CAPITAL UNIVERSITY OF SCIENCE AND TECHNOLOGY, ISLAMABAD

Patient-Centered Pharmacist Care in Diabetes Patients: A Quasi Experimental Interrupted Time Series Study

by

Iqra Riaz

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in the

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I dedicate this work to my loving parents,
whose sacrifices, prayers, and unwavering support have
been the foundation of my success.

CERTIFICATE OF APPROVAL

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meaningful. I am also thankful to my friends for their kindness, understanding, and uplifting presence during challenging times.

(Iqra Riaz)

Abstract

Diabetes mellitus remains a significant global health concern, with poor glycemic control leading to serious complications and diminished quality of life. Pharmacist-led interventions, particularly those focused on patient education and medication management, have been shown to support improved diabetes management; however, evidence regarding their impact in Pakistan's healthcare settings remains limited. This study aimed to assess the impact of pharmacist-led care on glycemic control, medication adherence, health-related quality of life (HRQoL), diabetes self-efficacy, and patient satisfaction among individuals with diabetes. A quasi-experimental interrupted time series design was employed across selected hospitals and community pharmacies in Islamabad, Rawalpindi, and Mirpur. Participants were recruited through purposive sampling based on predefined eligibility criteria. The intervention included structured patient counseling, medication therapy management (MTM), lifestyle modification education, and follow-up assessments. Primary outcomes, including random blood sugar (RBS), fasting blood glucose (FBG), and glycated hemoglobin (HbA1c), were objectively measured through laboratory investigations. Secondary outcomes, such as medication adherence, HRQoL, and patient satisfaction, were assessed using validated tools including the general medication adherence scale (GMAS), EQ-5D-3L, and a diabetes management self-efficacy scale. A total of 322 patients completed the study assessments at baseline and 298 remained at last follow-up visits. By the end of the study, the mean RBS levels reduced to 246.16mg/dL, fasting blood glucose improved to 162.17 mg/dL, and HbA1c levels decreased to 7.80%, indicating meaningful improvements in glycemic control. Additionally, significant enhancements were observed in medication adherence and health-related quality of life scores. Patients also demonstrated improved self-efficacy in managing their diabetes and reported high satisfaction with the pharmacist-led intervention. The findings of this study provide evidence supporting the integration of pharmacist-led, patient-centered care into routine diabetes management in Pakistan. The intervention was associated with improved clinical and patient-reported outcomes, emphasizing the vital role pharmacists can play as part of multidisciplinary diabetes care teams. This study

highlights the potential for expanding pharmacist-led services within hospital and community pharmacy practice models to improve chronic disease management and patient-centered care delivery in resource-constrained healthcare systems.

Keywords: Diabetes mellitus, Patient-centered care, Pharmacist intervention, Medication adherence, Quality of life.

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Abbreviations

ACEI	Angiotensin converting enzyme inhibitors
ADA	American diabetes association
ARBs	Angiotensin receptor blockers
DKA	Diabetic ketoacidosis
DM	Diabetes mellitus
DSME	Diabetes self-management education
eGFR	Estimated glomerular filtration rate
FBG	Fasting blood glucose
F1	Follow-up 1
F2	Follow-up 2
GC	Glycemic control
GDM	Gestational diabetes mellitus
GMAS	General medication adherence scale
HbA1c	Hemoglobin A1c
HRQoL	Health-related quality of life
ITS	Interrupted time series
LMICs	Low- and middle-income countries
MI	Motivational interviewing
MTM	Medication therapy management
PCC	Patient-centered care
PCC	Patient centered communication
PCPC	Patient-centered pharmacist care
QESD	Quasi experimental study design
QOL	Quality of life
RBS	Random blood sugar

RCT	Randomized controlled trial
SGLT2	Sodium glucose like cotransporter 2
SPSS	Statistical package for the social sciences
TR	Time trade-off (utility value)
TIDM	Type I diabetes mellitus
T2DM	Type II diabetes mellitus
VAS	Visual analogue scale
WHO	World Health Organization

Chapter 1

Introduction

1.1 Background

Diabetes mellitus is a common endocrine disease that is chronic, multifaceted, and difficult to cure which disrupts the body in terms of producing or using insulin. Diabetes, also known as DM, is a group of chronic metabolic disorders that can occur when an individual has an abnormal rise of blood sugar level because of inadequate production of insulin by the pancreas or no proper use or reaction of the body cells to the insulin produced [1]. On the other hand, diabetes mellitus can be thought of a condition where the body fails to correctly metabolize food for energy. The hormone insulin is produced by the pancreas, an organ located close to the stomach, that help our body cells to absorb glucose. Blood sugar levels rise when a diabetic patient's body either produces insufficient insulin or is unable to use it as well as it should be [1]. Hyperglycemia, along with the metabolic dysfunctions of proteins, lipids, and carbohydrates, gradually impacts multiple organs in the body [2]. The microvascular and macrovascular complications are caused by structural and functional abnormalities of blood vessels of different organ systems. These complications affect the organs of the body and are marked by damage, dysfunction, and ultimately, failure of the organs [3]. The tissues that are primarily influenced by metabolic problems related to diabetes include the skeletal muscles, the adipose, and the liver due to insulin resistance [4]. If diabetes is not

managed properly, it can result in various complications. Immediate issues include diabetic ketoacidosis and nonketotic hyperosmolar coma [5]. Diabetes mellitus is a complicated disease, where self-care activities and long-term monitoring of blood sugar level, food consumption, emotional stresses, physical activities, and intake of medications becomes the regular priority and crucial task [6]. Diabetes self-management education (DSME) is the process of facilitating the knowledge, skills, and abilities necessary for diabetes self-care. Also education on diabetes significantly reduces both short- and long-term complication risks while enhancing health outcomes and quality of care [7].

The primary therapeutic objective in managing all diabetic patients is to maintain good glycemic control (GC) to prevent macrovascular and microvascular complications [8]. Glycemic control, the optimal blood sugar level in a DM patients [9]. The American Diabetes Association (ADA) considers HbA1c levels below 7% as indicative of good diabetic control, whereas the American College of Endocrinologists set it at 6.5%. Regarding fasting blood glucose, the recommended range is 70-130mg/dL (3.9-7.2mmol/l) as set by ADA, whereas the American College of Endocrinologists and the International Diabetes Federation set it at less than 110 mg/dL (6.1 mmol/l) and 100 mg/dl (5.5 mmol/l), respectively [9].

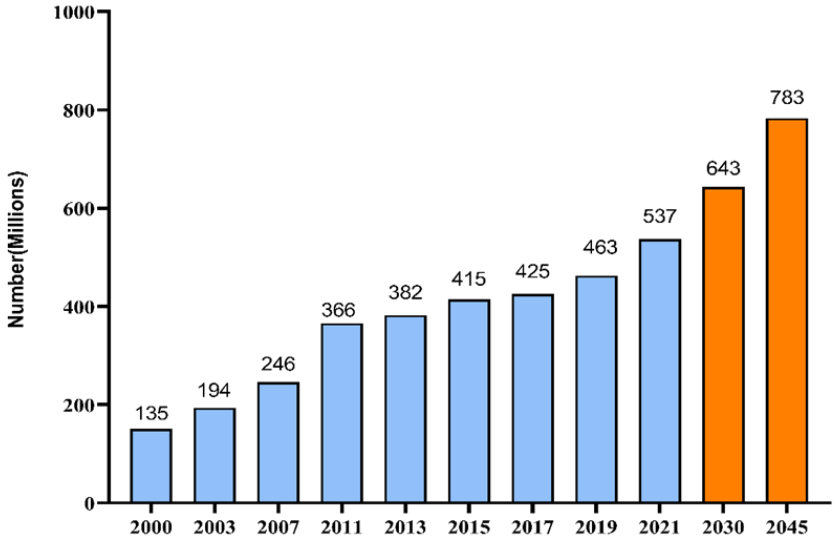


FIGURE 1.1: Worldwide prevalence of diabetes [10]

1.2 Global Prevalence and Burden

Diabetes mellitus is a significant, long-term disease that profoundly affects individuals, their families, and communities across the globe. It ranks among the ten leading causes of mortality in adults and is estimated to have claimed the lives of four million people worldwide [11]. It has been estimated that 240 million people across the globe have undiagnosed diabetes, with nearly half of all adults with diabetes being unaware of their illness [12]. Diabetes has a significant economic burden on healthcare structure across the globe It is estimated that 537 million (10.5%) individuals (those aged 20–79 years) worldwide are currently living with diabetes [13]. In 2021, the International Diabetes Federation estimated that 537 million people worldwide were living with diabetes, accounting for 10.5% of the global population, with healthcare costs reaching $966 billion globally [14]. The top 10 countries that have the highest prevalence of diabetes in the world include India, China, USA, Indonesia, Japan, Pakistan, Russia, Brazil, Italy and Bangladesh [15] It is frightening that the rate of DM is expected to reach 643 million (11.3%) by 2030 and 783 million (12.2%) by 2045 [10]. The trend is also uprising representing the number (millions) of individuals aged 20-79 years with diabetes in the globe as shown in figure 1.1. As a result of this, health issue has become a global disaster, developing prevalence of DM in low- and middle-income countries (LMICs) is quite high compared to that in high-income countries [10]. It is also important to mention that the leading population of people living with diabetes is residing in the LMICs, covering an almost 80% of the diabetic population globally [16]. Some of the socio-economic problems affecting LMICs include poor nutrition, poverty and inactivity. In a new report, it was stated that specific and accurate information is urgently needed to lead the way to the implementation of efficient initiatives helping solve these issues [17].

1.2.1 Prevalence in Pakistan

According to an article by "The News", Pakistan ranks 3rd in the world in diabetes prevalence behind China and India. The prevalence of diabetes in Pakistan was 11.77% in 2016, 16.98% in 2018, and 17.1% in 2019. The International Diabetes

Federation estimates that 26.7% of Pakistani adults would have diabetes in 2022, for a total of almost 33,000,000 cases. Around 463 million persons worldwide have diabetes, with type 2 diabetes mellitus accounting for 90% of cases [18].

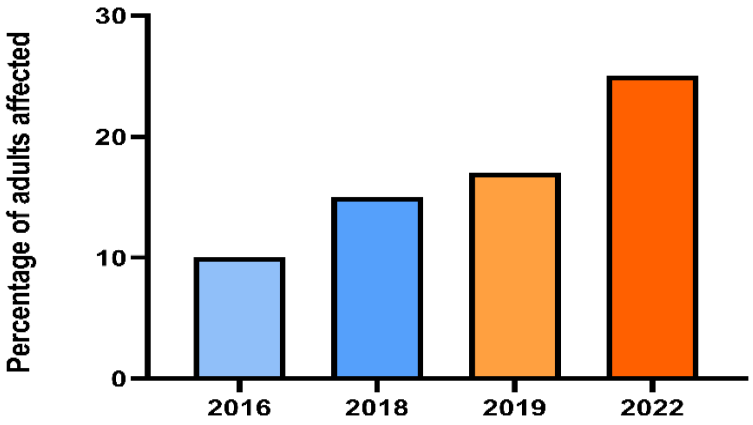


FIGURE 1.2: Prevalence of diabetes in Pakistan [18]

1.3 Justification for the Study

Diabetes is increasingly prevalent worldwide, necessitating effective management strategies. Pharmacist-led intervention involves direct patient care through medication management, counseling, and adherence support. It is crucial for chronic disease management like diabetes, ensuring optimal medication use and better health outcomes. In Pakistan, diabetes is a growing public health concern, with a high prevalence and poor disease control due to factors such as low medication adherence, lack of patient awareness, and inadequate healthcare resources. Given these challenges, patient-centered pharmacist care can serve as an effective strategy to improve diabetes management. Studies globally have demonstrated that pharmacist interventions lead to better glycemic control, improved adherence, and enhanced patient satisfaction. However, limited research has been conducted in Pakistan, particularly using a quasi-experimental interrupted time series study in community pharmacies and hospitals. Pharmacists are underutilized in direct patient care in Pakistan; this study will give scientific evidence on the effects of initiatives led by pharmacists and support their inclusion in diabetes management programs.

1.4 Significance of Study

Pharmacist-led interventions are a vital part of diabetes care, significantly improving medication adherence, therapeutic outcomes, and reducing complications through Medication Therapy Management. Pharmacists monitor blood glucose and HbA1c levels, educate patients, and provide lifestyle counseling. Globally, these interventions enhance glycemic control, quality of life, and reduce healthcare costs. In Pakistan, where diabetes is highly prevalent, community pharmacists play a crucial role, especially in underserved areas. Their involvement helps improve self-management, prevent complications, and reduce hospital admissions, ultimately strengthening the healthcare system.

1.5 Problem Statement

Diabetes mellitus is highly prevalent in Pakistan, yet its management remains suboptimal due to poor medication adherence, limited patient education, and lack of structured self-care support. Although international evidence supports pharmacist-led interventions in improving diabetes outcomes, pharmacists in Pakistan are rarely involved in direct patient care. Most existing care models fail to empower patients or utilize pharmacists effectively. Research evaluating the real-world impact of such interventions in Pakistan is scarce. Therefore, this study aims to evaluate the role of patient-centered pharmacist care in improving glycemic control, adherence, and quality of life among diabetic patients.

1.6 Aim and Objectives

1.6.1 Aim

This study aimed to assess how a patient-centered pharmacist care intervention affects diabetes patients' quality of life, treatment results, and self-management. to

strengthen the pharmacist's role in offering adherence support, lifestyle counseling, medication management, and individualized education in the pursuit of a patient-centered care strategy.

1.6.2 Objectives of the Study

1. To compare the blood sugar levels of diabetic patients before and after implementing pharmacist care interventions.

2. To analyze changes in patient adherence and quality of life to diabetes medications following pharmacist-led counselling and education.

3. To evaluate the impact of pharmacist interventions on the incidence of complications related to diabetes.

4. To collect patient satisfaction feedback regarding the pharmacist's role in their diabetes management through surveys and interviews.

Chapter 2

Literature Review

2.1 Classification of Diabetes

The original classification system for diabetes included two main types: juvenile-onset diabetes (now termed type 1 diabetes) and adult-onset diabetes (currently known as type 2 diabetes).Today, over 50 subcategories are acknowledged, each resulting from various pathogenic mechanisms or occurring alongside other diseases and syndromes [19].

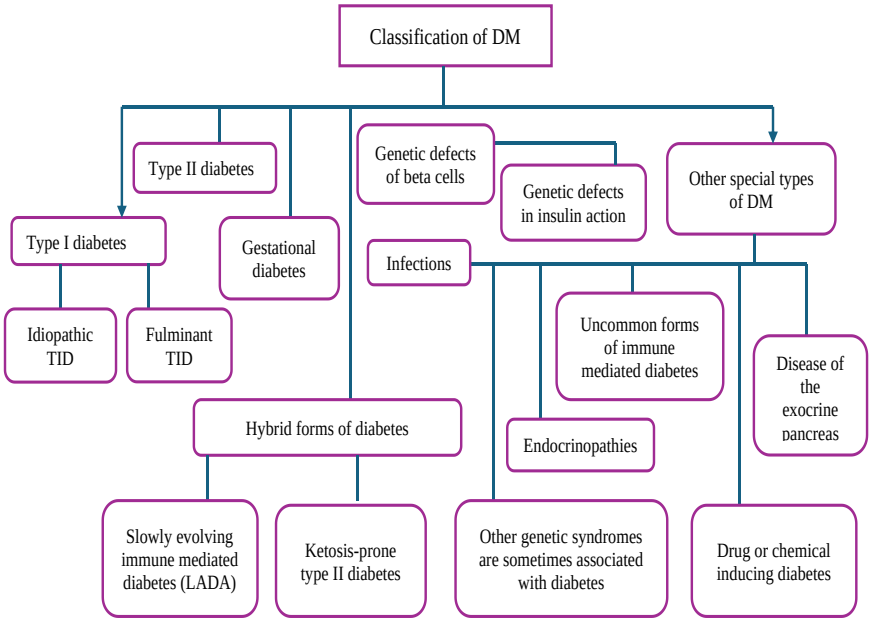


FIGURE 2.1: The latest diabetes classification includes Type 1, Type 2, and other special types [19]

2.1.1 Type 1 Diabetes

Insulin-dependent diabetes, another name for type 1 diabetes, typically first appears in childhood [20]. An autoimmune condition when the immune system unintentionally kills the beta cells in the pancreas that make insulin. This phenomenon is referred to as an autoimmune cause or response and it results in diabetes by depriving the body of adequate insulin to operate normally [21]. Type 1 diabetes can be detected well before insulin production declines, with a gradual reduction in insulin levels starting at least two years before the diagnosis [22]. The sensitivity of β-cells to glucose diminishes around the same timeframe. While the final insulin response amplifies, the initial insulin response decreases, which could indicate a compensatory adjustment. The decline in insulin responsiveness continues to intensify in the early phase following a diagnosis. A biphasic decline in insulin secretion is observed within the initial years after diagnosis, with a sharper decrease during the first year compared to the second. After being diagnosed, there may be minimal to no insulin production for several years due to the decrease in insulin secretion. Even when glucose levels are considered normal, they can still reflect type 1 diabetes. There are significant alterations in glucose levels during the onset of type 1 diabetes [23].

2.1.2 Type 2 Diabetes

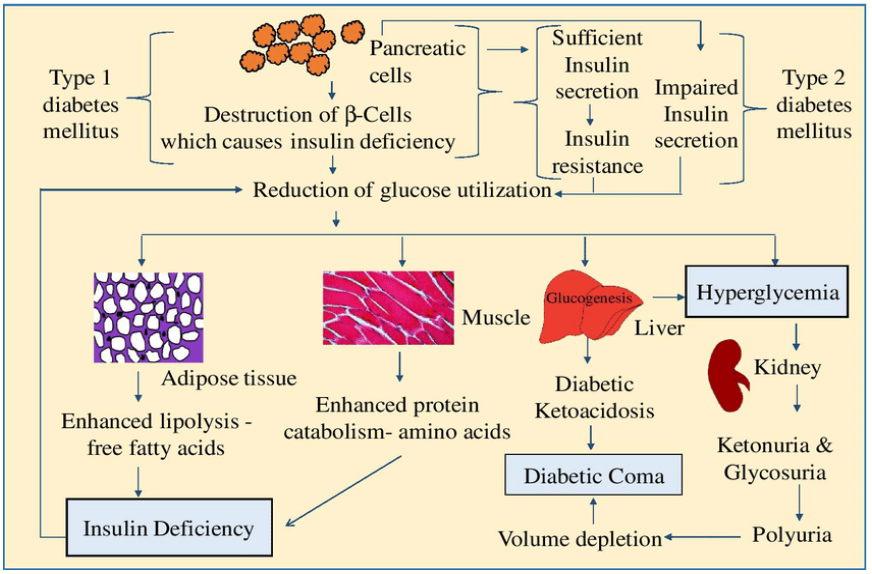
Type 2 diabetes is often called non-insulin-dependent diabetes or adult-onset diabetes. While it is usually less severe than type 1, it can still have serious effects and result in serious complications particularly within the small blood vessels of the kidneys, nerves as well as the eyes [20]. Impaired insulin production has a major impact on the underlying mechanisms of type 2 diabetes. This type of diabetes is characterized by two main insulin-related anomalies: insulin resistance and β-cell dysfunction [24]. Insulin resistance results from disturbances in a number of cellular pathways, leading to a less response or sensitivity of cells in peripheral tissues especially muscle, liver, and adipose tissue to insulin. At an early stage of the disease, this decreased insulin sensitivity triggers β-cells to increase

insulin production as a compensatory mechanism to maintain normoglycemia. As a result, high insulin levels (hyperinsulinemia) help prevent hyperglycemia. However, over time, the β-cells increased insulin secretion becomes insufficient to fully compensate for the declining insulin sensitivity [25]. Additionally, β-cell function progressively declines, eventually leads to insulin deficiency. This decline impairs the body's ability to maintain normoglycemia, leading to hyperglycemia. While insulin production decreases, residual secretion typically remains adequate to prevent diabetic ketoacidosis (DKA) in most cases [26].

2.1.3 Gestational Diabetes

In 1824, Bennewitz first noted the occurrence of diabetes during pregnancy in Germany. Subsequent case studies in the US and the UK revealed elevated perinatal mortality rates among expectant mothers with diabetes [27]. Gestational diabetes mellitus (GDM) is a type of hyperglycemia which appears during pregnancy and poses risk to both the mother and the fetus. This risk is present whether the hyperglycemia takes the form of T2D identified before or during pregnancy. During early pregnancy, both fasting and postprandial blood sugar range tend to be lower than normal. However, during the third trimester, sugar levels typically rise. When these levels reach diabetic thresholds, the condition is diagnosed as gestational diabetes mellitus [28]. Infants born to mothers with gestational diabetes have an increase chance of developing diabetes in later life. During pregnancy, hyperglycemia results in babies of higher weight and, thus, constitutes an important risk factor in a number of pregnancy complications such as preterm birth, the birth of large-for-gestational age babies, macrosomia (birth weights over 4.5 kg), cesarean section, and preeclampsia [29]. Gestational diabetes mellitus affects around 5–15% of pregnant women, with prevalence varying across different ethnic groups and regions [30]. Some of these risk factors may influence the condition and they include a family history of diabetes, obesity, older maternal age, polycystic ovarian syndrome, and failure to undertake physical activity among others and also exposure to environmental toxins [27].

2.2 Pathophysiology



2.3 Risk Factors in Diabetes

In majority of patients, risk factors associated with diabetes are either of genetic or environmental origin [31]. The type 1 diabetes mellitus is mostly hereditary while type 2 diabetes is due to some physical factors. Some conventional risk factors includes; dyslipidemia, hypertension, coagulopathy [32]. Other possible risk factors include; obesity, alcohol use, family history, smoking and diet [33].

2.3.1 Obesity

Being overweight is one of the strongest predictors of developing diabetes. Lack of physical activity (Sedentary lifestyle) leads to poor weight management and raises the chance of diabetes

and many heart conditions [34]. Maintaining a normal body and daily exercise such as walking and jogging increase metabolic as well as cardiovascular efficiency [35].

2.3.2 Diet

Excessive carbohydrate intake results in hyperglycaemia where the insulin present is inadequate for normal glucose metabolism [36]. Also saturated fats accumulate over time resulting in hypercholesterolemia which can subsequently lead to artherosclerosis and ketoacidosis [37].

2.3.3 Smoking

Cigarette smoking results in vasoconstriction due to release of chemo mediators which stimulates the sympathetic nervous system thus enhances the risk of heart diseases and eventually diabetes [38]. Nicotinic acid from tobacco is an important chemical which induces diabetes. Smoking therefore should be avoided in diabetic patients [39].

2.3.4 Ageing and Family History

The blood vessel tends to stiffen with time as the collagen fibre in artery and wall continue to increase in number [40]. Decreased elasticity results in a reduced cross-sectional area during systole, contributing to the onset of high blood pressure [41]. Hypertension plays a key role in the development of diabetes. Children of parents with diabetes are at a higher risk of developing hyperglycemia relevant to those without family history of this condition. This is as a result of genetic transfer from one generation to the other [42].

2.3.5 Alcohol Abuse

Consumption of large amount of alcohol increases the risk of diabetes [43]. Alcohol interferes with steroid production glucocorticoids which could induce hyperglycaemia where control is inadequate [31]. Reduction or total withdrawal from alcohol intake will help in lowering blood glucose in predisposed individuals [44].

2.4 Patient Centered Care in Diabetes Management

2.4.1 Concept of Patient Centered Care

Patient-centered care is the practice of acknowledging and addressing each patient's unique preferences, needs, and values, enabling them to make informed decisions that best suit their individual circumstances. A strategy known as patient-centered pharmacist care highlights how crucial it is to customize pharmaceutical services to each patient's unique requirements, preferences, and values. This model is in line with the more general idea of patient-centered care, which values patients involvement in healthcare decisions and acknowledges their particular situation. Additionally, recognizing patient needs and personalizing pharmaceutical care are essential for providing tailored services. Patient-focused communication enables pharmacists to address medication-related concerns by considering the patient's medical history, psychosocial factors, and through collaborative decision-making. In pharmacy practice, clear communication about patients medication experiences, health concerns, and treatment expectations is important to promote adherence and identify drug-related issues, including medication misuse, adverse effects, and non-compliance [45]. Its goal is to deliver holistic, patient-centered care that improves access, quality, and efficiency [46].

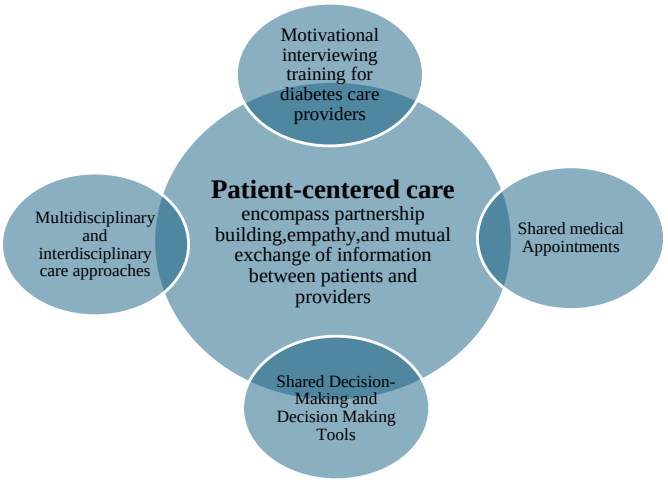


FIGURE 2.2: Patients centered approaches [46]

2.5 Core Principles of Patient-Centered Pharmacist Care

2.5.1 Respect for Patient Preferences

Each patient's values and preferences must be acknowledged and respected as part of PCPC. In order to guarantee that patients actively participate in their treatment regimens, pharmacists participate in shared decision-making. This regard encourages a cooperative connection between patients and pharmacists, improving medication compliance and general patient happiness [47].

2.5.2 Effective Communication

Open, reciprocal communication between patients and pharmacists is essential to PCPC. Pharmacists are required to attentively listen to patients worries, answer any queries or misunderstandings, and give patients accurate information on medications. In order to detect possible medication-related issues like side effects or interactions and eventually improve health outcomes, this communication is essential [48].

2.5.3 Individualized Care

When administering care, PCPC mandates that pharmacists take the patient's lifestyle, psychosocial characteristics, and medical history into account. By using this customized approach, pharmacists can better meet the unique needs of each patient by customizing medication therapy management [49].

2.5.4 Empowerment and Education

One of the most important aspects of PCPC is educating patients about their diseases and treatments. Pharmacists can enhance adherence and health outcomes

by arming patients with information that helps them make educated decisions about their medication options [45].

2.6 Benefits of Patient-Centered Care in Diabetes Management

The key components of this strategy are responding to patient needs, concerns as well as expectations, and promoting healthy behaviour. Besides that, the patient-centered approach promotes an active participation of the patient and mutual care with the team that manages it during the entire management process. Ongoing patient support and self-care education are regarded as the keystone in the push towards the maximum possible care of individuals with diabetes. The types of interventions, instructional methods, delivery format, duration, and total contact hours are some of the features and elements summing up effectiveness of various education interventions applied among patients. Effective self-management of diabetes entails proper knowledge among patients and their families that involve an understanding the effect of diabetes on the body, treatment objectives, and the impact of the different forms of behavior on glycemic control [50].

2.7 Role of Pharmacist

Pharmacists are the most accessible healthcare professionals, with roles expanding far beyond medication dispensing. They now provide comprehensive patient care, including counseling on lifestyle changes, medication therapy management, chronic disease management, and strategies to improve medication adherence [51]. The involvement of the pharmacist in diabetes disease state management programs in different settings is evolving, and the use of technology tools to deliver patient management is an emerging health care delivery system that is proving to be beneficial in the improvement of the diabetes results [52]. In most developed nations, pharmacists are recognized as essential healthcare team members and represent

the most accessible point of care for patients [53]. Pharmacists are equipped with a variety of knowledge and skills unique to the profession that can enable the pharmacists to assume a leadership position in any healthcare organizations in their quest to achieve safe and effective acute glycemic interventions among hospitalized patients. In the past, literature examples were used to describe the place of pharmacist in the task-based model at the individual patient care level [54]. Beyond pharmaceutical care, pharmacists actively contribute to chronic disease management through patient education. Research demonstrates their effectiveness in enhancing diabetes self-care, disease awareness, and blood sugar control [55]. Pharmacists are valued for their expertise in conducting medication reconciliation, evaluating drug therapy, and developing care plans through a problem-solving approach. They also provide education to patient and family on disease management, medications, and lifestyle modifications, along with scheduled follow-up calls to ensure optimal outcomes [56].

2.8 Quasi Experimental Studies in Healthcare Research

2.8.1 Overview of Quasi-Experimental Design

To assess both the effectiveness and safety of non-randomized treatments in real-world settings, patients or their healthcare providers on their behalf self-select into one of several available treatment groups in a quasi-experiment, which can be either prospective or retrospective. Quasi-experimental studies maintain the structural framework of randomized controlled trials in many ways but differ in one critical aspect: treatment allocation is determined by patient choice or clinical judgment rather than random assignment [57]. Quasi-Experiments are more than just a substitute for RCTs in situations where they are not practical. Compared with RCTs, quasi-experiments have a number of clear advantages because they combine some of the benefits of nonexperimental research with those of investigator-led and controlled trials. Specifically, they circumvent certain risks to both internal

and external validity that may occur in nonblinded RCTs. They are also ideal for producing causal evidence on long-term results at a minimal cost [58].

2.8.2 Advantages of Quasi-Experimental Studies in Establishing Causal Relationships

Quasi-experimental studies are increasingly being used as a form of proving causation in epidemiology and health systems research. The possibilities of the quasi-experimental research to prove and improve the evidence of the causal impacts are significant:

1. In situations whereby the use of randomized controlled trials is impracticable, they can provide causal evidence.
2. In many cases, they produce causal evidence with a high level of external validity.
3. When participants in non-blinded trials alter their behavior in response to being assigned to either the intervention or control arm, they avoid the risks to internal validity that result (such as compensatory rivalry or resentful demoralization) [57].
4. They are often effective in generating causal evidence related to both the long-term health outcomes of an intervention and its social and economic impacts.
5. They frequently produce evidence more quickly and cheaply than trials and other intervention studies [58].

2.9 Importance of Interrupted Time Series

Interrupted Time Series (ITS) designs are among the most reliable types of quasi-experimental designs. They involve repeated data collection at intervention sites to

determine whether an intervention is associated to changes in a specific outcome, using trends over time rather than a non-equivalent control group for comparison that existed prior to the intervention. When a similar control group cannot be found, as can happen after extensive enforcement of policy requirements, quality improvement projects, or distribution campaigns, they are very helpful [59]. A time series refers to a continuous succession of observations collected from a population over time, typically at regular intervals. An intervention at a defined point in time "interrupts" the existing trend established by a time series of a specific result of interest in an ITS study. It is being utilized more and more to assess the efficacy of interventions ranging from national public health laws to therapeutic therapy. When randomization is not feasible, ITS analyses are among the best evaluative designs. In addition, they frequently enable a more thorough evaluation of the intervention's longitudinal effects than may be feasible with an RCT, and because they are usually conducted in real-world contexts, they may also have higher external validity [60].

Chapter 3

Research Design and Methodology

3.1 Methodology Overview

Quasi-experimental interrupted time series studies are a commonly used research design for evaluating the effects of an intervention or policy over time [61]. In an interrupted time series design, data measured repeatedly and at equally spaced time intervals (e.g. weekly, monthly, or annually) before and after the intervention. A key aspect of this design is having a precise record of when the intervention takes place [62]. In contrast to the randomized controlled trials quasi experimental studies do not randomize the assignment of subjects to treatment or control groups, making them more applicable to real-world scenarios. Data is gathered at multiple time points in an ITS study design both before and after the intervention, allowing for the identification of trends and determining whether observed changes can be attributed to the intervention itself, rather than other influencing factors [63]. Quasi-experimental designs include stepped wedge designs, interrupted time series and pre-post designs involving non-equivalent control groups can prove to be beneficial to implementation researchers especially in circumstances where the use of experimental designs is impossible [59]. Because patients can serve as their own controls to account for potential confounders and prevent regression to the mean,

the quasi-experimental, interrupted time series approach is helpful for the pre-post evaluation of an intervention. The linear mixed random segmented regression model is a valuable tool for addressing missing data with repeated measures and is a reliable study for detecting changes in the slope before and after intervention. To improve the accuracy of the result assessment, we used a combination of subjective and objective approaches to evaluate adherence. Given the high rate of acceptance for the therapeutic interventions, this pilot trial offers preliminary insights into the critical role that patient-centered pharmacist care employing MTM and MI plays in lowering MRPs [64].

3.2 Study Design

The study used a quasi-experimental interrupted time series research design to determine how patient-centered care program led by a pharmacist would impact diabetes management in the hospital-community pharmacy.

3.3 Study Setting

The study was carried out at selected community pharmacies and hospital outpatient departments located in Islamabad, Rawalpindi, and Mirpur. These sites were chosen based on accessibility, and a consistent flow of diabetes patients.

3.4 Sample Size and Recruitment

For this study, a 95% confidence level ($\alpha = 0.05$, Z = 1.96) and 80% statistical power ($\beta = 0.20$, Z = 0.84) were assumed. The standard deviation of HbA1c was taken as 1.68, based on previous studies, and the minimum expected detectable difference (Δ) was set at 0.36% [64]. Using these assumptions, the calculated sample size was approximately 346 participants. Initially 346 people were approached for participation. After the inclusion criterion and exclusion criterion have been applied, 330 patients

were evaluated for eligibility. Among them, 8 individuals were excluded 5 did not fulfil the inclusion criteria, 2 refused to participate, and 1 was excluded for other clinical or logistical reasons. This resulted in a final cohort of 322 eligible participants who were enrolled in the study and completed baseline data collection.

3.5 Sampling Technique

A non-probability purposive sampling method was employed to select participants for the study. This method was appropriate given the targeted nature of the study, which aimed to evaluate a specific intervention on a specific patient population within available resources and time constraints.

3.6 Study Population

The study targeted the adult patients diagnosed with diabetes mellitus, who were already seeking care at the selected sites. Patients were recruited based on a predefined set of criteria.

3.6.1 Inclusion Criteria

Patients aged 30 years and older, who were already prescribed antidiabetic medications and residing in Islamabad, Rawalpindi, and Mirpur were included in the study. Only those individuals who were able to provide informed consent and were receiving care from both hospital and community pharmacy settings were considered eligible for participation.

3.6.2 Exclusion Criteria

Patients who declined to participate were excluded from the study, were pregnant or breastfeeding, or were unable to comprehend or manage their medications.

Those already enrolled in another study, those with incomplete medical records, or those with a prior medical history that could impact the study outcomes were also excluded.

3.7 Intervention Description

The quasi-experimental interrupted time series study was conducted to assess how a pharmacist led intervention impacts the medication adherence and patient outcomes. and patient outcomes. In this single group assignment, all participants received the same intervention, with no comparison group such as a placebo or non-intervention group.

Conducted as an open label study, all participants were aware of the treatment they were receiving. Baseline data were collected prior to the intervention, which enabled an assessment of the outcome stability and potential changes over time.

The intervention, consisting of pharmacist-led care that included medication therapy management and motivational interviewing, was introduced at a specific "interruption" point, after which post-intervention data were collected to evaluate the resulting changes compared to the baseline measurements.

3.8 Follow-up Structure

All 322 participants completed the baseline assessment and received the pharmacist-led intervention. In the second month, the first follow-up was done, and 304 subjects remained in the study. Total of 18 respondents were lost at this stage: 13 due to health-related mortality and 5 due to loss of contact despite repeated follow-up attempts. By the second follow-up, conducted in the third month, 298 participants remained active in the study.

An additional 6 participants were lost 1 due to mortality, 3 due to continued loss of contact, and 2 for unspecified reasons. In total, 24 participants dropped out

during the study period. Overall, the follow-up structure ensured that repeated measures were taken from the majority of participants across the study period.

3.9 Data Collection Procedure

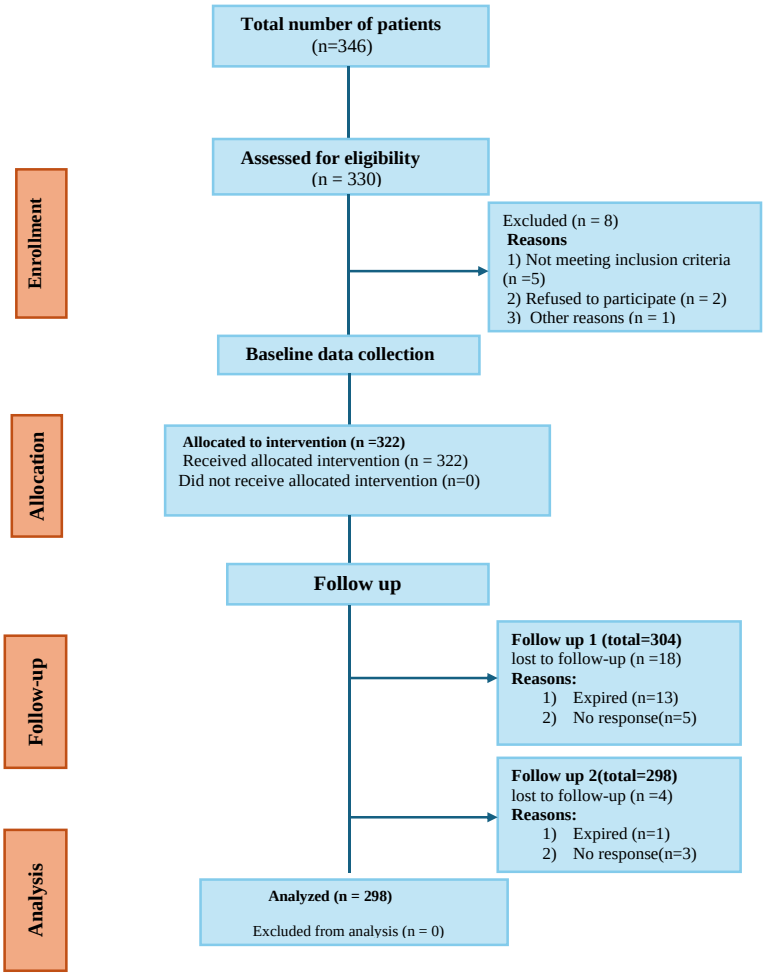


FIGURE 3.1: Methodology Flow Chart

3.9.1 Baseline Data Collection

Total of 322 participants were assessed during the baseline data collection. Baseline data were collected before the intervention to establish a reference point and assess the stability of outcomes. Key clinical measures included RBG, FBG, and HbA1c to evaluate glycemic control, while medication adherence was assessed using the GMAS scale. After

gathering baseline data on participants demographic information, self-care practices, and knowledge of the disease, the pharmacist provided education on diabetes, its symptoms, normal blood glucose levels, and the importance of regular monitoring, food selections of diabetics, the significance of physical exercise and medication adherence, and, diabetes related complications and their monitoring.

3.9.2 First Follow-up

The pharmacist scheduled a follow up of patients after every month. Follow-up 1 was conducted by the end of the second month. At this stage, 304 participants remained engaged in the study out of the 322 who received the pharmacist-led intervention. A total of 18 participants were no longer part of the study 13 due to health-related deaths and 5 due to loss of contact despite repeated follow-up attempts. Data collection was conducted with the cooperation of participants. At every visit, the pharmacist conducted a complete interview of the patients participating in the study. In addition to providing disease-related education, the pharmacist also identified factors contributing to poor medication adherence. The education covered diabetes-related information, lifestyle modifications, medication counseling, and tips aimed at enhancing patients' knowledge of diabetes, improving medication adherence, and promoting health-related quality of life (HRQoL). Those who could attend in person were evaluated during scheduled visits, while participants who were unable to come were contacted by phone and assessed through structured telephonic interviews.

3.9.3 Second Follow-up

The second follow-up occurred in the third month of the study, during which 298 participants remained actively involved.

Since the previous follow-up, four more participants had dropped out one due to mortality and three who consistently refused to respond, despite repeated follow-up efforts.

Data collection followed the same hybrid approach, with both in-person assessments and phone interviews, depending on participant availability.

3.10 Study Intervention

All participants received a structured pharmacist-led, patient-centered intervention designed to enhance diabetes self-management. The intervention involved face-to-face counseling sessions conducted by trained pharmacists. These sessions covered various aspects including education on diabetes, its complications, and the importance of glycemic control. Pharmacists also counseled participants on lifestyle modifications such as diet and exercise, provided guidance on medication compliance by using the general medication adherence scale (GMAS), and reviewed patient lab values (RBG, FBG, HbA1c). Educational brochures were provided to support learning, and pharmacists recorded the details of the sessions using a standardized intervention checklist. Follow-up sessions were used to reinforce the counseling provided and support adherence to management plans.

TABLE 3.1: Description of the Study

Participant Group/Arm	**Intervention/Treatment**
Experimental Patient-centered pharmacist care intervention included the comprehensive interviewing of patients at the baseline point and at months 2 and 3. In these interviews, all drugs were reviewed applying the concepts of MTM (medication therapy management) and MI (motivational interviews). Before the commencement of the study, all of the participants were evaluated at baseline and then on a monthly basis to evaluate the changes in the study outcomes.	**Patient-Centered Pharmacist Care** A thorough interview using the concepts of MTM and MI.

3.11 Data Collection Tools

The first section dealt with the demographic questionnaire different questions were designed to collect information about the participants. The second part was regarding a tool of medication adherence called general medication adherence scale which was developed in the English and the Urdu language and was used to assess medication compliance in the patients with diabetes [65]. It consists of 11 multiple-choice items offering four response categories: always, mostly, occasionally, and never. It assesses adherence across three

distinct aspects: patient-related behaviors, presence of coexisting conditions along with medication load, and personal financial expenditure on medications [66]. The third section consisted of questions that dealt with the perception of HRQoL by the person which shows comfort over the areas that are impacted by the health condition of such individual [67]. The EQ-5D-3L assessed five key health domains: self-care, pain/ discomfort, usual activities, mobility and anxiety/depression. The rating of each dimension had three levels which included level 1 indicating no problems, level 2 indicating some or moderate problems and level 3 indicating extreme problems [67]. The participant's health state was described in 243 different health states. These health states' score ranges from 1 to - 0.594, where 1 indicates the best health state (1111) and - 0.594 for the worse health state (3333) [67]. The visual analogue scale (EQ-VAS) was also included in EQ-5D-3L. The visual analogue scale (EQ-VAS) is a calibrated line, and it determined the respondents self-rated status of health on a graduated (0–100) scale, where 0 indicates feeble health and 100 for the good health of patients. HRQoL is a significant outcome measure that can support the healthcare workers in gaining the level of satisfaction and illness of their patients [68].The fourth section related to feedback of patient satisfaction. Patient satisfaction is one of the most effective indicators and at the same time the most widespread indicators to estimate the quality of care offered to the patients. Although it is not a direct indicator, it has the capability to alter the decision-making of patient, outcomes of treatment and clinical, humanistic and economical outcomes of the treatment [69]. The objective was to design and validate a new bilingual (Urdu and English) patient satisfaction feedback questionnaire tailored for Pakistani patients, assess its validity within this population, and evaluate patient satisfaction after a pharmacist-led counseling session as a pilot initiative [70]. Lab results were collected from the patient's lab profile. Approval for the use of the questionnaire was obtained from the original author prior to data collection.

3.12 Primary and Secondary Outcomes

The main outcome of the study was the change in patient's pharmacological adherence and glycemic control levels, assessed through HbA1c, Random Blood Sugar (RBS), and fasting blood glucose (FBG) measured at baseline and upon

completion of the monitoring period. Secondary outcomes included changes in quality of life (QOL), the number of medication-related problems at months 2 and 3 compared to baseline, patient self-efficacy, Patient satisfaction feedback and number of accepted therapeutic interventions provided by the pharmacist in healthcare approach.

Table 3.2: Primary Outcome Measures

Outcome Measure	**Measure Description**	**Time Frame**
Changes in pharmaco adherence of patients.	Comparing changes in adherence during each of the six interviews	Monthly and up to 3 months.
Random Blood Glucose Diabetes: A blood sugar level of 200 mg/dL (11.1 mmol/L) or higher at any time, accompanied by symptoms of diabetes such as excessive thirst and frequent urination.**Hemoglobin A1c (HbA1c)** A blood test that indicates the average blood glucose levels over the past 2 to 3 months: Normal: Below 5.7% Prediabetes: Between 5.7% and 6.4% Diabetes: 6.5% or higher **Fasting Blood Glucose (FBG):** Normal: Less than 100 mg/dL (5.6 mmol/L) Prediabetes: 100–125 mg/dL (5.6–6.9 mmol/L) Diabetes: 126 mg/dL (7.0 mmol/L) or higher on two separate tests	Indicators of Diabetes change were obtained as the venous plasma was collected and analyzed in a single centralized laboratory according to a standardized method to obtain uniformity of the methodology.	Monthly and up to 3 months.

3.13 Ethical Consideration

Ethical approval for the study was obtained from the Pharmacy Research Ethics Committee (PREC) at the Capital University of Science and Technology, Islamabad (Reference No. REC/FoP/F2024/04). The study was granted ethical approval (Case No.6034/2/Adm-1) by the Ethics Review Committee of Fauji Foundation

Table 3.3: Secondary Outcome Measures

Outcome Measure	**Measure Description**	**Time Frame**
Changes in QOL	Quality of life was evaluated over time using the EQ-5D-3L instrument, which measures five key health domains: self-care, mobility, usual activities, pain/discomfort, and anxiety/depression. Measurements were taken at baseline and repeated until study completion to track changes.	At month 1 month 2 and month 3 of the study.
Change in patient satisfaction after patient-centered care approach.	Change in patient satisfaction, and feedback.	Monthly and up to 3 months.
The difference in the level of medications errors at month 2 and 3 as compared to baseline.	Number of medication related issues.	At month 2 and month 3 of the study.
Number of accepted therapeutic interventions provided by the pharmacist in healthcare approach.	Number of therapeutic interventions suggested by the pharmacists to alter medication regimen based on discussion and approval of prescribing physicians	Monthly and up to 3 months.
Self-management	The questionnaire evaluating self-management was self-made and consisted of 9 statements addressing the self-management behaviors and diabetes knowledge. Patient responses were measured using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), where higher scores indicated better self-management and greater knowledge of their condition.	Self-management will be measured at three points in time (1) at baseline, (2) at completion of 2 months intervention, and (3) at three months follow-up.

Hospital Rawalpindi, and from different community pharmacies. The research objectives and justification were communicated verbally to participants by the principal investigator. Written informed consent was obtained from all participants prior to their enrollment in the study. Participants were guaranteed that their personal health information would remain confidential and would only be accessible to the research team. All study participation was voluntary and participants were not remunerated for their involvement. All participants completed both outcome measures and the full intervention protocol. Pharmaceutical care was provided to the patients during their initial and follow-up visits. Patients received three interventions in total during their monthly follow-up visits with the pharmacist.

3.14 Statistical Analysis

Data analysis was conducted using the statistical package for the social sciences (SPSS), version 27. Descriptive statistics, including means, standard deviations,

and percentages, were used to summarize the baseline demographic characteristics of the participants. The Kolmogorov Smirnov test was used to assess the normality of the data, and non-parametric tests were employed when the data deviated from a normal distribution. To compare baseline vs, follow up values, paired-samples t-test was performed within groups. Mann–Whitney U test and Wilcoxon test was used. Furthermore, regression analysis was carried out to examine the association of key demographic and clinical variables with primary outcomes such as glycemic control, medication adherence, and quality of life. The results were presented using regression coefficients, confidence intervals, and p-values, with a p-value of less than 0.05 considered statistically significant across all analyses. GraphPad Prism was used for graphical representation of the data.

Chapter 4

Results

4.1 Demographics

The data presented in table 4.1 indicate that most of the respondents were between the age of 46 to 60 years 46.0%, followed by those aged 61 to 75 years 25.2%, 31 to 45 years 23.5%, and a smaller proportion above 75 years 5.4%. In terms of gender, most respondents were female 70.8%, while male comprises 29.2% of the sample. Regarding marital status, nearly all participants were married 97.7%, and only a small fraction were single 2.3%. Employment status revealed that 44.6% of participants were employed, whereas 55.4% were not working. A substantial group of respondents 73.5% were found to have a positive family history of diabetes, but 26.5% were from negative family history. The duration of diabetes among participants showed that 65.4% had been diagnosed for less than 10 years, while 34.6% had been living with the condition for more than 10 years. Regular exercise habits were reported by 39.9% of individuals, whereas 60.1% did not engage in regular physical activity. Support for diabetes management was primarily received from family members 59.1%, with 40.9% indicating support from healthcare providers. In terms of medication, 53% of the patients were taking oral diabetes pills, 33.6% were using insulin injections, and 13.4% were on both types of treatment. Co-morbid conditions commonly reported included hypertension 47%, followed by other conditions 33.6%, kidney problems 11.1%, and high cholesterol 8.4%.

TABLE 4.1: Sociodemographic features of the participants of the study

Demographics	**n (%)**
Age (groups)	
31-45	70 (23.5)
46-60	137(46.0)
61-75	75(25.2)
>75	16(5.4)
Gender	
Female	211(70.8)
Male	87(29.2)
Marital status	
Single	7(2.3)
Married	291(97.7)
Employment	
Yes	133(44.6)
No	165(55.4)
Family history of diabetes	
Positive	219(73.5)
Negative	79(26.5)
Duration of diabetes	
<10 years	195(65.4)
>10 years	103(34.6)
Regular Exercise	
No	179(60.1)
Yes	119(39.9)
Support for diabetes management	
Health care providers	122(40.9)
Family	176(59.1)
Type of Medication	
Diabetes Pills	158(53.0)
Injection	100(33.6)
Both	40(13.4)
Co-Morbidities associated with	
Hypertension	140(47.0)
High Cholesterol	25(8.4)
Kidney problems	33(11.1)
Others	100(33.6)

4.2 Evaluation of Random Blood Sugar Variations

The results obtained in table 4.2 and figure 4.1 show a gradual decrease in the levels of random blood sugar during the three follow-ups, thereby signaling improvement with time. At baseline the mean RBS was recorded at 267.06 ± 89.88 mg/dL. This value showed a notable reduction at the first follow-up, with a mean of 258.25 ± 46.86 mg/dL, and further decreased to 246.16 ± 38.10 mg/dL at the second follow-up.

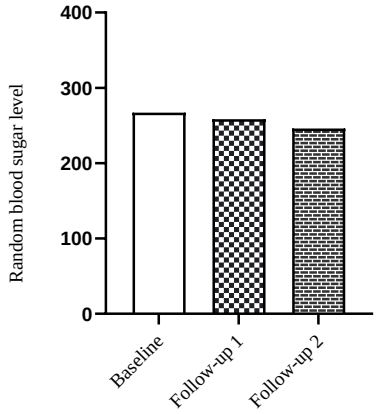


FIGURE 4.1: Variations in mean random blood sugar across study follow-ups.

TABLE 4.2: Descriptive statistics of random blood sugar levels at each follow-up

Follow-ups	**Mean**	**Std. Deviation**
Baseline	267.05	89.88
Follow up 1	258.25	46.86
Follow up 2	246.16	38.10

4.3 Statistical Comparison of Random Blood Sugar

To determine the statistical significance of changes in random blood sugar levels across the follow-up intervals, paired-sample comparisons were performed, as presented in table 4.3. The comparison between baseline and the first follow-up

showed a mean difference of 8.79 mg/dL ± 85.50, which was not statistically significant p = 0.07. A statistically significant difference was observed between follow-up 1 and the second follow-up, with a mean change of 12.09 mg/dL ± 49.92; p < 0.01. The comparison between baseline and F2 indicated a statistically significant mean reduction of 20.89 mg/dL ± 90.23; p < 0.01.

TABLE 4.3: Paired sample analysis of random blood sugar

Follow-ups	**Mean**	**Std dev.**	**P value**
Baseline- F1RBS	8.79	85.50	0.07
F1RBS – F2RBS	12.09	49.92	< 0.01
Baseline – F2RBS	20.89	90.23	< 0.01

F1-Folllow-up 1, F2-Follow-up-2, RBS-Random blood sugar

4.4 Results of Fasting Blood Glucose

Table 4.4 and Figure 4.2 demonstrate a steady decline in fasting blood glucose levels across the three follow-up intervals, indicating a continuous improvement throughout the study period. At the baseline, the mean FBG was recorded at 189.48 ± 84.31 mg/dL. This value declined to 176.13 ± 53.63 mg/dL at the first follow-up, and further decreased to 162.17 ± 41.69 mg/dL by the second follow-up.

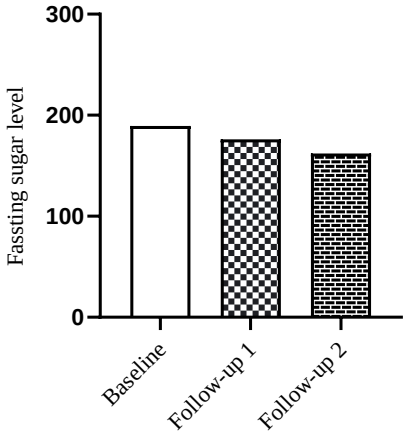


FIGURE 4.2: Variations in mean fasting blood sugar across study follow-ups

TABLE 4.4: Descriptive statistics of fasting sugar levels at each follow-up

Follow-ups	**Mean**	**Std. Deviation**
Baseline FBG	189.48	84.30
F1-FBG	176.13	53.63
F2FBG	162.17	41.69

B-FBG; Baseline fasting blood glucose F1-Folllow-up 1, F2-Follow-up-2

4.5 Statistical Comparison of Fasting Blood Glucose

To evaluate the statistical significance of changes in fasting blood glucose levels across follow-up intervals, paired sample comparisons were conducted see table 4.5. A statistically significant reduction of 13.34 ± 89.01 mg/dL was observed between the baseline and follow-up 1 p =0.10. Similarly, the reduction from follow-up 1 to the follow-up 2 was also significant, with a mean difference of 13.96 ± 53.38 mg/dL p = 0.01. The overall change from baseline to follow-up 2 showed a substantial and statistically significant decrease of 27.31 ± 86.20 mg/dL, p = 0.01.

TABLE 4.5: Paired sample comparison of fasting blood glucose between follow-ups

Follow-ups	**Mean Difference**	**Std. Deviation**	**P value**
Baseline- F1FBG	13.34	89.01	0.10
F1FBG – F2FBG	13.96	53.38	0.01
Baseline – F2FBG	27.31	86.20	0.01

F1-Folllow-up 1, F2-Follow-up-2, FBG-Fasting blood glucose

4.6 Glycemic Control Assessment of HbA1c Levels

The average glycated hemoglobin (HbA1c) at baseline was 8.67 ± 1.68%, which dropped to 7.64 ± 1.06% by follow-up 2. The comparison between the initial

and final HbA1c readings showed a mean reduction of 1.03 ± 1.05%, which was statistically significant $p = 0.001$. The 95% confidence interval for this change ranged from 0.92% to 1.15%, reflecting a consistent and clinically meaningful improvement, as presented in illustrated in figure 4.3 and table 4.6.

TABLE 4.6: Descriptive statistics of HbA1c levels at baseline and second follow-up

Follow-ups	**Mean**	**Standard deviation**
Baseline	8.67	1.68
Follow-up 2	7.64	1.06

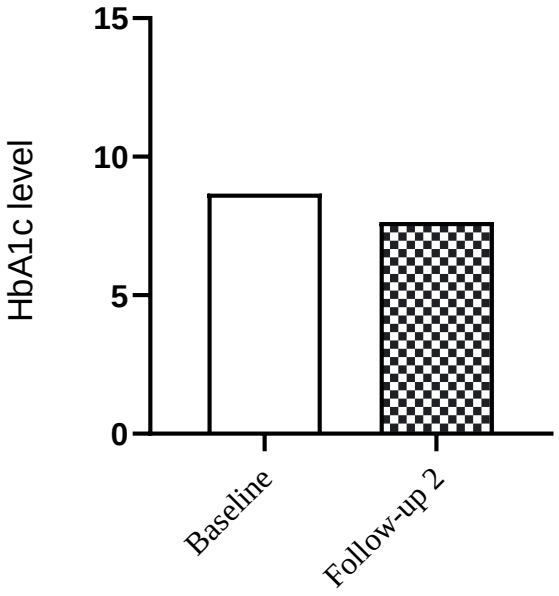


FIGURE 4.3: Variations in mean HbA1c across study follow-ups

4.7 Statistical Comparison of Hba1c

A paired-sample statistical analysis was employed to evaluate the variation in glycated hemoglobin levels between the initial and final follow-ups. The findings, as shown in table 4.7, revealed a statistically significant mean decline of 1.02 ± 1.05%, p = 0.001. The 95% confidence interval for this difference ranged from 0.92% to 1.15%, suggesting a reliable and clinically relevant reduction in HbA1c over time.

TABLE 4.7: Paired sample analysis of HbA1c between baseline and follow-up

Follow-ups	**Mean**	**S. D**	**95% CI**		**P value**
			Lower	**Upper**	
BHbA1C - F2HbA1c	1.02	1.05	0.91	1.14	0.001

B-Baseline, HbA1c-Glycated Hemoglobin, F2-Follow-up 2

4.8 Assessment of EQ-5D-3L Utility Scores

The time trade-off (TTO) utility scores, derived from the first section of the EQ-5D-3L scale, reflect participants perceived quality of life based on five key health dimensions. At baseline, the mean utility score was 0.77 ± 0.26. This increased to 0.89 ± 0.13 at the first follow-up and further improved to 0.93 ± 0.07 by the second follow-up, indicating a steady enhancement in quality of life over time, as shown in figure 4.4 and table 4.8.

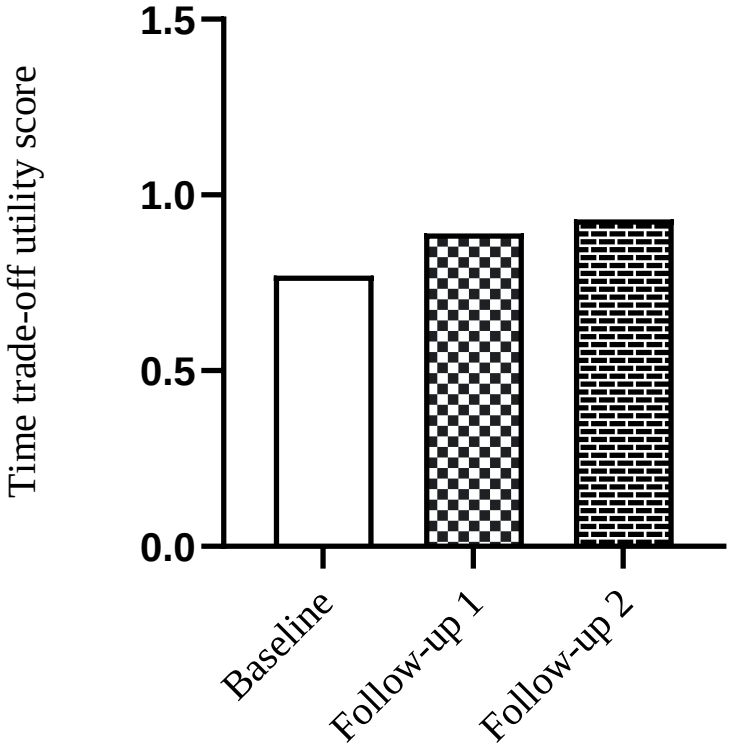


FIGURE 4.4: Difference between TR values across follow-ups

TABLE 4.8: Mean and standard deviation of TR values

Follow-ups	**Mean**	**St. Deviation**
BEQ-5D-3L	0.77	0.26
F1EQ-5D-3L	0.89	0.13
F2EQ_5D_3L	0.93	0.07

B; Baseline, F1; Follow-up 1, F2; follow-up 2, EQ-5D-3L; three-level EuroQol five-dimensional questionnaire

4.8.1 Statistical Comparison of EQ-5D-3L Utility Scores

Table 4.9, presents a statistical comparison of utility scores obtained at each stage of follow-up. The mean difference between baseline and follow-up 1 was 0.126 ± 0.18, $p = 0.03$, between follow-up 1 and follow-up 2 was 0.33 ± 0.98, $p = 0.01$, and mean difference was 0.15 ± 0.22, $p = 0.00$ between baseline and follow-up 2.

TABLE 4.9: Comparison of TR values

Follow-ups	**Mean**	**Std.**	**Sig. 2-tailed**
BEQOL -F1EQOL	0.12	0.18	0.03
F1EQOL - F2EQOL	0.33	0.98	0.01
BEQOL - F2EQOL	0.15	0.22	0.00

B; Baseline, F1; Follow-up 1, F2; follow-up 2, QOL; Quality of life

4.8.2 4.8.2 Descriptive Analysis of Visual Analogue Scale

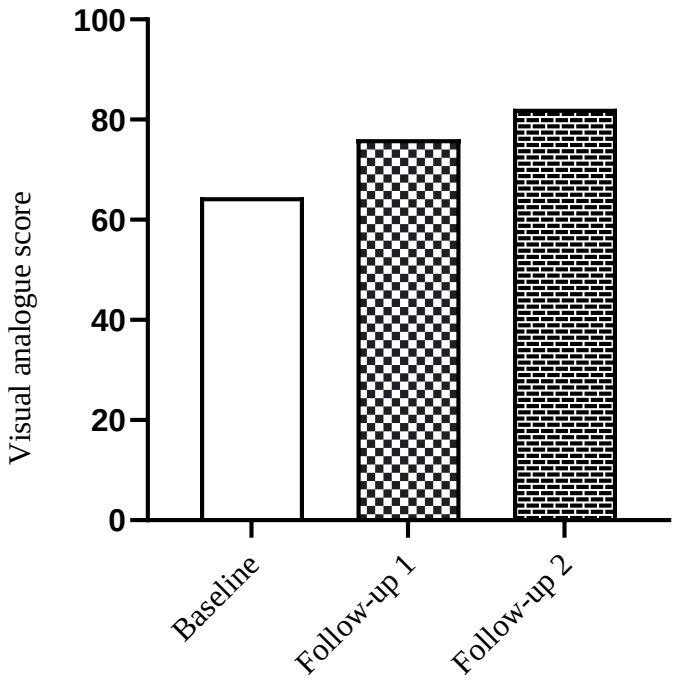


FIGURE 4.5: Trend in mean vas score across follow ups

This table presents the mean and standard deviation of Visual Analogue Scale scores collected across three follow-up points. The VAS reflects patients' subjective assessment of their overall health status. At baseline, the mean VAS score was 64.50 ± 16.75, indicating a moderate perception of well-being. By the first follow-up, the score had increased to 76.07 ± 14.51, and further improved to 82.15 ± 13.39 by the second follow-up. These trends suggest a steady enhancement in perceived health, as detailed in table 4.10 and illustrated in figure 4.5.

TABLE 4.10: Mean and standard deviation of VAS scores at follow-ups

Follow-ups	**Mean**	**Std. Deviation**
BVAS	64.49	16.75
F1VAS	76.07	14.50
F2VAS	82.14	13.38

VAS: visual analogue scale

4.8.3 Comparison of Mean VAS Score Changes

Table 4.11 illustrates the differences in VAS scores observed between each pair of monthly follow-up intervals. The comparison from baseline to F1 revealed an average improvement of 11.58 ± 11.97, p = 0.04, indicating a statistically significant change. From F1 to F2, the VAS score further increased by 6.07 ± 11.53, p = 0.03, while the overall change from baseline to F3 showed a total gain of 17.65 ± 11.47, p = 0.01y.

TABLE 4.11: Paired comparisons of VAS score differences between follow-ups

Follow-ups	**Mean**	**Std. Deviation**	**P value**
BQOL6 - F1QOL6	11.57	11.97	0.04
F1QOL6– F2QOL6	6.07	11.53	0.03
BQOL6 – F2QOL6	17.65	15.47	0.01

B; Baseline, F1; Follow-up 1, F2; Follow-up 2, QOL; quality of life

4.9 Simple Mean and Standard Deviation of GMAS Domains

As presented in the table 4.12, the mean score for Domain 1 (non-adherence due to patient behavior) decreased from 3.54 ± 1.02 at baseline to 2.40 ± 0.69 at follow-up 1 and 2.20 ± 0.74 at follow-up 2. In Domain 2 (non-adherence related to comorbidity and pill burden), the mean score declined from 2.85 ± 1.05 at baseline to 2.22 ± 0.92 and 1.96 ± 0.81 at the respective follow-ups. Similarly, Domain 3 (non-adherence due to financial constraints) showed a reduction from 2.88 ± 1.23 at baseline to 2.47 ± 0.97 at follow-up 1 and 1.97 ± 0.81 at follow-up 2. A consistent decline in mean scores was observed across all domains. Standard deviation values also showed a slight decrease over time.

TABLE 4.12: Longitudinal comparison of adherence domain scores across follow-ups

Follow-ups	Mean	Standard deviation
Domain 1: Non-adherence due to patient behaviour (un-intentional and intentional)		
Baseline	3.54	1.02
Follow-up 1	2.40	0.69
Follow-up 2	2.20	0.74
Domain 2: Non-adherence due to additional disease and pill burden		
Baseline	2.85	1.05
Follow-up 1	2.22	0.92
Follow-up 2	1.96	0.81
Domain 3: Non-adherence due to financial constraints		
Baseline	2.88	1.23
Follow-up 1	2.47	0.97
Follow-up 2	1.97	0.81

4.10 Non Adherence Due to Patient Behaviour

Table 4.13 shows that at baseline, adherence in the behavior-related domain was suboptimal, with only 10.1% of patients showing high adherence and 22.8% reporting good adherence. In contrast, a substantial proportion demonstrated partial 31.2%, low 21.8%, or poor adherence 14.1%. By follow-up 1, a marked improvement was observed, as the proportion of highly adherent patients increased to 20.5%, while good adherence increased to 32.2%. Correspondingly, partial adherence dropped to 23.5%, low adherence to 16.1%, and poor adherence to 7.7%. At follow-up 2, adherence further improved. High adherence reached 24.5%, and good adherence peaked at 40.6%. Meanwhile, partial, low, and poor adherence decreased to 20.1%, 11.1%, and 3.7%, respectively.

TABLE 4.13: Adherence levels in Domain

Grading 1 Baseline	**Frequency**	**Percent**
High Adherence	30	10.1
Good Adherence	68	22.8
Partial Adherence	93	31.2
Low Adherence	65	21.8
Poor Adherence	42	14.1
Grading 1 Follow-up 1		
High Adherence	61	20.5
Good Adherence	96	32.2
Partial Adherence	70	23.5
Low Adherence	48	16.1
Poor Adherence	23	7.7
Grading 1 Follow-up 2		
High Adherence	73	24.5
Good Adherence	121	40.6
Partial Adherence	60	20.1
Low Adherence	33	11.1
Poor Adherence	11	3.7

4.10.1 Non-Adherence Due to Disease Burden and Polypharmacy

In the baseline assessment, non-adherence due to polypharmacy and comorbid conditions was significant. Only 10.4% of patients were highly adherent, with 23.8% showing good adherence. The remainder were largely partially adherent 29.5%, low adherent 22.8%, or poorly adherent 13.4%. At follow-up 1, high adherence increased to 22.5%, and good adherence to 34.6%. Meanwhile, partial adherence fell to 20.1%, low adherence to 13.4%, and poor adherence to 9.4%. By follow-up 2, high adherence increased further to 25.8%, and good adherence to 44.6%,

nearly doubling the baseline level. Partial, low, and poor adherence reduced to 18.1%, 7.0%, and 4.4%, respectively. Table 4.14 shows the detailed distribution of adherence levels across the three study time points.

TABLE 4.14: Adherence levels in Domain

Grading-2 Baseline	**Frequency**	**Percent**
High Adherence	31	10.4
Good Adherence	71	23.8
Partial Adherence	88	29.5
Low Adherence	68	22.8
Poor Adherence	40	13.4
Grading-2 Follow-up 1		
High Adherence	67	22.5
Good Adherence	103	34.6
Partial Adherence	60	20.1
Low Adherence	40	13.4
Poor Adherence	28	9.4
Grading-2 Follow-up 2		
High Adherence	77	25.8
Good Adherence	133	44.6
Partial Adherence	54	18.1
Low Adherence	21	7.0
Poor Adherence	13	4.4

4.10.2 Non-Adherence Due to Financial Constraints

At baseline, only 10.7% of participants achieved high adherence, and 22.8% had good adherence. However, a substantial portion exhibited partial 30.5%, low 21.8%, and poor adherence 14.1%. At follow-up 1, improvements began to emerge. High adherence increased to 20.5%, and good adherence to 33.2%, while partial, low, and poor adherence decreased to 21.5%, 16.8%, and 8.1%, respectively. By follow-up 2, adherence showed further enhancement. High adherence increased to 30.9%,

and good adherence to 40.6% a substantial improvement over baseline. Partial adherence reduced to 15.8%, low adherence to 9.4%, and poor adherence to 3.4%. Table 4.15 presents the detailed distribution of adherence levels at each time point.

TABLE 4.15: Adherence levels in Domain 3

Grading-3 (Baseline)	**Frequency**	**Percent**
High Adherence	32	10.7
Good Adherence	68	22.8
Partial Adherence	91	30.5
Low Adherence	65	21.8
Poor Adherence	42	14.1
Grading-3 Follow-up 1		
High Adherence	61	20.5
Good Adherence	99	33.2
Partial Adherence	64	21.5
Low Adherence	50	16.8
Poor Adherence	24	8.1
Grading-3 Follow-up 2		
High Adherence	92	30.9
Good Adherence	121	40.6
Partial Adherence	47	15.8
Low Adherence	28	9.4
Poor Adherence	10	3.4

4.10.3 Grading for Overall Medication Adherence

The overall cumulative medication adherence scores were assessed using the general medication adherence scale. At baseline, the mean cumulative adherence score was 18.45 ± 4.53, indicating low to moderate adherence among participants. At the first follow-up, the mean score significantly increased to 23.20 ± 2.68, suggesting a notable improvement in adherence. This positive trend continued at the second follow-up, with the highest mean adherence score recorded at 23.97 ± 2.48. Table

4.16 presents the detailed progression of cumulative adherence scores across all three assessment points.

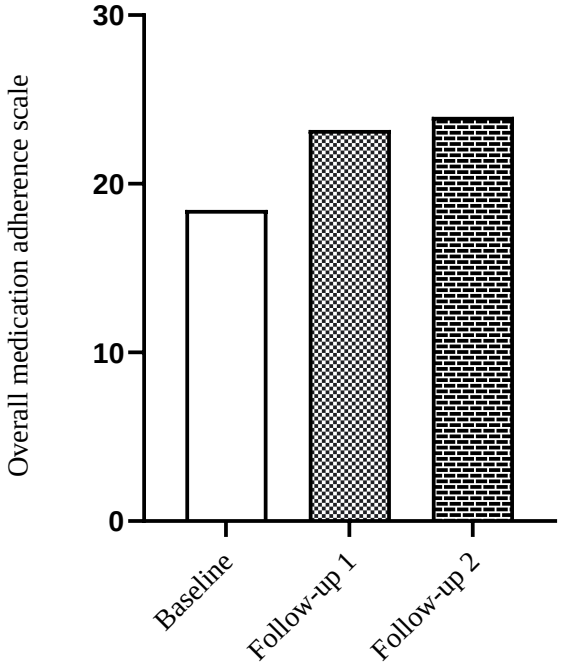


FIGURE 4.6: Trends in overall medication adherence.

TABLE 4.16: Mean and standard deviation of overall medication adherence

Follow-ups	**Mean**	**Standard deviation**
Baseline	18.45	4.53
Follow-up 1	23.20	2.68
Follow-up 2	23.97	2.48

4.11 Evaluation of Self-Management and Diabetes Knowledge Over Time

As presented in table 4.17, participants' baseline responses indicated moderate levels of self-management and knowledge regarding their illness. For self-management, the median score for most items was 3 with an interquartile range (IQR) of 1.

Participants moderately accused that the service encouraged them to keep their sickliness in control with a median = 3, and CI: 3.43–3.54, helped them take medications more consistently with a median = 4, CI: 3.45–3.56, and provided confidence to manage their condition with a median = 3, CI: 3.32–3.44. They also reported moderate agreement with feeling a sense of success after completing the service with a median = 3, and CI: 3.26–3.39 and noted some improvement in diet and exercise routines with a median = 3, CI: 3.37–3.49. Regarding knowledge, participants showed a fair understanding of dietary needs with a median = 3, CI: 3.39–3.50, exercise guidelines with a median score = 4, and CI: 3.45–3.57, and the effects of stress, weight, and blood pressure on blood sugar with a median = 4, and CI: 3.44–3.56. However, there was noticeable uncertainty about which types of exercises were beneficial for managing their illness, reflected by a low median score of 2 and CI: 2.40–2.52, indicating confusion in this area.

TABLE 4.17: Baseline scores of self-management and knowledge domains

		95% Confidence Interval	
Baseline	**M (IQR)**	**Lower Limit**	**Upper Limit**
Self-Management			
1) The service encourages me to maintain hold over my illness.	3(1)	3.43	3.54
2) Since I joined the service, I take my meds more consistently.	4(1)	3.45	3.56
3) The service provides me the confidence to manage my illness.	3(1)	3.32	3.44
4) After completing the service and reaching my goals, I feel a sense of success.	3(1)	3.26	3.39
5) Since joining the service, I have made improvements to my diet and workout routine.	3(1)	3.37	3.49
Knowledge			
1) I am happy with my knowledge of what I should consume so as to manage my illness.	3(1)	3.39	3.50
2) I am comfortable with my knowledge of the kinds and quantities of exercise I can perform to manage my illness.	4(1)	3.45	3.57

Continued on next page

		95% Confidence Interval	
Baseline	**M (IQR)**	**Lower Limit**	**Upper Limit**
3) I am pleased with my understanding of how aspects such as stress, weight and blood pressure can change my blood glucose level.	4(1)	3.44	3.56
4) I do not know what types of exercises can support me to handle my illness.	2(1)	2.40	2.52

4.11.1 Follow-Up 1 Assessment of Self-Management and Knowledge

During the first follow-up, results showed a noticeable improvement in both self-management and knowledge. For self-management, all items recorded a higher median score of 4. Participants strongly agreed that the service encouraged control over illness with a median=4, and CI: 3.97–4.00, improved medication consistency with a median=4, and CI: 3.66–3.76, boosted confidence with a median=4, and CI: 3.73–3.83, and led to a sense of accomplishment with a median=4, and CI: 3.75–3.84. They also acknowledged improvements in diet and workout routines with a median=4, and CI: 3.83–3.92. Knowledge also saw improvement, with higher agreement on understanding dietary needs with a median=4, and CI: 3.91–3.97, exercise guidelines with a median=4, and CI: 3.79–3.89, and the impact of lifestyle factors with a median=4, and CI: 3.76–3.85. Importantly, there was a considerable increase in clarity regarding appropriate exercise types, with the median increasing to 4 and CI: 3.21–3.40.

Table 4.18: Follow-up 1 scores of self-management and knowledge domains

		95% Confidence Interval	
Follow-up 1	**M (IQR)**	**Lower Limit**	**Upper limit**
Self-Management			
1) The service encourages me to maintain hold over my illness.	4(0)	3.97	4.0

Continued on next page

		95% Confidence Interval	
Follow-up 1	**M (IQR)**	**Lower Limit**	**Upper limit**
2) Since I joined the service, I take my meds more consistently.	4(1)	3.66	3.76
3) The service provides me the confidence to manage my illness.	4(0)	3.73	3.83
4) After completing the service and reaching my goals, I feel a sense of success.	4(0)	3.75	3.84
5) Since joining the service, I have made improvements to my diet and workout routine	4(0)	3.83	3.92
Knowledge			
1) I am happy with my knowledge of what I should consume so as to manage my illness.	4(0)	3.91	3.97
2) I am comfortable with my knowledge of the kinds and quantities of exercise I can perform to manage my illness.	4(0)	3.79	3.89
3) I am pleased with my understanding of how aspects such as stress, weight and blood pressure can change my blood glucose level.	4(0)	3.76	3.85
4) I do not know what types of exercises can support me to handle my illness.	4(1)	3.21	3.40

4.11.2 Follow-Up-2 Assessment of Self-Management and Knowledge

By the second follow-up, participants' self-management and knowledge continued to demonstrate strong and sustained improvements. As shown in table 4.19, self-management responses remained consistently high across all items, with median scores of 4 and narrower confidence intervals. Perceived control over illness reached a CI of 4.01–4.06, medication adherence 3.84–3.94, confidence in illness management 3.75–3.85, sense of success 3.86–3.95, and improvement in diet and workout routine 3.84–3.93. Knowledge scores were also notably positive. Participants expressed

high satisfaction with their understanding of dietary needs having CI: 3.96–3.99, exercise guidelines with a CI score from 3.79–3.89, and the impact of lifestyle elements including stress, weight, and blood pressure on blood sugar levels with a CI range from 3.68–3.79. Furthermore, prior uncertainty regarding beneficial exercise types had significantly diminished, with the median sustained at 4 and the confidence interval improving to 3.61–3.73.

TABLE 4.19: Follow-up 2 scores of self-management and knowledge domains

		95% Confidence Interval	
Follow-up 2	**M (IQR)**	**Lower Limit**	**Upper Limit**
Self-Management			
1) The service encourages me to maintain hold over my illness.	4(0)	4.01	4.06
2) Since I joined the service, I take my meds more consistently.	4(0)	3.84	3.94
3) The service provides me the confidence to manage my illness.	4(0)	3.75	3.85
4) After completing the service and reaching my goals, I feel a sense of success.	4(0)	3.86	3.95
5) Since joining the service, I have made improvements to my diet and workout routine	4(0)	3.84	3.93
Knowledge			
1) I am happy with my knowledge of what I should consume so as manage my illness.	4(0)	3.96	3.99
2) I am comfortable with my knowledge of the kinds and quantities of exercise I can perform to manage my illness.	4(0)	3.79	3.89
3) I am pleased with my understanding of how aspects such as stress, weight and blood pressure can change my blood glucose level.	4(1)	3.68	3.79
4) I do not know what types of exercises can support me to handle my illness.	4(1)	3.61	3.73

4.12 Patient Satisfaction Feedback on Pharmacist Counseling

As shown in table 4.20, at baseline, 52.2% of patients reported being able to receive counseling without difficulty. However, only 13% found the pharmacist to be very helpful in resolving their queries, while 52.2% considered them somewhat helpful, and 34.4% rated them as not helpful. In terms of counseling time, 46.8% felt it was appropriate, 26.1% desired more time, and 26.8% believed their time was wasted. Additionally, 52.5% of patients expressed willingness to recommend the counseling service to others, and 55.2% supported the idea of offering such services in their locality. Regarding overall satisfaction, only 18.1% reported being very satisfied, 35.5% were satisfied, 26.4% remained uncertain, and 19.7% expressed dissatisfaction.

Table 4.20: Baseline analysis of patient satisfaction feedback

Patient satisfaction feedback (Baseline)	**n (%)**
1) Were you able to get counseling without any trouble?	
Yes	156(52.2)
No	142(47.7)
2) Did the pharmacist help you with your questions?	
Very helpful	39(13.0)
Somewhat helpful	156(52.2)
Not helpful	103(34.4)
3) How do you feel about time limits of pharmacist counseling?	
More time should be given	78(26.1)
Appropriate time was given	140 (46.8)
My time was wasted	80(26.8)
4) Would you advise others to get counseling with pharmacists?	
Yes	157(52.5)
No	141(47.2)
5) Would you like the pharmacies in your locale to provide this service?	

Continued on next page

Patient satisfaction feedback (Baseline)	**n (%)**
Yes	265(55.2)
No	133(44.5)
6) What grade would you give on pharmacist counseling?	
Very satisfied	54(18.1)
Satisfied	106(35.5)
Uncertain	79(26.4)
Not satisfied	59(19.7)

Concluded

4.12.1 Effect of Pharmacist-Led Counseling on Patient Satisfaction at Follow-up 1

As shown in table 4.21, after the first intervention, patient satisfaction demonstrated noticeable improvement. Approximately 60.5% of participants reported receiving counseling without difficulty. The percentage of patients who found the pharmacist very helpful increased to 24.1%, while those who considered them unhelpful dropped to 23.1%. Most patients i.e. 60.5% felt the counseling time was appropriate, and only 21.1% believed their time was wasted. Moreover, 62.5% expressed willingness to recommend pharmacist counseling to others, and 64.5% supported offering the service in their local area. Overall satisfaction levels rose, with 23.7% reporting being very satisfied and 41.8% satisfied.

TABLE 4.21: Analysis of patient satisfaction feedback at first follow-up

Patient satisfaction feedback(F1)	**n (%)**
1) Were you able to get counseling without any trouble?	
Yes	181(60.5)
No	117(39.1)
2) Did the pharmacist help you with your questions?	

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Patient satisfaction feedback(F1)	**n (%)**
Very helpful	72(24.1)
Somewhat helpful	157(52.5)
Not helpful	69(23.1)
3) How do you feel about time limits of pharmacist counseling?	
More time should be given	54(18.1)
Appropriate time was given	181(60.5)
My time was wasted	63(21.1)
4) Would you advise others to get counseling with pharmacists?	
Yes	187(62.5)
No	111(37.1)
5) Would you like the pharmacies in your locale to provide this service?	
Yes	193(64.5)
No	105(35.1)
6) What grade would you give on pharmacist counseling?	
Very satisfied	71(23.7)
Satisfied	125(41.8)
Uncertain	60(20.1)
Not satisfied	42(14.0)

4.12.2 Effect of Pharmacist-Led Counseling on Patient Satisfaction at Follow-up 2

In the final follow-up, substantial improvement in patient satisfaction was observed. A high percentage (80.6%) could access counseling without any difficulty. The number of patients who found the pharmacist very helpful increased to 39.1%, and those finding them unhelpful dropped to 16.4%. About 74.9% rated the counseling time as appropriate. A significant 75.3% were willing to recommend the counseling

service, and 76.6% favored its availability in local pharmacies. Satisfaction levels were highest at this stage, with 34.4% being very satisfied and 48.8% satisfied, while dissatisfaction dropped to just 9%.

TABLE 4.22: Analysis of patient satisfaction feedback at second follow-up

Patient satisfaction feedback(F2)	**n (%)**
1) Were you able to get counseling without any trouble?	
Yes	241(80.6)
No	57(19.1)
2) Did the pharmacist help you with your questions?	
Very helpful	117(39.1)
Somewhat helpful	132(44.1)
Not helpful	49(16.4)
3) How do you feel about time limits of pharmacist counseling?	
More time should be given	37(12.4)
Appropriate time was given	224(74.9)
My time was wasted	37(12.4)
4) Would you advise others to get counseling with pharmacists?	
Yes	225(75.3)
No	73(24.4)
5) Would you like the pharmacies in your locale to provide this service?	
Yes	229(76.6)
No	69(23.1)
6) What grade would you give on pharmacist counseling?	
Very satisfied	103(34.4)
Satisfied	146(48.8)
Uncertain	22(7.4)
Not satisfied	27(9.0)

F2; Follow-up 2

4.12.3 Comparison of Patient Satisfaction Feedback Counselling Scale Across Follow-ups

As shown in table 4.23, at baseline, the mean patient satisfaction mean 9 score was 2.04 ± 0.57, indicating a moderate level of satisfaction. Following the first follow-up, the mean score increased to 2.53 ± 0.49, reflecting a

noticeable improvement in the satisfaction of patients following the intervention of pharmacist. In second follow-up, the mean score further improved to 2.98 ± 0.10, demonstrating a significant and sustained enhancement in satisfaction levels over time.

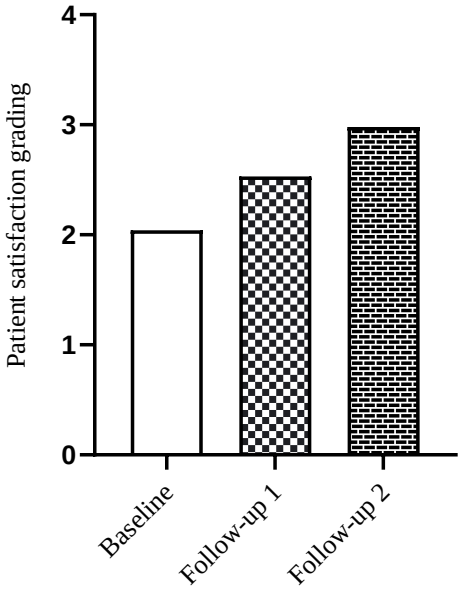

FIGURE 4.7: Difference in mean values across follow-ups

TABLE 4.23: Comparative analysis of mean PSF9 scores

Follow-ups	**Mean**	**Standard Deviation**
Baseline PSF9	2.04	0.57
Follow-up 1 PSF9	2.53	0.49
Follow-up 2 PSF9	2.98	0.10

PSF; Patient satisfaction feedback

4.13 Impact of Demographics on Random Blood Sugar

As shown in table 4.24, the impact of demographic variables on random blood sugar levels was assessed using the non-parametric Mann–Whitney U test. The findings showed that the differences were not statistically significant in random blood sugar

levels across any of the demographic variables evaluated. While participants aged 46–60 years had the highest mean rank of 109.47 and those aged 61–75 years had the lowest mean rank i.e. 44.86, the difference between age groups was statistically insignificant p = 0.98. Gender-wise, females had a higher mean rank 154.27 than males 137.94, but the difference was not significant p = 0.13. Married individuals exhibited a slightly higher mean rank of 150.73 than single participants having mean rank of 98.50, yet the result lacked statistical significance p = 0.11. Employment status showed negligible variation, with mean ranks of 148.32 for employed and 150.45 for unemployed individuals p = 0.83. Similarly, those with a positive family history of diabetes had a mean rank of 151.69, compared to 143.42 for those without family history of diabetes p = 0.46.

The duration of diabetes also showed no significant association with random blood sugar levels; participants with a diabetes duration of less than 10 years had a mean rank of 150.58, while those with more than 10 years had 147.45 and p = 0.76. Participants who did not engage in regular physical activity had a higher mean rank of 152.87 than those who did 144.42, but this was insignificant i.e. p = 0.40. Finally, the type of support received for diabetes management whether from healthcare providers with a mean rank of 151.14 or from family having mean rank equal to 148.36 did not yield significant differences in random blood sugar levels p = 0.78.

Table 4.24: Non-parametric analysis to corelate RBS and sociodemographic

Demographics	**n (%)**	**Mean Rank**	**p-value**
Age (groups)			0.98
31-45	70(23.5)	94.92	
46-60	137(46.0)	109.47	
61-75	75(25.2)	44.86	
>75	16(5.4)	48.47	
Gender			0.13
Female	211(70.8)	154.27	
Male	87(29.2)	137.94	
Marital status			0.11
Single	7(2.3)	98.50	

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Demographics	**n (%)**	**Mean Rank**	**p-value**
Married	291(97.7)	150.73	
Employment			0.83
Yes	133(44.6)	148.32	
No	165(55.4)	150.45	
Family history of diabetes			0.46
Positive	219(73.5)	151.69	
Negative	79(26.5)	143.42	
Duration of diabetes			0.76
<10 years	195(65.4)	150.58	
>10 years	103(34.6)	147.45	
Regular Exercise			0.40
No	179(60.1)	152.87	
Yes	119(39.9)	144.42	
Support for diabetes management			0.78
Health care providers	122(40.9)	151.14	
Family	176(59.1)	148.36	

F2; Follow-up 2

4.14 Impact of Demographics on Fasting Blood Glucose

As shown in table 4.25, there was a notable variation in fasting blood glucose levels between age groups p = 0.04, with participants aged 31–60 years exhibiting higher mean ranks compared to older age groups. Additionally, the type of support for diabetes management demonstrated a statistically significant association with FBG levels p = 0.01; individuals receiving support from healthcare providers had better FBG control compared to those supported primarily by family members. No statistically significant differences in FBG levels were found based on gender p = 0.16, marital status p = 0.07, employment status p = 0.47, family history of diabetes p = 0.221, or duration of diabetes p = 0.70, or regular exercise p = 0.76, although minor variations in mean ranks were observed.

TABLE 4.25: Non-parametric analysis to corelate FBG and sociodemographic

Demographics	**n (%)**	**Mean Rank**	**p-value**
Age (groups)			0.99
31-45	70(23.5)	104.47	
46-60	137(46.0)	104.57	
61-75	75(25.2)	42.91	
>75	16(5.4)	57.47	
Gender			0.16
Female	211(70.8)	153.97	
Male	87(29.2)	138.65	
Marital status			0.07
Single	7(2.3)	91.57	
Married	291(97.7)	150.89	
Employment			0.47
Yes	133(44.6)	153.50	
No	165(55.4)	146.28	
Family history of diabetes			.221
Positive	219(73.5)	153.17	
Negative	79(26.5)	139.34	
Duration of diabetes			0.70
<10 years	195(65.4)	150.87	
>10 years	103(34.6)	146.91	
Regular Exercise			0.76
No	179(60.1)	148.26	
Yes	119(39.9)	151.37	
Support for diabetes management			0.01
Health care providers	122(40.9)	163.51	
Family	176(59.1)	139.79	

4.15 Impact of Demographics on HbA1c

As presented in table 4.26, employment status significantly influenced HbA1c levels, with employed individuals demonstrating higher mean ranks 162.55 compared to their unemployed counterparts p = 0.01. Additionally, a significant correlation was observed between HbA1c levels and regular exercise p = 0.03, with individuals

who exercised regularly having higher mean ranks 162.67. Furthermore, the type of support for diabetes management showed a significant impact: participants receiving support from family exhibited higher mean ranks 158.74 than those supported by healthcare providers p = 0.02. In contrast, no significant differences were observed in the levels of HbA1c based on age, gender, marital status, family history of diabetes, and duration of diabetes since the p-value of all of these aspects was greater than 0.05.

TABLE 4.26: Impact of demographic factors on HbA1c levels

Demographics	**n (%)**	**Mean Rank**	**p-value**
Age (groups)			0.14
31-45	70(23.5)	95.97	
46-60	137(46.0)	108.92	
61-75	75(25.2)	47.43	
>75	16(5.4)	36.59	
Gender			0.46
Female	211(70.8)	147.14	
Male	87(29.2)	155.24	
Marital status			0.06
Single	7(2.3)	89.0	
Married	291(97.7)	150.96	
Employment			0.01
Yes	133(44.6)	162.55	
No	165(55.4)	138.98	
Family history of diabetes			0.63
Positive	219(73.5)	150.93	
Negative	79(26.5)	145.53	
Duration of diabetes			0.30
<10 years	195(65.4)	145.79	
>10 years	103(34.6)	156.52	
Regular Exercise			0.03
No	179(60.1)	140.75	
Yes	119(39.9)	162.67	
Support for diabetes management			0.02

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Demographics	n (%)	Mean Rank	p-value
Health care providers	122(40.9)	136.18	
Family	176(59.1)	158.74	

4.16 Impact of Demographics on Quality of Life

As shown in table 4.27, age was significantly associated with quality of life, with the 61–75 age group demonstrating the highest mean rank 97.11 compared to other age groups $p = 0.01$. Gender differences approached statistical significance $p = 0.05$, with males showing higher mean ranks 163.78 than females 143.61. Marital status did not significantly influence quality of life $p = 0.29$, and both single and married individuals exhibited similar mean ranks. Employment status showed a trend toward significance $p = 0.06$, with employed individuals having a higher mean rank 159.21 compared to unemployed individuals 141.68. There was no significant correlation between quality of life and family history of diabetes $p = 0.19$. However, duration of diabetes had a significant impact $p < 0.01$, with those diagnosed for less than 10 years reporting better quality of life mean rank = 165.24 than those with a longer duration mean rank = 119.70. Regular exercise also demonstrated a statistically significant association $p < 0.01$, with regularly exercising individuals scoring higher mean rank = 170.13 than those who did not exercise mean rank = 135.79. Quality of life scores did not significantly change based on the type of support from family or medical professionals received for managing diabetes $p = 0.69$.

Table 4.27: Impact of demographic factors on quality of life (TR) values

Demographics	n (%)	Mean Rank	p-value
Age (groups)			0.05
31-45	70(23.5)	93.86	
46-60	137(46.0)	110.01	
61-75	75(25.2)	48.70	
>75	16(5.4)	30.72	

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Demographics	n (%)	Mean Rank	p-value
Gender			0.22
Female	211(70.8)	145.80	
Male	87(29.2)	158.48	
Marital status			0.03
Single	7(2.3)	241.43	
Married	291(97.7)	147.29	
Employment			0.38
Yes	133(44.6)	154.09	
No	165(55.4)	145.80	
Family history of diabetes			0.18
Positive	219(73.5)	145.72	
Negative	79(26.5)	159.99	
Duration of diabetes			<0.01
<10 years	195(65.4)	164.48	
>10 years	103(34.6)	121.14	
Regular Exercise			<0.01
No	179(60.1)	136.41	
Yes	119(39.9)	169.20	
Support for diabetes management			0.34
Health care providers	122(40.9)	154.92	
Family	176(59.1)	145.74	

4.16.1 Impact of Demographics on Quality of Life (VAS Score)

Regarding age groupings, the 61–75 age group differed significantly from the others $p = 0.01$. with individuals in this age group showing the highest mean rank 97.11. Gender differences also showed a borderline significance $p = 0.05$, with males having a higher mean rank 163.78 compared to females 143.61. Marital status did not significantly influence the quality-of-life $p = 0.29$, with both single and married individuals exhibiting similar mean ranks. Employment status was found to be approaching significance $p = 0.06$, with employed individuals having a higher

mean rank 159.21 than those unemployed 141.68. No significant large effects were found between family history of diabetes and the quality-of-life $p = 0.19$, as there were similar mean ranks for both groups. The duration of diabetes highly impacts the quality-of-life $p < 0.01$, with individuals having diabetes for less than 10 years showing a higher mean rank 165.24 compared to those with diabetes for more than 10 years (119.70). Regular exercise had a significant effect $p < 0.01$, with individuals who exercised regularly showing a higher mean rank 170.13 than those who did not 135.79. Finally, the type of support for diabetes management did not show a significant variation $p = 0.69$, as individuals receiving support from healthcare providers and family had nearly identical mean ranks.

TABLE 4.28: Impact of demographic factors on quality of life

Demographics	**n (%)**	**Mean Rank**	**p-value**
Age (groups)			0.17
31-45	70(23.5)	48.68	
46-60	137(46.0)	30.81	
61-75	75(25.2)	97.11	
>75	16(5.4)	108.33	
Gender			0.05
Female	211(70.8)	143.61	
Male	87(29.2)	163.78	
Marital status			0.29
Single	7(2.3)	181.57	
Married	291(97.7)	148.73	
Employment			0.06
Yes	133(44.6)	159.21	
No	165(55.4)	141.68	
Family history of diabetes			0.19
Positive	219(73.5)	145.75	

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Demographics	**n (%)**	**Mean Rank**	**p-value**
Negative	79(26.5)	159.89	
Duration of diabetes			< 0.01
<10 years	195(65.4)	165.24	
>10 years	103(34.6)	119.70	
Regular Exercise			< 0.01
No	179(60.1)	135.79	
Yes	119(39.9)	170.13	
Support for diabetes management			0.69
Health care providers	122(40.9)	151.76	
Family	176(59.1)	147.93	

Concluded

4.17 Regression Model Analysis for HbA1c

A regression analysis was conducted to investigate the effects of various demographic and health-related factors on the threshold. Compared to individuals aged >75 years, those in the 31-45 years age group had a significantly lower threshold B = -1.19, 95% CI: -1.29, -1.10,and $p < 0.01$, while those in the age group of 46-60 years and 61-75 had significantly higher thresholds B = 0.82, 95% CI: 0.73, 0.91, and $p < 0.01$, and B = 2.90, 95% CI: 2.71, 3.08, and $p < 0.01$, respectively, suggesting that the threshold increases with age. Females had a significantly lower threshold B = -0.87, 95% CI: -0.96, -0.78, and p <0.01 compared to males. Single individuals had a significantly lower threshold B = -3.82, 95% CI: -4.11, -3.54, and $p < 0.01$ compared to married individuals, indicating that marital status significantly influences the threshold. Employed individuals also had a lower threshold B = -0.17, 95% CI: -0.25, -0.09, and $p < 0.01$ compared to unemployed individuals. Furthermore, individuals with a positive family history of diabetes had a significantly higher threshold B = 1.03, 95% CI: 0.94, 1.13, $p < 0.01$ compared to those with a negative

family history. Lastly, individuals with a shorter duration of diabetes <10 years had a higher threshold B = 0.61, 95% CI: 0.53, 0.70, and p < 0.01 compared to those with a longer duration of diabetes >10 years. These findings underscore the significant role that age, gender, marital status, employment, family history of diabetes, and diabetes duration play in determining the threshold.

TABLE 4.29: Regression results for HbA1c levels by demographic variables

		95% CI		
Demographics	**B**	**Lower**	**Upper**	**P value**
Age				
31-45	-1.19	-1.29	-1.10	0.00
46-60	0.82	0.73	0.91	0.00
61-75	2.90	2.71	3.08	0.00
Reference: >75				
Gender				
Female	-0.87	0.78	0.96	0.00
Reference: Male group				
Marital status				
Single	-3.82	-4.11	-3.54	0.00
Reference: Married				
Employment				
Yes	-0.17	-0.25	-0.09	< 0.01
Reference: No				
Family History				
Positive	1.03	0.94	1.13	0.00
Reference: Negative				
Duration of diabetes				
<10 years	0.61	0.53	0.70	0.00
Reference: >10 years				

B; Co-efficient of regression

4.18 Regression Model Analysis for Overall GMAS Score

The regression analysis revealed significant associations between several demographic and health-related factors and the threshold. Compared to individuals aged >75 years, those in the 31-45 years age group had a significantly lower threshold B = -1.17, 95% CI: -1.33, -1.01, while individuals in the age group of 46-60 years and 61-75 had significantly higher thresholds B = 0.84, 95% CI: 0.69,

0.98 and B = 2.91, 95% CI: 2.61, 3.21 respectively. Females had a significantly higher threshold B = 0.89, 95% CI: 0.75, 1.00 compared to males. Regarding marital status, single individuals had a significantly lower threshold B = -3.75, 95% CI: -4.19, -3.31 compared to married individuals. Employed individuals had a significantly lower threshold B = -0.23, 95% CI: -0.36, -0.09 with comparison to those who were unemployed. Individuals with a positive family history of diabetes had a significantly higher threshold (B = 1.01, 95% CI: 0.86, 1.16 in relation to those with a negative family history. Lastly, individuals with less than 10 years of diabetes had a significantly higher threshold B = 0.64, 95% CI: 0.50, 0.78 compared to those with a longer duration of diabetes >10 years. These findings underscore the significant impact of age, gender, marital status, employment status, family history of diabetes, and diabetes duration on the threshold.

TABLE 4.30: Regression results for Overall GMAS score by demographic variables

		95% CI		
Demographics	**B**	**Lower**	**Upper**	**P value**
Age				
31-45	-1.17	-1.33	-1.01	0.00
46-60	0.84	0.69	0.98	0.00
61-75	2.91	2.61	3.21	0.00
Reference: >75				
Gender				
Female	0.89	0.75	1.0	0.00
Reference: Male group				
Marital status				
Single	-3.75	-4.19	-3.31	0.00
Reference: Married				
Employment				
Yes	-0.23	-0.36	-0.09	<0.01

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		95% CI		
Demographics	**B**	**Lower**	**Upper**	**P value**
Reference: No				
Family History				
Positive	1.01	0.86	1.16	0.00
Reference: Negative				
Duration of diabetes				
<10 years	0.64	0.50	0.78	0.00

B; Co-efficient of regression

4.19 Regression Model Analysis for EQ-5D-3L VAS Score

A regression analysis was conducted to investigate the effects of various demographic and health-related factors on the threshold. Age had a significant impact on the threshold, with individuals in the 31-45 years age group exhibiting a significantly lower threshold B = -1.17, 95% CI: -1.20, -1.14 compared to those over 75 years, while individuals in the age group of 46-60 years and 61-75 years had significantly higher thresholds B = 0.91, 95% CI: 0.88, 0.94, and 3.02, 95% CI: 2.96, 3.08, respectively. Gender also played a role, with females showing a significantly higher threshold 0.86, 95% CI: 0.83, 0.89 than males. Marital status was another significant factor, as single individuals had a notably lower threshold B = -3.55, 95% CI: -3.63, -3.47 compared to married individuals. Regarding employment, employed individuals had a significantly lower threshold B = -0.19, 95% CI: -0.22, -0.17 with comparison those who were unemployed.

Family history of diabetes was positively associated with the threshold, with individuals having a positive family history showing a significantly higher threshold B = 0.99, 95% CI: 0.96, 1.02 compared to those with a negative family history. Finally,

duration of diabetes also influenced the threshold, with individuals diagnosed for less than 10 years having a significantly higher threshold B = 0.72, 95% CI: 0.70, 0.75 compared to those diagnosed for more than 10 years.

TABLE 4.31: Regression results for EQ-5D-3L VAS scores by demographic variables

		95% CI		
Demographics	**B**	**Lower**	**Upper**	**P value**
Age				
31-45	-1.17	-1.20	-1.14	0.00
46-60	0.91	0.88	0.94	0.00
61-75	3.02	2.96	3.08	0.00
Reference: >75				
Gender				
Female	0.86	0.83	0.89	0.00
Reference: Male group				
Marital status				
Single	-3.55	-3.63	-3.47	0.00
Reference: Married				
Employment				
Yes	-0.19	-0.22	-0.17	0.00
Reference: No				
Family History				
Positive	0.99	0.96	1.02	0.00
Reference: Negative				
Duration of diabetes				
<10 years	0.72	0.70	0.75	0.00
Reference: >10 years				

B; Co-efficient of regression

4.20 Adverse Drug Reactions Reported

Out of the total study participants, 177 cases 17.2% experienced ADRs. As illustrated in Figure 4.8, neuropathy was the most commonly reported complication, affecting 97 individuals 32.6%. This was followed by blood pressure-related issues in

86 cases 28.9% and retinopathy in 63 cases 21.1%. Nephropathy was reported in 32 participants 10.7%, while 16 individuals 5.4% underwent foot or leg amputations.

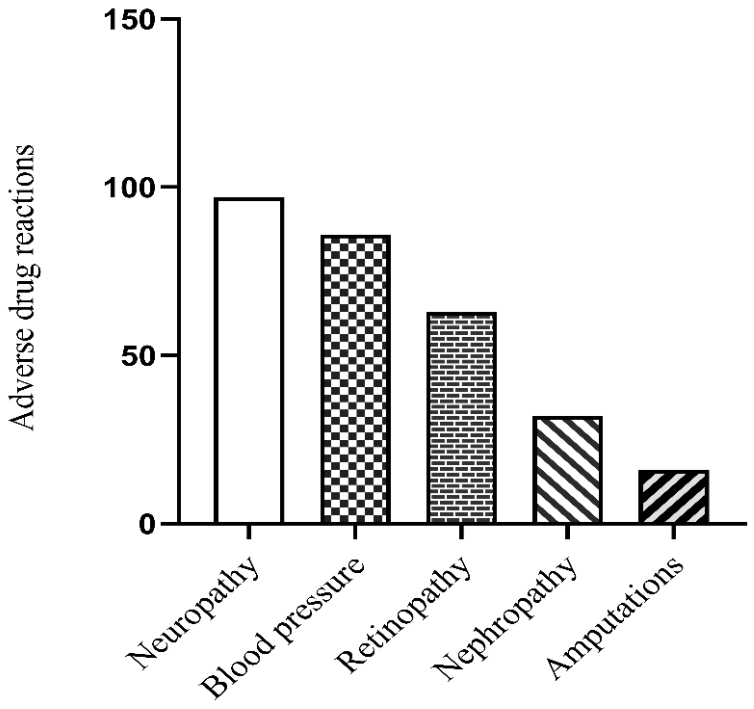

FIGURE 4.8: Incidence of adverse drug reactions reported

4.20.1 Pharmacological and Non-Pharmacological Management of Adverse Drug Reactions Reported

In patients who experienced neuropathy n = 97, pharmacological management was observed in 63 cases where patients were taking anticonvulsant medications including pregabalin and gabapentin. These interventions resulted in noticeable reductions in neuropathic pain and improvements in sleep quality. Non-pharmacological interventions were provided in 34 cases, including lifestyle modifications, physical therapy, and complementary practices. Among patients reporting blood pressure-related adverse effects n = 86, pharmacological therapy was administered in 59 cases. Patients were taking antihypertensive medications such as enalapril, lisinopril, losartan, and amlodipine, contributing to improved blood pressure control. Non-pharmacological interventions were provided in 27 patients, focusing on dietary sodium restriction, weight management, and physical activity.

Retinopathy was managed in 63 cases, with 41 patients maintaining glycemic and blood pressure control through medications such as metformin, insulin, ACE inhibitors, and ARBs. In 22 cases, ophthalmologic procedures including retinal laser photocoagulation and intravitreal anti-VEGF therapy: bevacizumab were performed to stabilize vision. Nephropathy management was observed in 32 patients. Pharmacological treatment was provided in 21 cases, where patients were taking angiotensin converting enzymes inhibitors (ACEI): ramipril, enalapril, angiotensin receptor blockers (ARBs): losartan, valsartan, sodium glucose cotransporter 2 inhibitors (SGLT-2): empagliflozin, and statins atorvastatin. Regular monitoring of renal parameters, including estimated glomerular filtration rate (eGFR), serum creatinine, and urinary protein levels, was emphasized in all nephropathy cases to assess disease progression. In 11 patients, dietary modifications and nephrology consultations were provided. In foot or leg complications n = 16, conservative management including wound care and infection control was observed in 9 patients. Pharmacological management involved the use of antibiotics such as amoxicillin-clavulanate, ceftriaxone, and clindamycin, alongside glycemic optimization with insulin therapy. Despite these interventions, 7 patients progressed to minor or major amputations due to advanced infection and tissue necrosis.

Non-pharmacological management strategies were consistently applied across patients with adverse drug reactions. These included lifestyle modifications such as improved glycemic control, dietary sodium and protein restriction, regular physical activity, and weight management. Stress reduction techniques, including yoga and relaxation exercises, were reported particularly among neuropathy cases. Foot care practices, including daily inspection, hygiene maintenance, and the use of protective footwear, were emphasized to prevent further complications. These combined approaches supported pharmacological management and contributed to improved patient outcomes across the observed adverse drug reactions.

Chapter 5

Discussion of Studies

The socio-demographic profile of the patients in this study showed the type of patients attending this resourceful setting. Since the prevalence of diabetic complications are rising, it is hence, quite crucial to help the patients in knowing how to manage their clinical condition effectively thereby preventing disease progression and avoidable complications [71]. The socio-demographic profile of the sampled population provides crucial insights into the context and applicability of the findings. The majority of participants were aged between 46 and 60 years, 46%, consistent with epidemiological trends showing increased diabetes prevalence in middle-aged adult [72]. This age group is often at higher risk due to prolonged exposure to sedentary lifestyles, dietary patterns, and stress-related factors. A notable proportion 25.2% of participants were between 61–75 years, indicating the chronic nature of diabetes and its persistence into older adulthood. A higher proportion of females 70.8% were included in the study compared to males 29.2%. While diabetes prevalence tends to be slightly higher among men globally, several regional studies have reported a greater attendance of females at healthcare facilities, particularly in South Asian settings, potentially explaining this skewed gender distribution. This may also indicate a higher level of health-seeking behavior among women or differences in social support systems [73]. The present study found that most participants were married 97.7%, highlighting the potential influence of marital status on diabetes management. According to the recent studies, there is a connection between marital status and the likelihood of getting type 2 diabetes mellitus. A

systematic review and meta-analysis including more than 1.4 million participants showed that unmarried people were more prone to developing type 2 diabetes mellitus than those who were married. Interestingly, divorced and widowed people proved to show a decreased probability of type 2 diabetes mellitus incidence in contrast to persons who were married [1]. A positive family history of diabetes was reported by 73.5% of individuals in this study. Recent research underscores the significant impact of family history on the risk of developing type 2 diabetes mellitus [5]. Specifically, obese men carrying a history of obesity in the family were at a 54 percent higher risk and women obese had a 42 percent higher risk than their normal-weight counterparts without such a positive history. This emphasizes the compounded risk when genetic predisposition intersects with modifiable factors like obesity [5]. A majority of participants 65.4% had been diagnosed with diabetes for under 10 years.

The duration of diabetes is a critical factor influencing the risk of various complications. Research indicates that a longer duration of diabetes is associated with a high risk of heart failure. Specifically, People who had diabetes for 15 years or longer were 32% more likely to have heart failure than people who had diabetes for less than 5 years [19]. Approximately 60.1% of the participants did not participate in regular physical activity. Lack of physical activity is a known modifiable risk factor for type 2 diabetes development and progression. Regular exercise improves insulin sensitivity, aids in glycemic control, and reduces cardiovascular risk factors. The American Diabetes Association recommends that adults with diabetes engage in at least 150 minutes of moderate-intensity aerobic exercise per week. A notable 59.1%, of participants reported receiving support for diabetes management from family members, while 40.9%, relied on healthcare providers. Family support plays a pivotal role in diabetes self-management, influencing adherence to treatment regimens, dietary practices, and physical activity. A study by [74] demonstrated that family support is positively linked to both medication adherence and glycemic control in adults with type 2 diabetes mellitus. The random blood sugar levels gradually decreased during the three follow-ups, indicating that the adopted intervention may be beneficial in enhancing glycemic control in diabetic individuals. Initially, at the baseline, the mean RBS was substantially elevated at 267.06 ± 89.88

mg/dL, indicating poor glycemic control. However, this value demonstrated a considerable reduction by the first follow-up, with the mean dropping to 258.25 ± 46.86 mg/dL, and a further slight but consistent decrease was observed at the second follow-up, with a mean of 246.16 ± 38.10 mg/dL. The reduction in random blood sugar over time aligns with findings from similar studies that emphasize the impact of multidisciplinary care models, particularly those involving pharmacists, in managing diabetes. According to a systematic reviews [75] and [76] reductions in random blood glucose levels and fasting were among the clinical outcomes that was better after the intervention by pharmacists. Moreover, a study by [27], demonstrated that diabetic patients receiving clinical pharmacy services achieved better glycemic control reflected by lower random blood sugar, compared to those under standard care. These results are consistent with the current findings and support the idea that continuous patient engagement and regular follow-ups are crucial for optimal diabetes management. This trend suggests that the intervention, likely involving patient-centered pharmacist care such as medication counseling, lifestyle modification advice, and adherence reinforcement, played a significant role in promoting better blood glucose regulation. Furthermore, the declining trend in random blood sugar might also reflect increased patient awareness and compliance resulting from regular pharmacist interactions. As patients receive education regarding the importance of diet, physical activity, and medication adherence, their self-care behaviors are likely to improve, ultimately translating into better glycemic profiles When patients are educated about the need to pay attention to their diets, physical exercises, and taking medicine, their self-care practices will tend to improve which will eventually pay-off in the form of better glycemic profiles. The American Diabetes Association has long recognized the value of team-based care, including pharmacists, as a vital strategy for chronic disease management [77].

Importantly, the overall change in random blood sugar from baseline to follow-up 2 showed a statistically significant mean reduction of 20.89 ± 90.23 mg/dL and p = < 0.01, underscoring the cumulative impact of the intervention. This finding is consistent with prior research showing that structured and continuous care

particularly when involving clinical pharmacists can lead to significant improvements in glycemic parameters. For instance, studies such as those by [78] and [79] reported similar significant reductions in blood sugar levels over time as a result of pharmacist interventions. The analysis of fasting blood glucose levels over the study duration indicates a consistent and statistically significant improvement in glycemic control among the participants, demonstrating the effectiveness of the implemented intervention. At the baseline, the mean FBG was 189.48 ± 84.31 mg/dL, a value indicative of suboptimal fasting glycemic control and consistent with the diagnosis of uncontrolled diabetes. However, this mean value showed a statistically significant reduction to 176.13 ± 53.63 mg/dL at the first follow-up, representing a mean decrease of 13.35 ± 83.59 mg/dL and $p = 0.00$. The reduction continued steadily, with fasting blood glucose further declining to 162.17 ± 41.69 mg/dL at the second follow-up, corresponding to an additional significant drop of 13.96 ± 53.38 mg/dL between follow-up 1 and follow-up 2 $p = 0.01$. The cumulative reduction from baseline to follow-up 2 amounted to 27.31 ± 86.20 mg/dL, which was also statistically significant i.e. $p = 0.01$. This progressive and consistent decline across all follow-ups strongly suggests that the intervention, likely involving pharmacist-led education, individualized medication reviews, and patient counseling, contributed meaningfully to improved glycemic outcomes. Pharmacists play a vital role in reinforcing adherence to pharmacologic and non-pharmacologic therapies, identifying drug-related problems, and enhancing patient understanding of disease management strategies. These results align with findings reported in previous studies, such as those by [80] and [81] both of which demonstrated significant improvements in fasting blood glucose and other glycemic markers following pharmacist-led interventions in diabetic populations. The consistent downward trend in fasting blood glucose over time may also indicate improved patient compliance with lifestyle modifications, such as dietary regulation, increased physical activity, and improved medication adherence all key factors known to influence fasting glucose levels. Additionally, continuous interaction with healthcare professionals, particularly pharmacists, often fosters trust and motivation, that play important roles in lifestyle management of long-term illnesses such as diabetes. These findings are in agreement with the American Diabetes Association 2024

Standards of Medical Care in Diabetes, which advocate for team-based care and structured follow-up to manage hyperglycemia effectively. According to the ADA, achieving target fasting glucose levels is essential for reducing the risk of both microvascular and macrovascular complications [82] and [83].

Nevertheless, while the reductions are statistically significant, the standard deviations ±83.59, ±87.35 suggest notable inter-individual variability in response. Factors such as baseline disease severity, socioeconomic status, comorbidities, or psychosocial barriers could have contributed to these variations and should be considered in future intervention planning [46] and [50]. These results are aligned with the growing of literature emphasizing that diabetes management is multifactorial and outcomes are influenced by both clinical and non-clinical determinants [84] and [85]. These findings support the need of frequent follow-up, individualized education, and multi-professional cooperation in effective long-term management of type 2 diabetes, as advocated by global diabetes care guidelines.

The findings from this study demonstrate a significant and clinically meaningful reduction in HbA1c levels among participants following the pharmacist-led intervention. At baseline, the average HbA1c was 8.67%, indicating poor glycemic control, which poses a substantial risk for long-term diabetes complications. By the second follow-up, this value had decreased to 7.64%, representing a mean reduction of 1.03%, $p = 0.001$. The 95% confidence interval 0.92% to 1.15% reinforces the consistency and reliability of this improvement. This reduction is not only statistically significant but also clinically relevant. The HbA1c level and T2DM management were significantly impacted by pharmacist involvement, according to a recent literature review [86]. The outcomes are reliable with existing literature supporting the role of pharmacist-led interventions in improving glycemic control. A systematic review by [87] found that HbA1c values were considerably lowered with pharmacist care, with an average reduction of 0.85%. A study found that stopping pharmaceutical care led patients to revert to pre-intervention behavior, highlighting the need for continuous care to sustain clinical outcomes [87]. Both research arms showed a decrease in HbA1c, likely due to access to specialized healthcare facilities. These hospitals in Lahore provided advanced diabetes management

services [88].The reduction in HbA1c suggests a strong impact of the intervention, potential confounding factors such as concurrent dietary or lifestyle changes, patient motivation, and self-monitoring practices could not be fully controlled. RCTs, would help establish causality and provide more generalizable findings [11]. This meta-analysis found a significant HbA1c reduction $\geq$0.50% in the pharmaceutical care group compared to controls. The results align with previous studies showing improved outcomes in diabetic patients receiving pharmaceutical care [89].

A paired-sample analysis showed a statistically significant improvement in the levels of HbA1c between the baseline and the final follow-up. The mean HbA1c at baseline was 9.23 $\pm$ 1.57%, which decreased to 8.20 $\pm$ 1.42% at the final follow-up, yielding a mean reduction of 1.03 $\pm$ 1.05% with p = 0.001. The 95% confidence interval CI: 0.92% to 1.15% for the difference confirms the precision of this improvement and underscores its clinical relevance. Such reduction in HbA1c is also in line with the results of other studies focusing on the impact of pharmacist-based interventions in diabetes care. For instance, [90] reported an average HbA1c reduction of 0.76% following pharmacist involvement in patient management. The results of the current study on the impact of demographic factors on random blood sugar, fasting blood glucose, and HbA1c levels showed several important observations, demonstrating varying levels of statistical significance. For random blood sugar levels, the analysis found not any meaningful variations between demographic factors like the age, gender, marital status, employment, family history, duration of diabetes, and exercise habits. This result aligns with some studies that suggest RBS levels are influenced more by immediate factors like food intake and insulin resistance rather than demographic characteristics [91]. Although age groups exhibited some variation in mean ranks particularly among participants aged 46–60 years the differences were not statistically meaningful (p = 0.98). This is in line with the findings [92] who reported that, while age is a known risk factor for diabetes onset, it does not always predict glycemic control outcomes once diabetes has developed. Gender-wise, females had slightly higher mean ranks than males, but this was also statistically insignificant p = 0.13. This is consistent with research by [93], who noted that although gender can influence diabetes risk and complications, glycemic control is often more affected by behavioral and treatment-related factors than by

gender alone.

Conversely, fasting blood glucose level showed a significant difference across age groups, with participants aged 31–60 years exhibiting higher mean ranks, suggesting that age could play a role in fasting glucose regulation. Another study found that median fasting plasma glucose levels in women were consistently 0.1–0.2 mmol/L lower across all age groups, indicating age-related differences in FPG patterns between gender, especially with relation to diabetes diagnosis [94]. Fasting plasma glucose significantly increases with age in Japanese men, while β-cell function decreases, indicating age-related deterioration [95].

Regarding HbA1c levels, the analysis indicated that employment status and regular exercise significantly influenced HbA1c, with employed individuals, those who exercised regularly, and those receiving family support showing higher mean ranks. A meta-analysis revealed that a reduction in body fat mass through regular exercise is significantly associated with a decrease in HbA1c levels, with an estimated reduction of 0.2% for every kilogram of body fat lost [96]. Regular exercise significantly decreased HbA1c levels in T2DM patients after a 12-week program, indicating improved glycemic levels [97]. On the contrary, the variables such as age, gender, marital status and duration of diabetes were all nonsignificant in relation to HbA1c. The study confirmed that HbA1c levels have no correlation with gender or age. Additionally, the duration of diabetes was not mentioned as influencing HbA1c levels, indicating that these factors do not impact HbA1c interpretation in the study's context [98].

The EQ-5D-3L utility scores demonstrate a consistent improvement in the perceived quality of life among diabetes patients receiving pharmacist-led care. At baseline, the mean Time Trade-Off utility score was 0.77 $\pm$ 0.26, which increased to 0.89 $\pm$ 0.13 by the first follow-up and further improved to 0.93 $\pm$ 0.07 at the final follow-up. This upward trend indicates a notable enhancement in health-related quality of life.

Pharmacist interventions have been widely recognized for their positive impact on clinical outcomes, medication adherence, and overall quality of life among patients

of the chronic diseases, such as diabetes [99]. The consistent rise in EQ-5D utility scores reinforces the value of integrating pharmacists into multidisciplinary care teams for diabetes management. This model not only benefits individual patient outcomes but may also reduce the burden on healthcare systems by improving self-management and potentially preventing complications [100].

The mean difference between the first follow-up and baseline utility scores was 0.12, followed by a smaller yet significant change of 0.33 from follow-up 1 to the follow-up 2. The cumulative improvement from baseline to follow-up 2 amounted to 0.15, with all changes achieving high statistical significance $p = 0.00$. These findings highlight the effectiveness of sustained pharmacist involvement in chronic disease management. The significant enhancements in EQ-5D-3L utility scores align with evidence from previous studies, which have emphasized the beneficial effects of pharmacist-led interventions on both clinical and humanistic outcomes of diabetes care [101]. Pharmacists, through their accessibility and expertise, contribute to the optimization of treatment regimens, finding and fixing of drug-related problems, and reinforcement of adherence behaviors, all of which are critical to enhance HRQoL in patients with chronic conditions [102].

The progressive increase in visual analogue scores across the three follow-up points indicates a notable improvement in patients perceived general health over time. At baseline, the mean visual analogue score of 64.50 ± 16.75 reflected a moderate level of well-being, which significantly improved by the first 76.07 ± 14.51 and second 82.15 ± 13.39 follow-ups. This upward trend suggests that patients experienced a meaningful enhancement in their quality of life during the study period. Prior studies have demonstrated that patient-centered interventions, particularly those involving pharmacist-led counseling and regular monitoring, are associated with improved health perceptions and treatment outcomes in patients with chronic diseases like diabetes [103]. Moreover, self-perception of health status, as measured by visual analogue score , has been shown to correlate strongly with glycemic control and psychological well-being in diabetic patients [104]. Therefore, the steady increase in visual analogue scores may also reflect improved metabolic control and reduced diabetes-related distress during the follow-up period.

The significant and progressive improvements in visual analogue score over the three follow-up intervals underscore the beneficial effects of the intervention on the patients' general quality of life and perception of their health. The statistically significant increase from baseline to Follow-up 1 i.e. 11.58 points and follow-up 1 to follow-up 2 6.07 points, along with the total gain of 17.65 points from baseline to final follow-up, highlights a consistent upward trend in subjective well-being among the diabetic population. Such results are consistent with the conclusions of previous researches which draw special attention to the need of regular monitoring, patient-centered care, and education in chronic disease management. Interventions involving frequent patient engagement, health counseling, and support systems have proved to bring not only better clinical outcomes but also better health related quality of life of patients [105]. The visual analogue score is a widely accepted tool for assessing subjective health perceptions and has been found to be valid across different populations especially those with diabetes [106]. The demographic analysis has given meaningful findings on the multiple dimensions of quality of life in diabetic patients. Age, diabetes duration, and regular exercise were found to significantly impact HRQoL. Socio-demographic factors including age, gender, social habits, socio-economic status, and living conditions have a significant impact on the quality of life outcomes in diabetic patients [107]. The study found that demographic factors such as age, gender, duration of diabetes, education level , smoking, and presence of other conditions significantly influenced the quality of life among diabetic patients [108]. Medication adherence is vital for managing chronic diseases but is often affected by behavioral, clinical, and financial barriers. In this study the evaluation of adherence was based on three dimensions namely patient behavior, disease and pill burden, and financial constraints. Notably, adherence improved significantly across all domains over time. Initially, only 10.1% of participants showed high adherence in the behavioral domain, while 67.1% fell into partial, low, or poor adherence categories. A negative attitude or lack of motivation is another factor that hinders adherence [109]. By the first follow-up, there was a remarkable shift: high adherence doubled to 20.5%, and good adherence rose to 32.2%. This trend continued into the second follow-up, where high and good adherence reached 24.5% and 40.6%, respectively. As shown by our results,

various interventions have been implemented by pharmacists all over the world to improve medication adherence [76].

Most interventions emphasize patient involvement in decision-making, aiming to raise diabetes awareness and improve treatment management. A key focus is enhancing medication adherence to achieve optimal outcomes [76]. The significance of education, skills trainings and problem solving is clear and must be explain to patients about medication adherence and glycemic control [110]. Domain 2, which explores non-adherence due to additional disease burden and polypharmacy, mirrored a similar pattern of progress. Initially, high adherence was observed in only 10.4% of cases, while partial and low adherence together comprised more than 50%. Treatment complexity contributes to nonadherence to glucose-lowering drugs, affecting both unintentional and partly intentional nonadherent patients similarly [111].

Yet, improvements were seen consistently across follow-ups. High adherence increased to 22.5% at first follow-up and reached 25.8% by the second. Notably, good adherence nearly doubled from 23.8% at baseline to 44.6% at follow-up 2. Adequate education on each of the above mentioned areas of medication is important in enhancing medication adherence, which hence leads to better glycemic control [112]. Financial barriers to adherence, covered in Domain 3, also demonstrated a steady pattern of improvement. At baseline, high adherence was recorded at 10.7%, with a large proportion 66.4% showing partial to poor adherence. Encouragingly, by follow-up 2, high adherence had increased to 30.9%, and good adherence to 40.6%, while poor adherence dropped sharply to 3.4%. The World Health Organization promotes patient education as a means to enhance adherence, using motivation and behavioral strategies to support compliance in chronic conditions [113]. Pharmacists, in both community and hospital settings, play a key role in improving adherence by identifying nonadherence risks, creating support strategies, and offering continuous education [114]. The findings from the current study indicate a significant and progressive improvement in overall medication adherence among diabetes patients following the pharmacist-led intervention. These improvements align with numerous studies emphasizing the favorable effect of the pharmacist intervention on drug

compliance in chronic diseases, particularly diabetes. The general medication adherence scale-based assessment in our study is consistent with its validated use in the South Asian population. The general medication adherence scale is a reliable tool that captures both intentional and unintentional non-adherence, making it especially effective in evaluating the impact of adherence-focused interventions [65]. Another study reported that reported that structured counseling and personalized medication reviews conducted by pharmacists significantly improved adherence scores in diabetic populations [115].

Progression in participants' knowledge and self-management abilities was evaluated across three follow-up assessments. Three measures of knowledge were taken to determine cognitive gains before and after the intervention. The mean score for baseline knowledge was 10.02 ± 1.10, which showed a slight increase to 10.25 ± 0.97 at follow-up 1, suggesting a modest improvement. Interestingly, the score declined to 9.81 ± 0.82 at follow-up 2. Although the increment of the baseline to follow-up 1 was statistically insignificant $p = 0.06$, the difference between follow-up 1 and follow-up2 was statistically significant mean difference = 0.44, $p = 0.01$. However, this apparent decline does not necessarily reflect an actual reduction in knowledge. Adequate disease-related knowledge empowers diabetic patients to recognize risks, seek appropriate care, and manage their condition throughout life [116]. Similar to the findings of other studies [117] the present study also demonstrated that the scores on disease-related knowledge improved significantly as a result of the intervention.. Pharmacists play a vital role in educating patients about their medications, enhancing both disease understanding and treatment adherence. Their expertise directly contributes to improved therapeutic outcomes [118]. Self-management scores showed a consistent and statistically significant upward trend across all time points. From a baseline mean of 17.15 ± 1.09, scores rose to 19.17 ±0.86 at follow-up 1 and further to 19.53 ±1.04 at follow-up 2. All inter-assessment comparisons were statistically significant from baseline to follow-up 1: $p = 0.01$, from follow-up 1 to follow-up 2: $p = 0.001$ and from baseline to follow-up 2 $p = 0.001$. This means that not only the intervention was effective in self-management enhancement behaviors but also the potential for these behaviors to consolidate over time with continued support. Besides what is contributed

by healthcare workers, the DM self-management is a highly significant method of achieving better outcomes [119]. The positive effect of intervention has been reported in the studies in the self-management of diabetes patients from Iran [120] and the US [121]. Effective self-management of diabetes improves metabolic control, reduces complications, enhances quality of life, and lessens the economic burden on patients [122]. Increased patient satisfaction with diabetes care is linked to better treatment compliance and improved glycemic control [123].

The steady increase in patient satisfaction from baseline to the first and second follow-ups underscores the significance of pharmacist-led counseling in enhancing both patient experience and healthcare outcomes. At baseline, satisfaction levels were moderate. Only 52.2% of patients could access counseling without difficulty, and merely 13% found the pharmacist very helpful. However, post-intervention data from follow-up 1 and follow-up 2 showed a progressive enhancement in satisfaction metrics. By follow-up 2, 80.6% of patients reported easy access to counseling, and 39.1% found the pharmacist very helpful, indicating an encouraging shift in perception and engagement. This trend mirrors results of a study by [70] which reported that effective communication and consistent pharmacist interaction significantly improved patients understanding and satisfaction. Similarly, a randomized controlled trial by [124] demonstrated that pharmacist interventions increased patient satisfaction, particularly regarding clarity of counseling and responsiveness to queries. The increase in satisfaction with counseling duration from 46.8% at baseline to 74.9% at F2 demonstrates the value patients place on quality time during consultations. A study by [125] in Nigeria emphasized that patients equate satisfaction with the opportunity to discuss health issues in a respectful, unrushed setting. This is further supported by the work of [126], which emphasized that patient satisfaction is influenced not just by drug dispensing but also by the depth and personalization of pharmacist communication. This aligns with international trends where pharmacist-patient interactions, when tailored and consistent, significantly improve public trust in pharmacists as healthcare providers [127]. Satisfaction levels also improved significantly by the end of the intervention, with the proportion of "very satisfied" patients rising from 18.1% to 34.4. This aligns

with the findings of a study conducted in Malaysia by [128] which found that satisfaction with pharmacist counseling positively influenced medication adherence and health outcomes in chronic disease management. Diabetes management programs play an integral role in the management of patients with diabetes. The current study findings have supported a study conducted in the United States by [129] according to which pharmacists-managed care has a potential role in protecting the patients from diabetic retinopathy and reduce its progression. The current study shows the improvement in retinopathy signs and symptoms was started from "blurred vision" and "trouble in night vision" predictor with $p = 0.021$ and 0.039, respectively [130]. Pharmacist-led intervention significantly improved renal function in patients with chronic kidney disease, particularly in stages 4-5, by ensuring appropriate dosage adjustments of nephrotoxic medications, leading to better outcomes compared to standard care without pharmacist involvement [131]. The pharmacist-led intervention improved nephropathy management by educating patients on kidney health, facilitating lab orders, and initiating Reno protective medications, resulting in enhanced understanding of kidney function and increased engagement in self-management among participants at risk for chronic kidney disease [132]. We found that pharmacist intervention was successful in improving one of the most important outcomes, namely reducing the pain intensity among the patients. Besides pain intensity and physical functioning, this review also noted that the pharmacist-led medication review has a positive impact on the quality of life, anxiety, depression and patient satisfaction [133]. Studies have confirmed pharmacist intervention to have a positive impact in chronic pain management [134]. A study [135] shows that educational efforts significantly improved patients' knowledge about diabetic neuropathy and resulted in a notable decrease in blood glucose levels ($p < 0.05$), demonstrating the effectiveness of such interventions in managing diabetic neuropathy among patients at Gatot Soebroto Hospital. The pharmacist-led intervention significantly improved diabetic peripheral neuropathic symptoms, with notable reductions in pain qualities such as electric shock, tingling, and pins and needles, as well as decreased pain interference after three months of lifestyle modification [136]. Follow-up by pharmacists significantly improved blood pressure in hypertension patients, with a mean reduction in systolic blood

pressure of −7.35 mmHg. Scheduled follow-ups were more effective, showing a greater reduction of −8.89 mmHg compared to as-needed follow-ups [137]. A study showed that community pharmacist counseling significantly improved blood pressure in diabetic patients, with systolic levels dropping from 145.85 ± 10.88 to 130.10 ± 6.89 mmHg over 6 months, underscoring pharmacists' role in chronic disease management [138]. By addressing medication-related issues and providing tailored support, pharmacists play a crucial role in managing blood pressure and reducing cardiovascular risks in patients with diabetes, thereby enhancing their overall treatment success [139].

5.1 Limitations of the Study

There are several limitations in this study that should be acknowledged. First, the quasi-experimental design did not involve random assignment of participants, which may have introduced selection bias and limited the ability to demonstrate a causal relationship between the intervention and observed outcomes. Secondly, although clinical outcomes were verified using patient's laboratory records, non-clinical measures for example, medication adherence, quality of life, and patient satisfaction were based on self-reported questionnaires, which may be subject to recall or response bias and could affect the accuracy of these specific findings. Lastly, the short follow-up duration may have influenced the results, as patients might have temporarily improved their behavior due to recent counseling, making it difficult to determine the long-term sustainability of the observed benefits.

Chapter 6

Conclusion and Future Recommendation

6.1 Conclusion

This quasi-experimental interrupted time series study examined the impact of a structured pharmacist-led, patient-centered care model on individuals with diabetes in selected hospitals and community pharmacies of Islamabad, Rawalpindi, and Mirpur. The intervention included comprehensive components such as Medication Therapy Management, Motivational Interviewing, personalized education, and lifestyle counseling to address challenges such as poor medication adherence, inadequate glycemic control, and limited patient engagement in self-management. The results of this research demonstrate that pharmacist-led interventions can significantly enhance diabetes care by improving clinical parameters, treatment adherence, quality of life, and patient satisfaction. These improvements reflect the vital role pharmacists can play in chronic disease management when integrated into patient-centered healthcare teams. The study also highlighted the value of pharmacist counseling in enhancing patients' understanding of their condition, promoting self-care, and addressing barriers to effective medication use. By fostering a collaborative relationship between patients and pharmacists, this model empowered individuals to actively participate in their own health management.

Overall, the findings underscore that patient-centered pharmacist care constitutes a feasible, sustainable, and impactful strategy for improving diabetes management outcomes. This research provides compelling evidence to support the integration of pharmacists into multidisciplinary care models, especially in settings with limited healthcare resources. Policymakers and healthcare institutions are encouraged to formally recognize and institutionalize the pharmacist's role in chronic disease management, particularly in patient education, therapeutic monitoring, and adherence enhancement within both hospital and community-based care frameworks.

6.2 Future Recommendations

Future research should be conducted over an extended duration to better evaluate the sustained impact of pharmacist-led interventions on clinical and behavioral outcomes. Incorporating a comparison group receiving standard care is recommended to enhance the validity and generalizability of results. Future studies should also broaden the scope by assessing additional clinical indicators such as diabetes-related complications and hospitalization rates. The integration of digital tools, including telephonic or app-based follow-ups, may improve accessibility and continuity of care, especially in remote settings.

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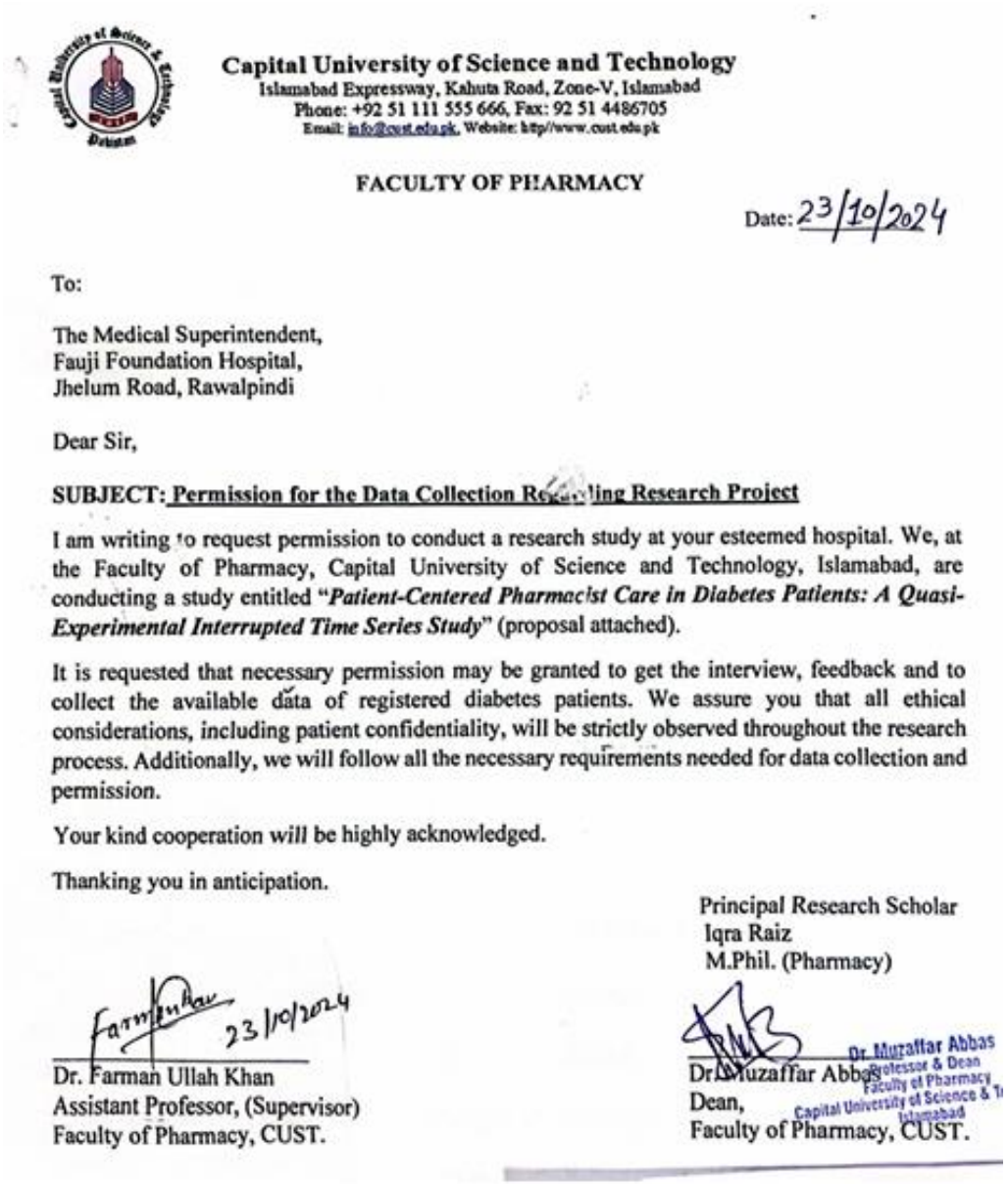
Annexures

Annexure A: Ethical Approval Letter from Hospital



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FACULTY OF PHARMACY

Date: 23/10/2024

To:

The Medical Superintendent,
Fauji Foundation Hospital,
Jhelum Road, Rawalpindi

Dear Sir,

SUBJECT: Permission for the Data Collection Regarding Research Project

I am writing to request permission to conduct a research study at your esteemed hospital. We, at the Faculty of Pharmacy, Capital University of Science and Technology, Islamabad, are conducting a study entitled "***Patient-Centered Pharmacist Care in Diabetes Patients: A Quasi-Experimental Interrupted Time Series Study***" (proposal attached).

It is requested that necessary permission may be granted to get the interview, feedback and to collect the available data of registered diabetes patients. We assure you that all ethical considerations, including patient confidentiality, will be strictly observed throughout the research process. Additionally, we will follow all the necessary requirements needed for data collection and permission.

Your kind cooperation will be highly acknowledged.

Thanking you in anticipation.

Principal Research Scholar
Iqra Raiz
M.Phil. (Pharmacy)

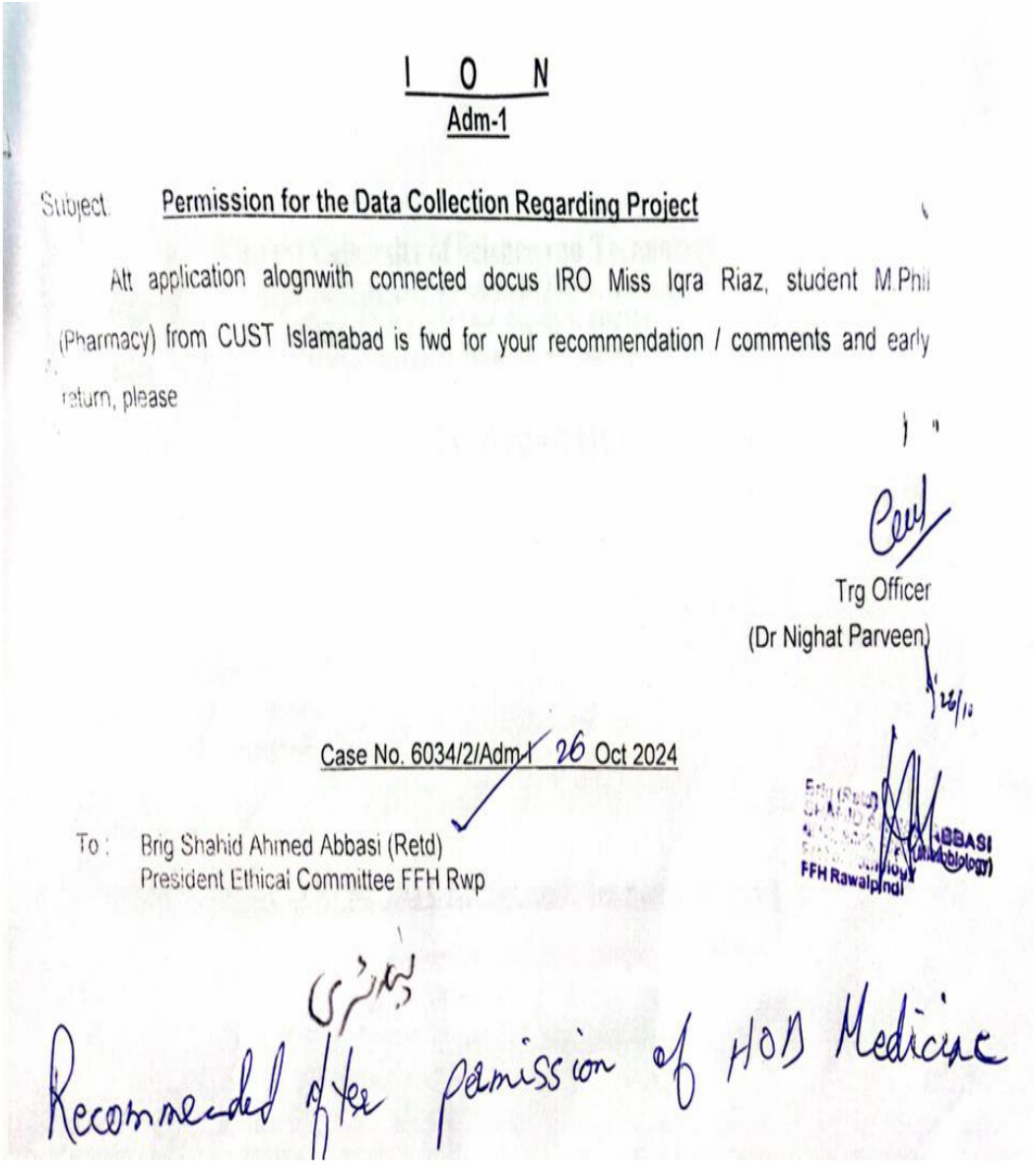
23/10/2024

Dr. Farman Ullah Khan
Assistant Professor, (Supervisor)
Faculty of Pharmacy, CUST.

Dr. Muzaffar Abbas
Professor & Dean
Faculty of Pharmacy
Capital University of Science & T
Islamabad

Dr. Muzaffar Abbas
Dean,
Faculty of Pharmacy, CUST.

Annexure B: Ethical Approval Letter from Hospital



I O N

Adm-1

Subject. **Permission for the Data Collection Regarding Project**

Att application alognwith connected docus IRO Miss Iqra Riaz, student M.Phil (Pharmacy) from CUST Islamabad is fwd for your recommendation / comments and early return, please

Trg Officer

(Dr Nighat Parveen)

Case No. 6034/2/Adm-I 26 Oct 2024

To : Brig Shahid Ahmed Abbasi (Retd)
President Ethical Committee FFH Rwp

FFH Rawalpindi

Recommended for permission of HOD Medicine

Annexure C: Patient Consent form

Topic

Patient-Centered Pharmacist Care in Diabetes Patients: A Quasi-Experimental Interrupted Time Series Study

Principal Researcher

Iqra Riaz (Capital University of Science and Technology)

You are invited to participate in this study to evaluate the effects of pharmacist-led, patient-centered care on the management of diabetes. This includes monitoring of blood glucose (random, fasting), HbA1c levels, medication adherence, patient satisfaction, and quality of life improvements.

Study Objective

If you agree to participate, you will be involved in baseline data collection and two follow-up visits (at month 2 and month 3). You will receive personalized medication reviews and lifestyle counseling regarding diabetes management. There are no known risks in this study. Your personal information will remain confidential and your identity will not be disclosed in any report. You may withdraw at any time, and participation is entirely voluntary.

Consent

I have read and understood the purpose, procedure, risks, and benefits of this study. I voluntarily agree to participate and understand that I can withdraw at any time. Both oral and written types of consent are accepted for this study.

Patient Signature/ thumbprint: _____

Investigator Signature: _____

Date: _____

Annexure D: Data Collection Tools

1: Participants Demographics

Demographic Questionnaire

1. Age

☐ 18-30 ☐ 31-45 ☐ 46-60 ☐ 61-75

2. Gender

☐ Male ☐ Female

3. Marital Status

☐ Single ☐ Married

4. Employment

☐ Yes ☐ No

5. Family History of Diabetes

☐ Positive ☐ Negative

6. Duration of Diabetes

☐ <10 years ☐ ≥10 years

7. Regular Exercise

☐ Yes ☐ No

8. Support for Diabetes Management

☐ Health Care Provider ☐ Family ☐ Co-worker ☐ Others

9. Type of Medication

☐ Diabetes Pills ☐ Injection ☐ Both

10. Co-morbidities

☐ Hypertension ☐ High Cholesterol ☐ Kidney Problems

☐ Others

2: Self-Management and Knowledge

Self-Management

S.No	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1.	The service encourages me to maintain control over my illness.					
2.	Since I joined the service, I take my meds more consistently.					
3.	The service provides me the confidence to manage my illness.					
4.	After completing the service and reaching my goals, I feel a sense of success.					
5.	Since joining the service, I've made improvements to my diet and workout routine.					

Knowledge

S.No	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
6.	I'm happy with my knowledge of what I need to eat to manage my illness.					
7.	I am satisfied with my knowledge of the kinds and quantities of exercise I can perform to manage my illness.					

8.	I am happy with my comprehension of how factors like stress, weight, and blood pressure can alter my blood sugar levels.					
9.	I'm not sure what kinds of exercise will help me manage my illness.					

3: General Medication Adherence Scale

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The General Medication Adherence Scale (GMAS)
CODING

No	Question	Categories	Grading	Grading within domain
Non-adherence due to patient behavior (un-intentional and intentional)				
1.	Do you have difficulty in remembering to take your medications?	Always Mostly Sometimes Never	0 1 2 3	• High adherence = 13 – 15 • Good adherence = 11 – 12 • Partial adherence = 8 – 10 • Low adherence = 5 – 7 • Poor adherence = 0 – 4
2.	Do you forget to take your medication due to your busy schedule, travelling, meeting, events at home, party, marriage, religious celebrations, etc.?	Always Mostly Sometimes Never	0 1 2 3	
3.	Do you discontinue your medication when you feel well?	Always Mostly Sometimes Never	0 1 2 3	
4.	Do you stop taking medications when you feel adverse effects such as gastric discomfort, etc.?	Always Mostly Sometimes Never	0 1 2 3	
5.	Do you stop taking medications without informing the doctor?	Always Mostly Sometimes Never	0 1 2 3	
Non-adherence due to additional disease and pill burden				
6.	Do you discontinue your medicines due to other medicines that you have to take for your additional disease?	Always Mostly Sometimes Never	0 1 2 3	• High adherence = 11 – 12 • Good adherence = 9 – 10 • Partial adherence = 6 – 8 • Low adherence = 4 – 5 • Poor adherence = 0 – 3
7.	Do you find it is a hassle to remember your medications due to medication regime complexity?	Always Mostly Sometimes Never	0 1 2 3	
8.	During the last month, had there been any occasion when you missed your medicines due to progression of disease and addition of new medicines?	Always Mostly Sometimes Never	0 1 2 3	
9.	Do you alter medication regimen, dose and frequency by yourself?	Always Mostly Sometimes Never	0 1 2 3	
Non-adherence due to financial constraints				
10.	Do you discontinue these medications because they are not worth of the money you spent on them?	Always Mostly Sometimes Never	0 1 2 3	• High adherence = 6 • Good adherence = 5 • Partial adherence = 3 – 4 • Low adherence = 2 • Poor adherence = 0 – 1
11.	Do you find it difficult to buy your medicines because they are expensive?	Always Mostly Sometimes Never	0 1 2 3	
Grading for overall medication adherence (cumulative) High Adherence = 30 – 33 Good adherence = 27 - 29 Partial Adherence = 17 – 26 Low Adherence = 11 – 16 Poor Adherence = 0 – 10				

4: Patient Satisfaction Feedback

4: Patient Satisfaction Feedback

PATIENT SATISFACTION FEEDBACK REGARDING PHARMACIST COUNSELLING مریض کا فارمسسٹ سے حاصل کردہ معلومات کے بارے میں اطمینان اوراظہارخیال	
1. Were you able to get counseling without any difficulty? ○ Yes ○ No	**۱۔ کیا آپ کو آسانی سے معلومات حاصل ہوگئیں؟** ○ ہاں ○ نہیں
2. Were you able to get knowledge which you required? ○ Yes completely ○ Yes to some extent ○ No, I did not get what I was seeking to know	**۲۔ کیا آپ کو وہ سب معلوم ہوگیا جو آپ جاننا چاہتے تھے؟** ○ ہاں، مکمل طور پر ○ ہاں، کسی حد تک ○ نہیں، مجھے وہ سب کچھ نہیں پتہ چلا جو میں جاننا چاہتا تھا
3. Did you find pharmacist helpful in resolving your queries? ○ Very helpful ○ Somewhat helpful ○ Not helpful	**۳۔ کیا فارمسسٹ نےآپ کے سب سوالات کے جوابات بہتر طور پردے دیئے؟** ○ بہت بہتر طور پر ○ کسی حد تک بہتر طور پر ○ بہتر طور پرنہیں دیئے
4. What is your opinion about the time duration of pharmacist counseling? ○ More time should be given ○ Appropriate time was given ○ My time was wasted	**۴۔ فارمسسٹ سے حاصل کردہ معلومات کے دورانیہ کے متعلق آپ کیا رائے رکھتے ہیں؟** ○ اس سے زیادہ وقت دینا چاہئے تھا ○ دورانیہ میری ضرورت کے مطابق تھا ○ میرا وقت برباد ہوگیا
5. Will you recommend getting counseling from pharmacists to others? ○ Yes ○ No	**۵۔ کیا آپ دوسروں کو فارمسسٹ سے مفید معلومات حاصل کرنے کی تجویز دیں گے؟** ○ ہاں ○ نہیں
6. In your opinion, should this service be offered by pharmacies in your locality? ○ Yes ○ No	**۶۔ کیا دوائیوں کی دوکان پراس قسم کی سہولت موجود ہونی چاہئے یا نہیں؟ آپ کی کیا رائے ہے؟** ○ ہاں ○ نہیں
7. Are you willing to pay for this counseling service? ○ Yes ○ No	**۷۔ کیا آپ فارمسسٹ سے مفید معلومات حاصل کرنے کے لئے پیسوں کی ادائگی کی حمایت کریں گے؟** ○ ہاں ○ نہیں
8. If yes, how much counseling fee should be charged for this service?_____	**۸۔ اگر آپ ہاں کہتے ہیں تو کتنے پیسے تجویز کریں گے؟**_____
9. How would you rate your satisfaction with pharmacist counseling? ○ Very satisfied ○ Satisfied ○ Uncertain ○ Not satisfied	**۹۔ فارمسسٹ سے حاصل کردہ معلومات سے آپ کتنے مطمئن ہیں؟** ○ بہت مطمئن ○ مطمئن ○ کچھ کہ نہیں سکتا ○ مطمئن نہیں ہوں
10. Indicate you satisfaction rate with pharmacist counseling on a scale of 1 – 10. **Worst** 1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10 **Best**	**۱۰۔ فارمسسٹ سے حاصل کردہ معلومات سے ہونے والے اطمینان کو ایک سے دس تک کے پیمانے پر ظاہر کیجیئے۔** بدترین 10 – 9 – 8 – 7 – 6 – 5 – 4 – 3 – 2 – 1 بہترین

5: EQ-5D-3L

Under each heading, please tick the ONE box that best describes your health TODAY.

MOBILITY

I have no problems in walking about ❑
I have slight problems in walking about ❑
I have moderate problems in walking about ❑
I have severe problems in walking about ❑
I am unable to walk about ❑

SELF-CARE

I have no problems washing or dressing myself ❑
I have slight problems washing or dressing myself ❑
I have moderate problems washing or dressing myself ❑
I have severe problems washing or dressing myself ❑
I am unable to wash or dress myself ❑

USUAL ACTIVITIES *(e.g. work, study, housework, family or leisure activities)*

I have no problems doing my usual activities ❑
I have slight problems doing my usual activities ❑
I have moderate problems doing my usual activities ❑
I have severe problems doing my usual activities ❑
I am unable to do my usual activities ❑

PAIN / DISCOMFORT

I have no pain or discomfort ❑
I have slight pain or discomfort ❑
I have moderate pain or discomfort ❑
I have severe pain or discomfort ❑
I have extreme pain or discomfort ❑

ANXIETY / DEPRESSION

I am not anxious or depressed ❑
I am slightly anxious or depressed ❑
I am moderately anxious or depressed ❑
I am severely anxious or depressed ❑
I am extremely anxious or depressed ❑

- We would like to know how good or bad your health is TODAY.
- This scale is numbered from 0 to 100.
- 100 means the best health you can imagine.
  0 means the worst health you can imagine.
- Mark an X on the scale to indicate how your health is TODAY.
- Now, please write the number you marked on the scale in the box below.

YOUR HEALTH TODAY = ☐