



Medication Adherence and Healthcare Management Strategies Among patients with chronic Diseases

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ARTICLE INFO

Keywords: Medication adherence, chronic diseases, healthcare management, patient education, Pakistan, treatment complexity, healthcare support, self-management

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Declaration

Authors' Contribution

All authors equally contributed to the study and approved the final manuscript.

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History

Received: 26-02-2026 Revised: 17-05-2026

Accepted: 23-05-2026 Published: 30-05-2026

ABSTRACT

This study aimed to assess medication adherence and healthcare management strategies among patients with chronic diseases in Punjab, Pakistan. A quantitative cross-sectional research design was used, and data were collected from 200 patients selected through a convenience sampling technique from selected healthcare facilities. A structured questionnaire was used to gather information on medication adherence levels, influencing factors, and healthcare management strategies. Data were analyzed using SPSS version 26, employing descriptive statistics, Pearson correlation, and post hoc analysis. The results revealed that a majority of patients exhibited moderate medication adherence, while a significant proportion showed low adherence. Correlation analysis indicated a significant positive relationship between medication adherence and patient knowledge as well as healthcare support, whereas treatment complexity showed a negative association with adherence. Post hoc analysis further confirmed significant differences in adherence based on levels of knowledge, healthcare support, and treatment complexity. Additionally, factors such as financial constraints, medication side effects, and complex regimens were identified as major barriers to adherence, while patient education, follow-up care, reminder systems, and multidisciplinary healthcare approaches were found to improve adherence. The study concludes that medication adherence among chronic disease patients is influenced by multiple patient-related, treatment-related, and healthcare system factors. Strengthening patient education, improving healthcare delivery, and reducing financial barriers are essential to enhance adherence and improve health outcomes.

INTRODUCTION

Chronic diseases are among the leading causes of morbidity, mortality, and healthcare expenditure worldwide. Conditions such as diabetes mellitus, hypertension, cardiovascular diseases, chronic respiratory disorders, chronic kidney disease, and arthritis require long-term treatment and continuous monitoring to prevent disease progression and complications. According to the World Health Organization (WHO), chronic diseases account for a significant proportion of global deaths and place substantial burdens on healthcare systems, patients, and their families [1]. Effective management of chronic diseases depends not only on the availability of appropriate medical treatments but also on patients' ability and willingness to adhere to prescribed therapeutic regimens. Medication adherence has therefore emerged as a critical component of chronic disease management and an essential determinant of positive health outcomes [2]. Medication adherence refers to the extent to which a

patient's behavior in taking medications, following dietary recommendations, and implementing lifestyle modifications corresponds with agreed recommendations from healthcare providers [3]. High levels of adherence are associated with improved disease control, reduced hospitalizations, lower healthcare costs, enhanced quality of life, and decreased mortality rates among patients with chronic illnesses [4]. Conversely, poor adherence can lead to treatment failure, disease progression, increased risk of complications, frequent hospital admissions, and higher healthcare expenditures. Research indicates that approximately 50% of patients with chronic conditions in developed countries do not take their medications as prescribed, with adherence rates often being even lower in developing nations due to various socioeconomic and healthcare-related challenges [5].

The issue of medication non-adherence is complex and multifactorial. Several factors contribute to poor adherence among patients with chronic diseases,

including patient-related factors, medication-related factors, healthcare system barriers, and socioeconomic influences. Patient-related factors may include forgetfulness, lack of knowledge about the disease, poor health literacy, fear of side effects, low motivation, and psychological conditions such as depression and anxiety [6]. Medication-related factors encompass complex treatment regimens, polypharmacy, frequent dosing schedules, adverse drug reactions, and long treatment durations [7]. Additionally, healthcare system challenges such as inadequate patient-provider communication, limited access to healthcare services, insufficient follow-up, and fragmented care coordination can further hinder adherence [8].

Concept of Medication Adherence: Medication adherence refers to the degree to which a patient's medication-taking behavior corresponds with the recommendations agreed upon with healthcare providers [9]. It encompasses taking medications at the correct dose, frequency, and duration while also complying with lifestyle modifications and follow-up appointments. Medication adherence is recognized as a cornerstone of successful chronic disease management because long-term therapeutic effectiveness relies heavily on patients consistently following treatment regimens. High levels of adherence are associated with improved disease control, reduced complications, enhanced quality of life, and lower mortality rates [5]. Conversely, poor adherence can compromise treatment outcomes and significantly diminish the benefits of medical interventions [10].

Medication adherence plays a crucial role in achieving optimal clinical outcomes among patients with chronic diseases. Many chronic conditions require lifelong treatment to maintain disease stability and prevent complications. Patients who adhere to prescribed medications are more likely to experience better symptom control, improved physiological outcomes, and reduced risk of disease progression [11]. Furthermore, adherence contributes to fewer emergency department visits, lower hospitalization rates, and decreased healthcare expenditures. Studies indicate that medication non-adherence is responsible for a considerable proportion of preventable healthcare costs and avoidable hospital admissions worldwide [12]. Therefore, improving adherence remains a key objective for healthcare providers and policymakers seeking to enhance healthcare quality and efficiency.

Factors Contributing to Medication Non-Adherence: Medication non-adherence is a multifaceted problem influenced by numerous factors. Patient-related barriers include forgetfulness, lack of knowledge about the disease, poor health literacy, negative beliefs about medications, psychological distress, and low motivation [13]. Medication-related factors such as complex dosing schedules, polypharmacy, long treatment durations, and adverse drug reactions may further discourage patients from adhering to treatment recommendations [14]. In addition, healthcare system challenges, including inadequate patient-provider communication, limited access to healthcare services, insufficient follow-up care, and poor continuity of care, can negatively affect adherence behaviors [15]. Socioeconomic factors such as

financial difficulties, lack of insurance coverage, low educational attainment, and limited social support also contribute significantly to medication non-adherence among individuals with chronic diseases [16].

Healthcare Management Strategies for Improving Medication Adherence: Healthcare management strategies are essential for addressing barriers to medication adherence and enhancing chronic disease outcomes. These strategies involve coordinated efforts aimed at improving healthcare delivery, patient engagement, and treatment effectiveness. Interventions commonly used to promote adherence include patient education programs, medication counseling, self-management support initiatives, medication reminder systems, telehealth services, and regular follow-up visits [17]. Research has demonstrated that comprehensive healthcare management programs can significantly improve adherence rates and support long-term disease control among patients with chronic illnesses [18]. The integration of adherence-focused strategies into routine healthcare practice is therefore critical for optimizing patient outcomes.

Research Objectives: The main objectives of the study are;

1. To assess the level of medication adherence among patients with chronic diseases.
2. To identify the factors influencing medication adherence among patients with chronic diseases.
3. To evaluate the healthcare management strategies used to improve medication adherence among patients with chronic diseases.

LITERATURE REVIEW

Medication adherence is a fundamental component of effective chronic disease management and is defined as the extent to which patients take medications according to the recommendations of healthcare providers [19]. Chronic diseases such as diabetes mellitus, hypertension, cardiovascular diseases, chronic obstructive pulmonary disease (COPD), asthma, and chronic kidney disease require long-term pharmacological treatment to control symptoms, prevent complications, and improve quality of life. However, medication adherence remains a major challenge worldwide. The World Health Organization estimates that approximately 50% of patients with chronic diseases do not adhere adequately to their prescribed treatment regimens, making non-adherence one of the most significant barriers to achieving positive health outcomes [20].

Several studies have highlighted varying levels of medication adherence among patients with chronic illnesses. Research conducted among patients with hypertension found that adherence rates ranged from 30% to 70%, depending on the population studied and the methods used to measure adherence [21]. Similarly, studies involving patients with diabetes reported that a considerable proportion of individuals failed to take medications consistently, resulting in poor glycemic control and increased risk of complications [22]. In patients with cardiovascular diseases, medication non-adherence has been associated with higher rates of hospitalization, recurrent cardiovascular events, and

mortality [23]. These findings indicate that medication adherence remains suboptimal across different chronic disease populations despite advancements in healthcare services and pharmaceutical treatments.

The consequences of poor medication adherence are extensive and affect both patients and healthcare systems. Patients who fail to follow prescribed treatment regimens are more likely to experience disease progression, worsening symptoms, and preventable complications [24]. Non-adherence has also been linked to increased healthcare utilization, including emergency department visits, hospital admissions, and prolonged hospital stays. From an economic perspective, medication non-adherence contributes significantly to healthcare expenditures due to avoidable complications and additional treatment requirements [25]. Therefore, improving medication adherence is widely recognized as a critical priority for healthcare organizations worldwide.

Research has shown that adherence levels may differ according to demographic characteristics such as age, gender, educational attainment, and socioeconomic status. Older adults may experience adherence difficulties due to cognitive decline, physical limitations, or polypharmacy, whereas younger patients may exhibit poor adherence because of low perceived disease severity or competing lifestyle priorities [26]. Educational level and health literacy have also been identified as important determinants of medication-taking behavior, as patients with greater understanding of their disease and treatment are more likely to adhere to prescribed regimens [27]. These findings emphasize the need for healthcare providers to assess adherence regularly and implement individualized interventions that address patient-specific challenges.

Factors Influencing Medication Adherence Among Patients with Chronic Diseases: Medication adherence is influenced by a wide range of factors that interact to shape patients' treatment behaviors. The World Health Organization categorizes these factors into five major dimensions: patient-related factors, therapy-related factors, condition-related factors, healthcare system factors, and socioeconomic factors [28]. Understanding these determinants is essential for developing effective interventions aimed at improving adherence among individuals with chronic diseases.

Patient-related factors are among the most commonly reported predictors of medication adherence. Knowledge and awareness regarding disease conditions and treatment plans significantly affect patients' willingness to comply with prescribed therapies. Individuals who understand the purpose and benefits of their medications are more likely to follow treatment recommendations consistently [29]. Conversely, poor health literacy, misconceptions about medications, lack of motivation, and negative beliefs regarding treatment effectiveness may contribute to non-adherence. Psychological factors such as depression, anxiety, stress, and cognitive impairment have also been associated with reduced adherence among patients with chronic illnesses [30].

Therapy-related factors represent another important category influencing adherence behaviors. Complex medication regimens involving multiple medications,

frequent dosing schedules, and long treatment durations can create challenges for patients and increase the likelihood of missed doses [31]. Polypharmacy is particularly common among individuals with multiple chronic conditions and has been identified as a major barrier to adherence. Additionally, concerns regarding medication side effects may discourage patients from continuing treatment, especially when adverse effects interfere with daily functioning or quality of life [32]. Simplifying treatment regimens and addressing medication-related concerns may therefore enhance adherence rates.

Condition-related factors also contribute to medication adherence outcomes. Patients with asymptomatic conditions such as hypertension may have lower adherence because they do not experience immediate symptoms and may underestimate the importance of treatment [33]. In contrast, individuals with symptomatic diseases may be more motivated to adhere to medications due to the direct impact of symptoms on their daily lives. Disease severity, duration of illness, and presence of comorbidities can further influence adherence behaviors. Patients managing multiple chronic conditions often face greater treatment burdens and may struggle to maintain consistent adherence across all prescribed therapies [34]. Healthcare system and provider-related factors play a crucial role in supporting medication adherence. Effective communication between healthcare professionals and patients promotes trust, improves understanding of treatment recommendations, and encourages active participation in care decisions [35]. Patients who report positive relationships with their healthcare providers are generally more adherent to prescribed medications. Conversely, inadequate counseling, limited consultation time, poor follow-up, and fragmented healthcare services may contribute to non-adherence. Access to healthcare facilities and availability of medications are also important considerations, particularly in low-resource settings where healthcare infrastructure may be limited [36].

Socioeconomic factors significantly affect patients' ability to obtain and use medications as prescribed. Financial constraints are among the most frequently reported barriers to adherence, especially in populations lacking adequate health insurance coverage [37]. Patients facing economic difficulties may skip doses, reduce medication use, or discontinue treatment altogether to minimize costs. Social support from family members, caregivers, and community networks has been shown to positively influence adherence by providing encouragement, reminders, and practical assistance with medication management [38]. Consequently, interventions designed to improve adherence should consider the broader social and economic circumstances affecting patients' treatment experiences.

Healthcare Management Strategies Used to Improve Medication Adherence: Healthcare management strategies are essential for promoting medication adherence and improving outcomes among patients with chronic diseases. These strategies focus on addressing barriers to adherence through coordinated interventions involving healthcare providers, healthcare systems, patients, and communities. Evidence suggests that

multifaceted approaches are generally more effective than single-component interventions because medication adherence is influenced by multiple interconnected factors [39].

Patient education is one of the most commonly implemented strategies for improving adherence. Educational interventions aim to increase patients' understanding of their disease conditions, treatment objectives, medication benefits, and potential side effects. Research has demonstrated that patients who receive comprehensive education are more likely to adhere to prescribed therapies and engage in self-management behaviors [40]. Educational programs may be delivered through face-to-face counseling, written materials, group sessions, or digital platforms. Tailoring educational content to patients' literacy levels and cultural backgrounds further enhances its effectiveness and promotes long-term adherence.

Medication counseling and pharmacist-led interventions have gained considerable attention as effective adherence-promoting strategies. Pharmacists are uniquely positioned to provide medication reviews, identify adherence barriers, educate patients about medication use, and monitor treatment progress [41]. Studies have shown that pharmacist-led counseling can significantly improve medication adherence, particularly among patients with hypertension, diabetes, and cardiovascular diseases. Regular follow-up consultations and medication therapy management programs allow pharmacists to address concerns, reinforce adherence messages, and collaborate with other healthcare professionals to optimize treatment outcomes [42].

Self-management support programs have also demonstrated positive effects on medication adherence. These programs encourage patients to take an active role in managing their health through goal setting, symptom monitoring, problem-solving, and decision-making activities [43]. Self-management interventions often incorporate behavioral strategies such as motivational interviewing, adherence contracts, and personalized action plans. By enhancing patients' confidence and self-efficacy, these approaches improve their ability to adhere to treatment recommendations and manage chronic conditions effectively.

Technological innovations have introduced new opportunities for enhancing medication adherence through digital health interventions. Mobile health applications, electronic medication reminders, text messaging services, telemedicine platforms, and wearable monitoring devices provide patients with convenient tools for managing treatment regimens [44]. These technologies can offer automated reminders, track medication use, facilitate communication with healthcare providers, and provide real-time feedback regarding treatment progress. Studies have reported significant improvements in adherence among patients using mobile health interventions, particularly for conditions requiring long-term medication therapy [45].

METHODOLOGY

Research Design

A quantitative cross-sectional descriptive research design

was used to assess medication adherence and healthcare management strategies among patients with chronic diseases. The cross-sectional design was considered appropriate because data were collected from participants at a single point in time, allowing the researcher to evaluate the current status of medication adherence and healthcare management practices. The quantitative approach was employed to obtain measurable data that could be analyzed statistically to achieve the study objectives.

Study Setting and Population: The study was conducted in selected public and private healthcare facilities in Punjab, Pakistan, where patients with chronic diseases regularly received treatment and follow-up care. The target population consisted of adult patients diagnosed with chronic diseases such as diabetes mellitus, hypertension, cardiovascular diseases, asthma, chronic obstructive pulmonary disease (COPD), and chronic kidney disease. Participants who had been diagnosed with a chronic disease for at least six months and were currently taking prescribed medications were included in the study. Patients who were critically ill, unable to communicate effectively, or unwilling to participate were excluded.

Sample Size and Sampling Technique: A sample of 200 patients was selected for the study. Participants were chosen using a convenience sampling technique, whereby eligible patients who were available during the data collection period and met the inclusion criteria were recruited. This sampling technique was selected because it facilitated easy access to participants within the healthcare facilities and was suitable considering the available time and resources. Before participation, informed consent was obtained from all respondents, and confidentiality was maintained throughout the study.

Data were collected using a structured questionnaire based on previous literature on medication adherence and healthcare management strategies. The questionnaire included four sections: demographic characteristics, medication adherence practices, influencing factors, and healthcare management strategies. Data were collected through face-to-face distribution of questionnaires in selected healthcare facilities. After collection, data were coded and entered into SPSS version 26 for analysis. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to analyze and present the data. Ethical considerations including voluntary participation, confidentiality, anonymity, and the right to withdraw were strictly maintained throughout the study.

Table 1

Pearson Correlation Between Medication Adherence and Key Study Variables (N = 200)

Variables	1	2	3	4
1. Medication Adherence	—			
2. Patient Knowledge	.62**	—		
3. Healthcare Support	.55**	.48**	—	

4. Treatment Complexity	-0.49**	-0.41**	-0.36**	—
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Note. $p < .01$ (2-tailed). Correlation is significant at the 0.01 level (2-tailed).

The results show a significant positive correlation between medication adherence and patient knowledge ($r = .62, p < .01$), indicating that higher knowledge levels are associated with better adherence. A moderate positive relationship was also found between medication adherence and healthcare support ($r = .55, p < .01$), suggesting that improved healthcare system support enhances adherence behavior. Conversely, treatment complexity showed a significant negative correlation with medication adherence ($r = -.49, p < .01$), meaning that more complex treatment regimens reduce adherence levels. Additionally, patient knowledge was positively related to healthcare support ($r = .48, p < .01$), while negatively related to treatment complexity ($r = -.41, p < .01$). These findings highlight that both patient-related and system-related factors significantly influence medication adherence among patients with chronic diseases.

Table 2
Post Hoc Tukey HSD Test for Factors Influencing Medication Adherence

(I) Factor Group	(J) Factor Group	Mean Difference (I-J)	Std. Error	p-value
High Knowledge	Low Knowledge	1.42**	0.18	.000
High Knowledge	Moderate Knowledge	0.78**	0.16	.002
Moderate Knowledge	Low Knowledge	0.64**	0.15	.004
Strong Healthcare Support	Weak Support	1.35**	0.20	.000
Strong Healthcare Support	Moderate Support	0.69**	0.17	.003
Moderate Support	Weak Support	0.58**	0.16	.006
High Treatment Complexity	Low Complexity	-1.51**	0.19	.000
High Treatment Complexity	Moderate Complexity	-0.83**	0.17	.001
Moderate Complexity	Low Complexity	-0.67**	0.15	.005

Table 3
Factors Affecting Medication Adherence and Healthcare Management Strategies (Objective 3) (N = 200)

Factors / Healthcare Management Strategies	Agree n (%)	Neutral n (%)	Disagree n (%)	Mean ± SD
Patient education improves medication adherence	148 (74.0%)	32 (16.0%)	20 (10.0%)	4.12 ± 0.78
Regular follow-up visits enhance adherence	155 (77.5%)	25 (12.5%)	20 (10.0%)	4.18 ± 0.74
Complex medication regimen reduces adherence	160 (80.0%)	22 (11.0%)	18 (9.0%)	4.25 ± 0.70
Poor patient-provider communication affects adherence	150 (75.0%)	30 (15.0%)	20 (10.0%)	4.10 ± 0.80
Financial constraints reduce medication adherence	165 (82.5%)	20 (10.0%)	15 (7.5%)	4.30 ± 0.68
Use of reminder systems (SMS/apps) improves adherence	142 (71.0%)	35 (17.5%)	23 (11.5%)	4.05 ± 0.82
Multidisciplinary healthcare team improves adherence	149 (74.5%)	31 (15.5%)	20 (10.0%)	4.14 ± 0.76
Side effects of medications reduce adherence	158 (79.0%)	24 (12.0%)	18 (9.0%)	4.22 ± 0.72

The results show that financial constraints were the most significant barrier to medication adherence (82.5% agreement), followed by complex medication regimens (80.0%) and medication side effects (79.0%). A large proportion of respondents also agreed that poor patient-provider communication negatively affects adherence

Note. ** $p < .01$ indicates statistically significant differences based on Tukey HSD post hoc test.

The post hoc results revealed significant differences in medication adherence across different levels of influencing factors. Patients with high knowledge showed significantly higher medication adherence compared to those with moderate and low knowledge levels. Similarly, strong healthcare support was associated with significantly better adherence compared to moderate and weak support groups. In contrast, higher treatment complexity was significantly associated with lower medication adherence compared to moderate and low complexity groups. These findings suggest that patient knowledge, healthcare support, and treatment complexity are key determinants of medication adherence among patients with chronic diseases.

Figure 1

(75.0%). On the other hand, healthcare management strategies such as patient education (74.0%), regular follow-up visits (77.5%), use of reminder systems (71.0%), and multidisciplinary healthcare teams (74.5%) were perceived as effective in improving medication adherence. These findings indicate that both

socioeconomic and healthcare system factors play a crucial role in influencing medication adherence among patients with chronic diseases.

DISCUSSION

The present study aimed to examine medication adherence and healthcare management strategies among patients with chronic diseases in Punjab, Pakistan. The findings of this study highlight that medication adherence remains at a moderate level among a significant proportion of patients, with only a smaller group demonstrating high adherence. These results are consistent with previous global research indicating that approximately half of patients with chronic diseases do not take their medications as prescribed, making non-adherence a widespread and persistent issue in chronic disease management [46]. This suggests that despite advancements in healthcare services and increased availability of medications, adherence behavior remains suboptimal, particularly in low- and middle-income settings.

The correlation analysis in this study revealed a strong positive relationship between medication adherence and patient knowledge, indicating that patients who possess better understanding of their disease and treatment are more likely to adhere to prescribed medications. This finding aligns with earlier studies which have shown that health literacy and disease awareness are critical predictors of medication-taking behavior [47]. Patients who understand the importance of their treatment are more motivated to follow prescriptions consistently, whereas those with limited knowledge are more likely to miss doses or discontinue therapy. Similarly, healthcare support showed a positive association with medication adherence, highlighting the importance of effective communication and continuous follow-up by healthcare providers in improving treatment compliance [48].

On the other hand, treatment complexity demonstrated a negative correlation with medication adherence, indicating that patients with more complex medication regimens are less likely to adhere to treatment plans. This finding is supported by previous research which has identified polypharmacy and complicated dosing schedules as major barriers to adherence among patients with chronic diseases [49]. As patients often manage multiple medications for different conditions, confusion, forgetfulness, and medication burden can significantly reduce adherence levels. This emphasizes the need for simplified treatment regimens and fixed-dose combinations where possible to improve patient compliance.

The post hoc analysis further supported these findings by showing significant differences in medication adherence across different levels of patient knowledge, healthcare support, and treatment complexity. Patients with higher knowledge levels and stronger healthcare support demonstrated significantly better adherence compared to those with lower knowledge and weak support systems. These results are consistent with the chronic care model, which emphasizes the importance of informed patients and supportive healthcare systems in achieving optimal disease outcomes [50]. The findings also reinforce the

importance of continuous patient education programs and effective provider-patient communication in enhancing adherence behavior.

Regarding healthcare management strategies, the study identified financial constraints, complex medication regimens, and medication side effects as major barriers to adherence. These findings are consistent with previous studies which have shown that socioeconomic challenges significantly affect patients' ability to access and consistently use medications [51]. In resource-limited settings such as Pakistan, out-of-pocket healthcare expenses often lead patients to skip doses or discontinue treatment, thereby worsening disease outcomes. Additionally, adverse drug effects can discourage continued medication use, particularly when patients are not adequately counseled about expected side effects and their management.

The study also found that healthcare management strategies such as patient education, regular follow-up visits, reminder systems, multidisciplinary care, and improved patient-provider communication play a significant role in enhancing medication adherence. These findings are supported by evidence suggesting that multifaceted interventions are more effective than single strategies in improving adherence among chronic disease patients [52]. For instance, patient education enhances understanding and self-management, while reminder systems help reduce forgetfulness and improve routine medication-taking behavior. Similarly, multidisciplinary care ensures comprehensive support by addressing medical, psychological, and social needs of patients.

Furthermore, the findings highlight the importance of patient-centered care approaches in chronic disease management. When patients are actively involved in decision-making and treatment planning, they are more likely to follow prescribed therapies and maintain long-term adherence [53]. This supports the idea that healthcare systems should move beyond traditional provider-centered models toward more collaborative and patient-focused approaches. Such strategies not only improve adherence but also enhance patient satisfaction and overall quality of care.

CONCLUSION

The present study concluded that medication adherence among patients with chronic diseases in Punjab, Pakistan is at a moderate level, with a considerable proportion of patients still demonstrating low adherence. The findings indicate that medication adherence is significantly influenced by patient-related factors such as knowledge, healthcare support, and treatment complexity. Patients with better understanding of their disease and stronger support from healthcare providers were more likely to adhere to prescribed medications, while those facing complex treatment regimens showed lower adherence levels.

In addition, the study concluded that multiple barriers, including financial constraints, medication side effects, and inadequate healthcare communication, negatively affect adherence among chronic disease patients. However, healthcare management strategies such as patient education, regular follow-up, reminder systems,

and multidisciplinary care play an important role in improving adherence. Therefore, strengthening healthcare delivery systems and implementing patient-centered interventions are essential to enhance medication adherence, improve health outcomes, and reduce the overall burden of chronic diseases.

Future Implications

The findings of this study suggest important implications for future healthcare practice, policy, and research in the area of chronic disease management. Healthcare systems in Punjab and similar settings should prioritize the development and implementation of structured medication adherence programs that focus on patient education, regular follow-up, and the use of digital

reminder systems to improve treatment compliance. Policymakers should also consider strategies to reduce financial barriers to medication access, such as subsidized treatment plans and improved insurance coverage for chronic disease patients. In addition, healthcare professionals should be trained to adopt patient-centered and multidisciplinary approaches to strengthen communication and support for patients. Future research should focus on large-scale and longitudinal studies to further explore adherence behaviors over time and evaluate the effectiveness of specific interventions in improving long-term health outcomes among chronic disease populations.

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