-positioned to enhance chronic disease management by optimizing medication therapy, providing patient education, and offering continuous monitoring. Their involvement has been associated with improved health outcomes, reduced hospital readmissions, and enhanced medication adherence (7). Evidence from multiple studies supports the efficacy of pharmacist-led interventions in chronic disease care. A meta-analysis demonstrated that pharmacist-led hypertension management programs significantly reduced systolic blood pressure by an average of 7.6 mmHg, highlighting the potential of pharmacists in optimizing therapeutic outcomes (8). Similarly, pharmacist-led interventions in elderly care have been shown to improve overall quality of care and medication safety (9). These programs typically involve medication therapy management (MTM), lifestyle counseling, and close patient monitoring, all of which contribute to better disease control. Furthermore, collaborative care models, in which pharmacists work alongside physicians to manage chronic conditions, have gained increasing recognition as effective strategies for improving patient outcomes (10). Despite strong evidence supporting the benefits of pharmacist-led care, their role in chronic disease management remains underutilized in many healthcare settings (11). Several barriers, including limited professional recognition, inadequate reimbursement policies, and resistance from other healthcare professionals, have hindered the widespread adoption of pharmacist-led models (12). Overcoming these obstacles requires healthcare policy reforms, structural changes, and increased awareness among healthcare providers and policymakers regarding the advantages of integrating pharmacists into chronic disease management. This study aims to evaluate the impact of pharmacist-led interventions in managing hypertension and type 2 diabetes mellitus (T2DM) within a secondary care hospital setting. Specifically, it will assess improvements in glycemic and blood pressure control, medication adherence, and patient monitoring under a pharmacist-integrated model. By systematically analyzing these outcomes, this research will contribute to the growing body of evidence advocating for pharmacist involvement in chronic disease management. The findings may serve as a foundation for policy development and healthcare reforms, ultimately promoting the integration of pharmacists into public health programs to enhance patient-centered care and long-term health outcomes.

METHODS

This prospective, interventional study was conducted at the Internal Medicine Department of Federal General Hospital, Chak Shahzad, Islamabad, over a 12-month period from January 2024 to December 2024. The study aimed to assess the impact of a pharmacist-led intervention on the management of hypertension (HTN) and type 2 diabetes mellitus (T2DM) in hospitalized patients. A single clinical pharmacist was integrated into the multidisciplinary healthcare team through physician-approved collaborative practice agreements, providing medication therapy management, patient education, and structured post-discharge follow-up (13). The required sample size was calculated as 196 patients using the standard formula for estimating proportions, with a 95% confidence interval ($Z = 1.96$), an assumed proportion (p) of 0.5, and a margin of error (d) of 0.07. To account for an anticipated 10% loss to follow-up, the final sample size was adjusted to 210 patients. A non-probability consecutive sampling technique was employed to recruit participants who met the eligibility criteria. Patients were included if they were aged 18 years or older, had a confirmed diagnosis of HTN (BP ≥140/90 mmHg) and/or T2DM (HbA1c ≥6.5%), were admitted to the Internal Medicine Department, and had at least one documented follow-up visit within 90 days post-discharge. Patients were excluded if they were admitted to the intensive care unit (ICU), were pregnant or lactating, or had severe cognitive impairment that prevented active participation in the intervention (14).

The pharmacist-led intervention involved medication therapy management (MTM) through comprehensive prescription reviews, identification and prevention of drug interactions, and therapy optimization in collaboration with physicians. In addition to

pharmacological management, patients received structured education on diet, medication adherence, self-monitoring of blood pressure and glucose levels, and lifestyle modifications. Baseline data were collected at the time of hospital admission, including blood pressure, HbA1c levels, lipid profile, and body mass index (BMI). Upon discharge, the pharmacist facilitated structured medication discharge planning, ensuring patients received a comprehensive medication regimen and appropriate referrals to outpatient clinics for continued monitoring. Patients were followed up at the time of discharge and reassessed after 90 days, with clinical parameters and medication adherence being evaluated (12). For data analysis, patients served as their own controls, with baseline values compared to follow-up measurements. Continuous variables, such as blood pressure, HbA1c, BMI, and lipid levels, were analyzed using paired t-tests, while categorical variables, including the proportion of patients achieving target BP and HbA1c levels, medication adherence (measured using the Morisky Medication Adherence Scale-8 [MMAS-8]), and hospital readmission rates, were analyzed using chi-square tests. A p-value of <0.05 was considered statistically significant (15). Ethical approval for the study was obtained from the institutional ethics committee of Federal General Hospital. Written informed consent was obtained from all participants before enrollment, ensuring their voluntary participation. Confidentiality and privacy of patient data were strictly maintained throughout the study in accordance with ethical guidelines.

RESULTS

A total of 210 patients were enrolled in the study based on the calculated sample size, of whom 138 (65.7%) were female. Among the participants, 172 (81.9%) had both type 2 diabetes mellitus (T2DM) and hypertension (HTN). The mean follow-up duration was 265 ± 132 days. Significant improvements were observed in key clinical parameters following the pharmacist-led intervention. The mean HbA1c level decreased from 8.5 ± 1.2% at baseline to 7.1 ± 1.3% at follow-up ($p < 0.001$). The proportion of patients achieving target HbA1c levels (<7%) increased from 7.6% to 48.9% ($p < 0.001$). Similarly, systolic blood pressure (SBP) improved from 148 ± 18 mmHg to 135 ± 14 mmHg ($p < 0.001$), while diastolic blood pressure (DBP) decreased from 90 ± 11 mmHg to 85 ± 10 mmHg ($p = 0.002$). The percentage of patients achieving blood pressure control (<140/90 mmHg) increased from 23.2% at baseline to 50.2% at follow-up ($p < 0.001$). A significant reduction in low-density lipoprotein (LDL) cholesterol was observed, with levels decreasing from 130 ± 35 mg/dL to 115 ± 28 mg/dL ($p < 0.001$), and the proportion of patients achieving LDL cholesterol targets (<100 mg/dL) increased from 37.2% to 56.2% ($p = 0.002$). However, no statistically significant changes were noted in body mass index (BMI), which showed a slight decrease from 28.7 ± 5.1 kg/m² to 28.2 ± 4.9 kg/m² ($p = 0.082$), and weight remained relatively unchanged.

Medication adherence significantly improved, with the proportion of patients achieving high adherence scores on the Morisky Medication Adherence Scale-8 (MMAS-8) increasing from 42.3% to 78.3% ($p < 0.001$). The readmission rate for diabetes- and hypertension-related complications decreased from 29.5% to 7.5%, reflecting a 22% reduction ($p = 0.004$). Completion rates for essential laboratory tests, including lipid panels, HbA1c, and microalbuminuria screening, increased by 15.8%, while the completion rate for diabetic foot and retinal screenings increased by 39% ($p < 0.001$). Aspirin use increased significantly, from 35.2% at baseline to 83.5% at follow-up ($p < 0.001$). Similarly, prescriptions for angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs) for hypertension management increased from 43.5% to 65.5% ($p < 0.001$). Patients managed under the pharmacist-led intervention were more likely to achieve treatment goals, complete necessary screenings, and receive evidence-based medication therapy, with all key improvements demonstrating statistical significance ($p < 0.001$).

Table 1: Changes in treatment goals and medication use (baseline vs. follow-up)

Outcome Measure	Baseline (%)	Follow-up (%)	p-value
Patients achieving HbA1c <7%	7.6	48.9	< 0.001
Patients achieving BP control <140/90 mmHg	23.2	50.2	< 0.001
Patients achieving LDL cholesterol <100 mg/dL	37.2	56.2	0.002
Aspirin use	35.2	83.5	< 0.001
ACE/ARB use	43.5	65.5	< 0.001

Table 2: Changes in clinical parameters (baseline vs. follow-up)

Clinical Parameter	Baseline (Mean ± SD)	Follow-up (Mean ± SD)	p-value
HbA1c (%)	8.5 ± 1.2	7.1 ± 1.3	< 0.001
Systolic BP (mmHg)	148 ± 18	135 ± 14	< 0.001
Diastolic BP (mmHg)	90 ± 11	85 ± 10	0.002
LDL Cholesterol (mg/dL)	130 ± 35	115 ± 28	< 0.001
BMI (kg/m²)	28.7 ± 5.1	28.2 ± 4.9	0.082

Table 3: Comparison of Medication Adherence, Readmission Rates, and Screening Completion at Baseline and Follow-Up"'s the complete table with baseline and follow-up values

Outcome Measure	Baseline (%)	Follow-up (%)	Change (%)	p-value
High medication adherence (MMAS-8)	42.3	78.3	+36	<0.001
Readmission rates for diabetes & hypertension	29.5	7.5	-22	0.004
Completion rates for laboratory tests	55.5	71.3	+15.8	-
Diabetic foot & retinal screenings	39.2	78.2	+39	<0.001
Aspirin use	35.2	83.5	+48	<0.001
ACE inhibitors/ARBs prescriptions	43.5	65.5	+22	<0.001

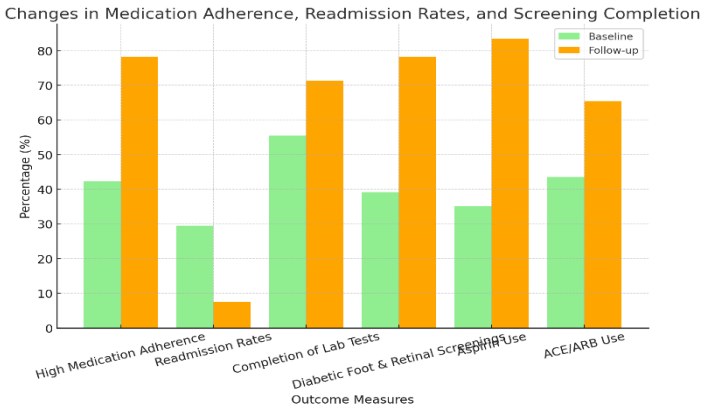

Figure 1 Changes in Medication Adherence, Readmission Rates, and screening Completion

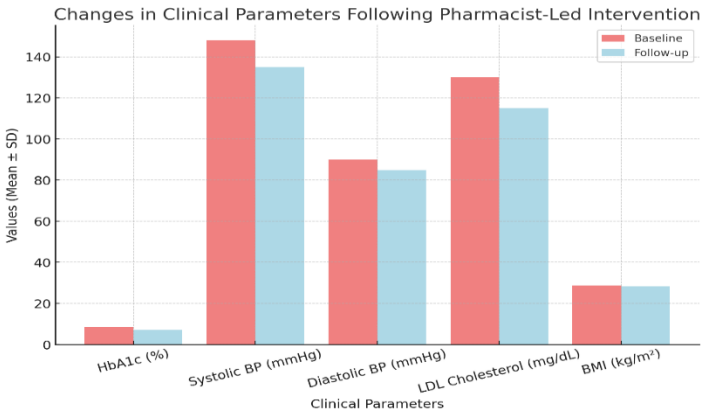

Figure 2 Changes in Clinical Parameters Following Pharmacist-Led Intervention

DISCUSSION

The findings of this study demonstrate the effectiveness of pharmacist-led interventions in enhancing hypertension and diabetes management within a secondary care hospital. Significant improvements were observed in key clinical parameters, including reductions in HbA1c from 8.5% to 7.1%, systolic blood pressure from 148 mmHg to 135 mmHg, and diastolic blood pressure from 90 mmHg to 85 mmHg. Medication adherence showed a substantial increase, and lipid profiles improved, with LDL cholesterol levels decreasing from 130 mg/dL to 115 mg/dL. These findings align with previous research supporting the role of pharmacists in chronic disease management. Pharmacist-led hypertension programs have been consistently associated with reductions in systolic blood pressure, and studies in diabetes management have highlighted pharmacists' contributions to improving glycemic control through medication optimization and patient education (8). Additionally, research indicates that many patients with diabetes in primary care settings struggle with uncontrolled HbA1c due to medication management challenges, emphasizing the importance of pharmacist involvement in

medication adherence and patient engagement (13). However, effective communication between pharmacists and patients remains a critical factor in optimizing clinical outcomes. A major strength of this study was the integration of a pharmacist within an inpatient secondary care setting, where physician time is often constrained due to high patient loads. Unlike studies conducted in primary care or outpatient settings, the current study focused on hospitalized patients, ensuring structured and intensive pharmacist-led interventions. The pharmacist played a crucial role in discharge planning, medication reconciliation, and post-discharge follow-ups, leading to improved disease control and a 22% reduction in hospital readmission rates. While most previous studies have examined pharmacist-led interventions in outpatient settings, these findings provide additional evidence supporting pharmacist involvement in inpatient chronic disease management, addressing an important gap in the literature (14,16).

Beyond disease control, the study also highlights the role of pharmacists in improving medication adherence and preventive care. The use of aspirin increased by 48%, and prescriptions for ACE inhibitors or ARBs rose by 22%, contributing to better cardiovascular protection among high-risk patients. Additionally, completion rates for annual diabetic foot and retinal exams improved by 39%, underscoring the pharmacist's role in comprehensive chronic disease management. These findings are consistent with existing evidence demonstrating that pharmacist-led interventions enhance medication adherence and guideline-directed preventive care measures (15). However, the current study extends this understanding by emphasizing the impact of pharmacist-led interventions in a hospital-based setting, an area with relatively limited research (17). Despite the promising results, several limitations must be acknowledged. The study was conducted in a single secondary care hospital, which may limit the generalizability of the findings to other healthcare settings. The use of a pre-post study design without a control group restricts the ability to establish a direct causal relationship between pharmacist interventions and patient outcomes. The follow-up period was limited to 90 days post-discharge, preventing the assessment of long-term impacts on disease progression or recurrent hospitalizations. Additionally, medication adherence was assessed using a self-reported scale, which may be influenced by recall bias. Future research should consider multi-center randomized controlled trials (RCTs) with longer follow-up durations to provide more robust evidence on the impact of pharmacist-led interventions in chronic disease management (18-21). Addressing these limitations could further enhance the understanding of pharmacist contributions to improving patient outcomes. Expanding the study to multiple hospitals and incorporating a control group would strengthen the validity of findings. Longer follow-up periods would allow for the assessment of sustained benefits and potential disease progression prevention. Furthermore, integrating objective adherence measures, such as electronic medication tracking, could provide more reliable adherence assessments. Future studies should also explore the cost-effectiveness of pharmacist-led interventions to support policy decisions regarding pharmacist integration into chronic disease management programs.

CONCLUSION

This study underscores the pivotal role of pharmacist-led interventions in enhancing chronic disease management by improving glycemic and blood pressure control, promoting medication adherence, and strengthening preventive care measures in patients with type 2 diabetes and hypertension. The findings reinforce the significance of integrating pharmacists into multidisciplinary healthcare teams, where their expertise in medication therapy management and patient education contributes to better clinical outcomes and a reduction in hospital readmissions. By demonstrating the effectiveness of pharmacist involvement in inpatient care, this study provides valuable insights that support healthcare policy advancements aimed at optimizing chronic disease management and fostering patient-centered care.

AUTHOR CONTRIBUTIONS

Author	Contribution
Ayesha Inam1*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Imran Akram	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Asia Rubab	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published

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