RESEARCH ARTICLE
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Evaluating Patient Knowledge of Type 2 Diabetes in Türkiye: A Community Pharmacy-Based Cross-Sectional Study

ABSTRACT

Background: Type 2 diabetes mellitus (T2DM) represents a significant global and national public health burden, with growing prevalence, high morbidity, and escalating economic costs. In Türkiye alone, over 9 million adults live with diabetes, and this number is expected to rise substantially. While pharmacists have been increasingly recognized as essential contributors to chronic disease management, their role in structured diabetes care in Türkiye remains underdeveloped. This study aimed to assess the knowledge levels of individuals with T2DM and to explore opportunities for pharmacist-led educational interventions in the community pharmacy setting.

Methods: A descriptive, cross-sectional study was conducted at a community pharmacy in Istanbul between October 2020 and April 2021. One hundred and two adult patients with T2DM were recruited and interviewed by a pharmacist using a structured 25-item Diabetes Mellitus Knowledge Test. Sociodemographic and clinical data were also collected. Statistical analyses included descriptive summaries and bivariate comparisons, with significance defined at $P < .05$.

Results: Participants demonstrated high awareness in core domains such as disease identification and medication adherence, but substantial gaps were found in areas related to complication prevention and self-care practices. The overall knowledge level was moderate to high, with mean performance scores around 74.5%. Educational attainment and number of comorbidities were associated with knowledge variability.

Conclusion: These findings highlight the potential for community pharmacists to address critical knowledge gaps in diabetes care. Tailored educational services delivered in pharmacies could enhance patients' self-management capacities and support national diabetes control strategies.

Keywords: Community pharmacy services, health literacy, pharmacists, Türkiye, type 2 diabetes mellitus

What is already known on this topic?

- Type 2 diabetes mellitus (T2DM) is a growing global health concern with high morbidity and cost, and suboptimal patient knowledge is a persistent barrier to effective self-management.
- Pharmacists, especially in community settings, have demonstrated the potential to improve diabetes outcomes through counseling, medication reviews, and patient education in many countries.
- In Türkiye, despite curricular progress in clinical pharmacy, pharmacists' integration into structured diabetes education remains limited and variable across practice settings.

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disease of pandemic scale characterized by persistent hyperglycemia due to impaired insulin secretion and/or action.[1] It poses a major global health challenge, affecting an estimated 537 million adults in 2021—a figure projected to rise to 783-784 million by 2045.[2] The global prevalence of DM (~10% of adults) has risen sharply in recent decades.[1,2] Morbidity and mortality are high: diabetes and its complications account for about 12% of global deaths, exceeding 4 million annually.[3] Beyond its human toll, diabetes imposes a major economic burden due to long-term microvascular and macrovascular complications (e.g., nephropathy, neuropathy, retinopathy, cardiovascular disease) requiring continuous care.[4] Global healthcare expenditure on diabetes is substantial; in Türkiye alone, annual management costs were estimated at $4.5 billion (31.3 billion TL) in 2020.[3] With over 9 million adults living with diabetes and prevalence around 14%-15%, Türkiye has one of Europe's highest rates.[2] This number is projected to rise further, highlighting the urgent need for stronger diabetes prevention and management efforts.

Pharmacists, as medication experts and accessible health advisors, have critical roles in confronting the diabetes burden. Traditionally, their responsibilities centered on dispensing, but the profession has embraced patient-oriented

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What this study adds on this topic?

- This study is among the first in Türkiye to quantify T2DM patients' knowledge levels using a structured diabetes knowledge test in a real-world community pharmacy setting.
- The findings reveal high awareness in core areas (e.g., medication adherence and disease definition) but significant knowledge gaps in complication prevention, self-care, and renal monitoring.
- The study highlights the untapped potential of Turkish community pharmacists to deliver educational interventions and calls for enhanced clinical training and national policy support to empower their role in diabetes management.

care models to improve chronic disease outcomes.[5-11] Within multidisciplinary teams, pharmacists ensure safe medication use, provide counseling, and support self-management. They educate patients on drug use, lifestyle, glucose monitoring, and adherence. Through medication management and follow-up, pharmacists identify and resolve drug-related problems, prevent adverse effects, and optimize therapy. Evidence shows pharmacist-led interventions (education, counseling, medication reviews, physician collaboration) improve outcomes in type 2 DM (T2DM).[12-17] Pharmacist involvement reduces glycated hemoglobin (HbA1c), improves blood pressure, lipid control, adherence, knowledge, and self-care capacity.[7,13,16,18] With individualized education and ongoing support, pharmacists help prevent complications, enhance quality of life, and improve treatment success.[14-16]

To realize the full potential of pharmacists in diabetes care, pharmacy curricula must provide adequate clinical training. In line with global trends, pharmacy education in Türkiye has increasingly adopted a patient-oriented, clinically focused approach since the early 1990s, with clinical pharmacy courses that train students to apply pharmacotherapy to real cases, monitor outcomes, and collaborate with patients and other healthcare professionals.[5] This evolution—from product-focused dispensing to patient-centered care—prepares pharmacists to provide diabetes self-management education and chronic disease coaching.[5,9,11,19-21] However, the sufficiency and consistency of clinical training remain uncertain. Studies indicate that pharmacy students still have gaps in diabetes prevention and complication management, suggesting that further curricular strengthening is needed to ensure graduates are fully competent and confident in providing diabetes-related services.[5,9,11,22]

In Türkiye, community pharmacists remain an underused resource in diabetes management. Regulatory and reimbursement barriers, together with the relatively recent introduction of clinical pharmacy services and variability in training across institutions, limit their systematic involvement in patient care. Although clinical pharmacy is expanding, integration of pharmacists into routine diabetes care teams is not yet standard practice, and service models are still evolving. Strengthening both undergraduate curricula and health-system support has been identified as essential for enabling community pharmacists to provide consistent, sustainable diabetes care services in the community.[8]

MATERIAL AND METHODS

Study Design and Setting

This observational, cross-sectional study was conducted at a community pharmacy located in Istanbul, Türkiye, between October 2020 and April 2021. The primary objective was to evaluate the knowledge levels of adult patients with DM regarding their disease, treatment, and self-management practices. The study was designed as a patient-centered interview-based assessment conducted in a real-world community pharmacy setting, reflecting routine patient–pharmacist interactions in daily practice.

The study protocol was reviewed and approved by the Bezmialem Vakıf University Ethics Committee (Date: October 27, 2020; Decision No: 18/362). All procedures were performed in accordance with the ethical principles of the Declaration of Helsinki. Participation was voluntary, and written informed consent was obtained from all patients before data collection.

Participants and Eligibility Criteria

Adult patients (aged ≥18 years) with a confirmed diagnosis of T2DM who visited the pharmacy during the study period were invited to participate. Eligibility criteria included the ability to communicate in Turkish, willingness to provide informed consent, and regular use of at least 1 antidiabetic medication. Patients with cognitive

impairment, acute illness, or communication barriers preventing effective interview participation were excluded.

A convenience sampling strategy was employed, enrolling a total of 102 participants. This sample size was considered sufficient for descriptive and inferential analyses based on comparable studies assessing diabetes knowledge in community pharmacy settings.

Data Collection and Instruments

Data were collected through face-to-face structured interviews conducted by the community pharmacist. A standardized Patient Profile Form was used to record sociodemographic data (age, sex, marital status, educational attainment, and social security status), lifestyle factors (smoking and alcohol use), clinical characteristics (duration of diabetes, comorbidities, and concurrent medications), and other relevant health information.

Knowledge levels regarding diabetes were assessed using a structured Diabetes Mellitus Knowledge Test (DMKT), which consisted of 25 multiple-choice items covering key areas such as disease definition and causes, symptoms, complications, treatment, medication adherence, self-monitoring, and lifestyle modifications. Each correct response was scored as 1 point, yielding a total possible score ranging from 0 to 25. Higher scores indicated greater knowledge.

All interviews were conducted in a private counseling area within the pharmacy to ensure confidentiality and minimize response bias. Each interview lasted approximately 15-20 minutes. The pharmacist administering the survey received prior training to standardize data collection and ensure consistency across interviews.

Variables and Classification

The primary outcome variable of the study was the total diabetes knowledge score, which was calculated based on the number of correct responses obtained from the DMKT. Each correct response was assigned a score of 1, and the cumulative total reflected the participant's overall knowledge level regarding diabetes. For comparative purposes, participants were categorized into 3 knowledge categories based on the percentile distribution of total scores: individuals whose scores fell within the upper 25th percentile were classified as having a high level of knowledge (≥75th percentile), those between the 50th and 74th percentiles were classified as having a moderate level of knowledge, and those below the 50th percentile were considered to have a low level of knowledge. This categorization enabled the evaluation of demographic and clinical factors associated with varying degrees of diabetes-related awareness.

Independent variables included a range of sociodemographic and clinical parameters such as age, sex, marital status, educational attainment, and social security coverage. Lifestyle-related factors, including smoking and alcohol consumption, were also recorded as potential influencers of knowledge levels. Clinical characteristics comprised the number of prescribed medications, the presence and type of comorbidities, and the classification of polypharmacy, which was defined as the concurrent and regular use of 4 or more medications. These variables were selected based on their potential relevance to the patient's health literacy, engagement in disease management, and access to healthcare information. This comprehensive classification framework allowed for the exploration of associations between diabetes knowledge and multiple determinants, enabling an in-depth understanding of how individual, behavioral, and clinical factors may influence patients' awareness and self-management capacity within the community pharmacy context.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics version 31 (IBM Corp., Armonk, NY, USA) and Jamovi version 2.4. Descriptive statistics were used to summarize participant characteristics. Categorical variables were presented as frequencies and percentages, while continuous variables were expressed as means ± SD or medians with interquartile ranges, depending on data normality. Normality was evaluated using the Shapiro–Wilk test and visual inspection of histograms and Q–Q plots. All analyses were two-tailed, and statistical significance was set at $P < .05$. Results were reported with 95% CIs to indicate precision of estimates.

RESULTS

Demographic and Clinical Characteristics

A total of 102 patients with T2DM participated in this study. Their demographic and clinical characteristics are summarized in Table 1. Of the total sample, 56% (n = 57) were male and 44% (n = 45) were female. The majority of participants were married (68.6%), while 17.6% were widowed or divorced and 13.8% were single. Educational attainment was relatively high, with 34.3% being university graduates and 26.5% high school graduates, whereas only 4.9% reported having no formal education.

Nearly all participants had social security coverage, primarily through public insurance (82.3%), with 6.9% holding private insurance and 10.8% being uninsured. Lifestyle factors revealed that 63.7% of the patients were current or former smokers and 48.0% reported alcohol consumption to some degree. The mean number of prescribed drugs per patient was 3.3 ± 2.8, and polypharmacy (≥4 drugs) was identified in 26.5% of the cohort. A graphical summary of the distribution, including sex and education level, is presented in Table 1.

Comorbidities

The 5 most prevalent comorbidities among participants were hypertension (67.6%), hyperlipidemia (17.6%), coronary artery disease/myocardial infarction (12.7%), psychiatric disorders (7.8%), and hypothyroidism (3.9%) (Table 2).

Table 1. Demographic and Clinical Characteristics of Participants (n = 102)

	Number of Participants (n = 102)	Percentage (%)
Sex		
Male	57	56
Female	45	44
Marital status		
Married	70	68.6
Divorced/Widowed	18	17.6
Single	14	13.8
Education level		
None	5	4.9
Primary school graduate	18	17.6
Secondary school graduate	16	15.7
High school graduate	27	26.5
University graduate	35	34.3
Postgraduate/doctorate	1	0.98
Social security		
Yes - Public insurance	84	82.3
Yes - Private insurance	7	6.9
No- None	11	10.8
Smoking (Yes)	65	63.73
Alcohol (Yes)	49	48.04
Number of drugs per patient (mean ± SD)	3.3 ± 2.8	
Polypharmacy (≥4 drugs)	27	26.47

Data are presented as frequencies and percentages. Percentages were calculated based on valid responses.

The co-occurrence of the 3 most common comorbidities—hypertension, hyperlipidemia, and coronary artery disease—is illustrated in Table 2, showing substantial overlap between hypertension and hyperlipidemia and a smaller subset of patients affected by all 3. These findings confirm that cardiovascular and metabolic disorders remain the dominant comorbidities among adults with diabetes in this population.

Medication Use

The most frequently prescribed antidiabetic medication was metformin (61%), followed by insulin preparations (38.2%). Other common agents included low-dose acetylsalicylic acid (15.7%), valsartan (14.7%), and statins (14.7%), mainly atorvastatin or rosuvastatin, a predominance of oral antihyperglycemic and cardiovascular protective agents seen in Table 3.

Knowledge Levels Regarding Diabetes

The patients' knowledge concerning diabetes management, monitoring, and self-care was evaluated across 15 domains (Table 4). Overall, participants demonstrated high awareness in foundational areas such as disease definition (99.0%), chronicity (94.9%), medication adherence (95.7%), and treatment approach (91.1%). These findings indicate a strong understanding of the fundamental aspects of diabetes care. However, notable deficiencies were observed in more complex domains. Only 61.0% correctly identified insulin deficiency as the primary cause of diabetes, and 24.0% were uncertain. Similarly, awareness of renal complications was poor, with only 31.4% recognizing the purpose of urine testing as an indicator of kidney function. Knowledge regarding blood pressure monitoring frequency (62.0%) and preventive foot care (17.4%) was also limited. A detailed visual summary of knowledge adequacy

Table 2. Most Common 5 Comorbidities Among Adult Patients with Type 2 Diabetes (n = 102)

Comorbidity	Number of Patients (n = 102)	Percentage (%)
Hypertension	69	67.6
Hyperlipidemia	18	17.6
Coronary artery disease/Angina/MI	13	12.7
Psychiatric disorders (anxiety, depression, etc.)	8	7.8
Hypothyroidism	4	3.9

Most patients presented with diabetes mellitus as a primary condition, frequently accompanied by hypertension and hyperlipidemia.
MI, myocardial infarction.

Table 3. Most Commonly Prescribed Medications Among Participants (n = 102)

Medication	Number of Patients (n = 102)	Percentage (%)
Metformin	61	61
Insulin preparations (glargine, aspart, lispro, detemir, etc.)	39	38.23
Acetylsalicylic acid – low dose	16	15.68
Valsartan	15	14.70
Statins (atorvastatin / rosuvastatin)	15	14.70
Gliclazide	12	11.76
Vildagliptin	8	7.84
Amlodipine	8	7.84
PPIs (pantoprazole / lansoprazole / esomeprazole, etc.)	8	7.84
β-blockers (carvedilol / metoprolol / nebivolol, etc.)	7	6.86

Percentages may not sum to 100% because patients could be prescribed more than 1 antidiabetic medication.
PPIs, proton pump inhibitors.

across thematic domains is provided in Figures 1-3. These results collectively show that while awareness was highest for disease identification and monitoring, it declined markedly for lifestyle-related behaviors and preventive care measures. The radar chart (Figure 2) illustrates the distribution of knowledge adequacy across 6 composite thematic domains. The strongest performance was observed in disease awareness (96.3%), treatment adherence (95.7%), and comprehensive management (91.1%), whereas lifestyle and self-care (42.0%) and complication prevention (61.0%) emerged as the weakest areas. This visual pattern underscores the need for targeted educational interventions

Table 4. Summary of Diabetes Knowledge Among Participants (n = 102)

Knowledge Item	Knowledge Domain / Theme	Adequate / Correct Knowledge (%)	Inadequate Knowledge (%)	Uncertain / Do Not Know (%)
Definition of diabetes (blood sugar-related disorder)	Disease awareness and conceptual understanding	99.0	1.0	0.0
Chronic nature of diabetes (lifelong condition)	Disease awareness and chronicity	94.9	5.1	0.0
Regular medication adherence	Treatment adherence and pharmacotherapy awareness	95.7	4.3	0.0
Main cause (insulin deficiency)	Pathophysiological understanding	61.0	15.0	24.0
Awareness of complications	Complication recognition and prevention	78.0	15.0	7.0
Correct monitoring method (blood glucose test)	Disease monitoring and glycemic control	94.1	3.9	2.0
Blood pressure monitoring frequency	Cardiovascular risk and comorbidity control	62.0	24.0	14.0
Eye examination frequency (every 6-12 months)	Complication prevention (retinopathy awareness)	76.0	5.0	19.0
Purpose of urine testing (renal function)	Complication prevention (nephropathy awareness)	31.4	32.3	36.3
Management of hypoglycemia (sugar intake)	Emergency management and self-care response	77.0	12.0	11.0
Treatment approach (lifestyle + medication)	Comprehensive disease management	91.1	1.0	7.9
Role of regular exercise	Lifestyle modification and metabolic control	40.0	28.0	32.0
Proper foot care practices	Preventive self-care and complication avoidance	17.4	59.8	22.8
Non-effective treatment (antibiotics)	Pharmacological misconceptions	51.0	3.9	45.1
Balanced diet components	Nutritional management and lifestyle education	72.0	14.0	14.0

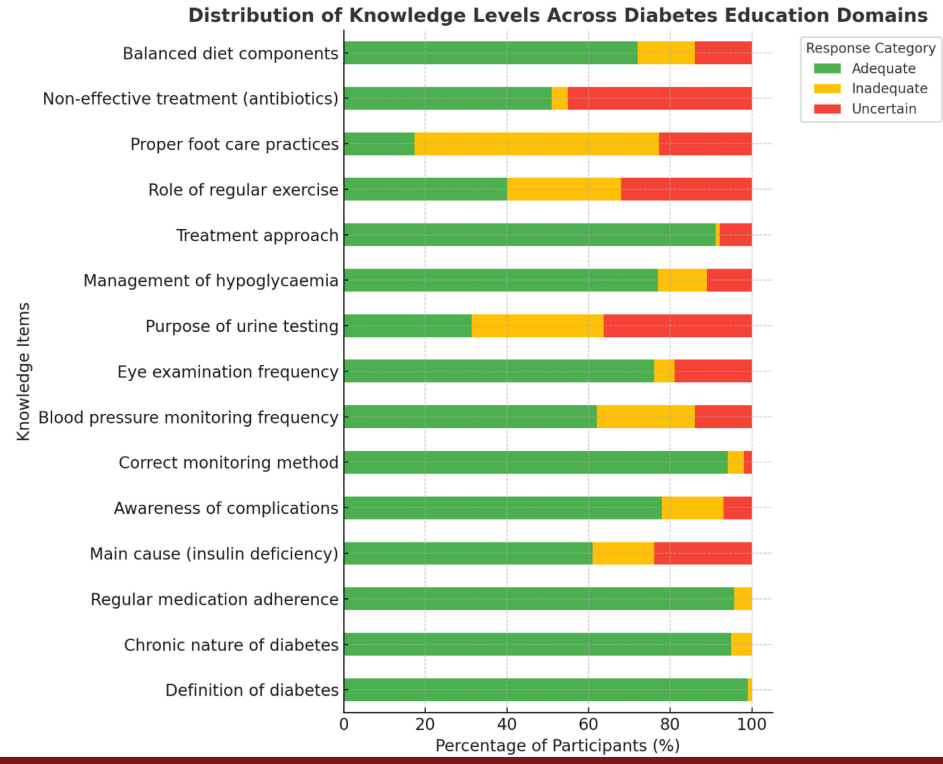

Figure 1. Distribution of knowledge levels across diabetes education domains.

focusing on behavioral modification, preventive strategies, and complication awareness.

DISCUSSION

This study underscores the need to strengthen diabetes care through better patient education and greater pharmacist involvement in community settings. The finding of only moderate patient knowledge, particularly regarding complication prevention and lifestyle management, highlights a clear opportunity for community pharmacists to address these gaps through targeted counseling. Evidence from Türkiye and neighboring countries shows that pharmacist-led interventions can reduce HbA1c by approximately 1.4%-1.8% and improve blood pressure, lipid profiles, body mass index (BMI), and medication adherence, and even a 1% reduction in HbA1c is associated with a substantial decrease in microvascular risk.[16] Turkish studies similarly demonstrate that pharmacist involvement improves glycemic control, lipid levels, weight, and patient understanding, especially among those with poor glycemic control (HbA1c > 9%), underscoring the important contribution that clinical pharmacists can make to diabetes management in Türkiye.[22]

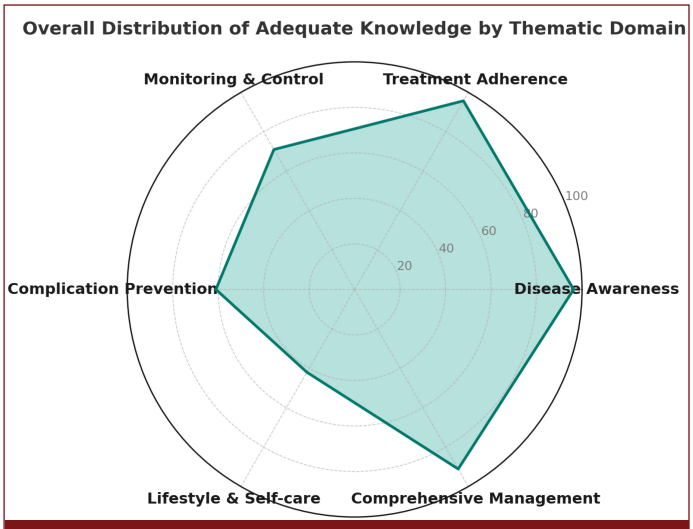

Figure 2. Overall distribution of adequate knowledge by thematic domain.

Expanding the role of pharmacists in the management of T2DM holds promise for both patients and the healthcare system. By using their professional knowledge and skills, community pharmacists can provide a range of diabetes care services in addition to dispensing, including routine blood glucose monitoring, medication review, lifestyle counseling, risk factor screening (e.g. for foot or eye complications), and timely referral to physicians when needed. Implementing such services in community pharmacies may help detect therapy-related problems earlier and support patients' motivation and adherence. Evidence from clinical pharmacy initiatives in Türkiye indicates that when pharmacists systematically identify and resolve drug-related problems and actively educate patients, medication adherence and self-care behaviors improve,

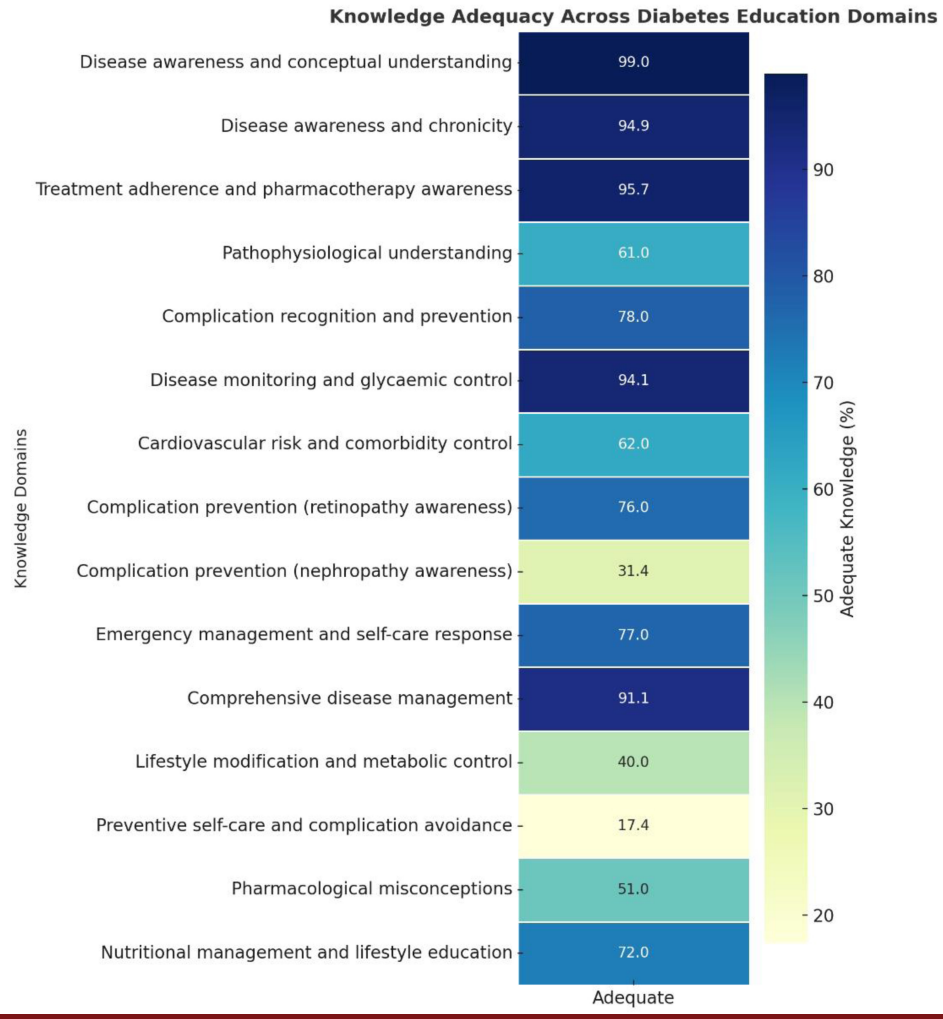

Figure 3. Knowledge adequacy across diabetes education domains.

with potential benefits for preventing adverse events and reducing avoidable hospitalizations.[8,12,20-22]

In Europe alone, suboptimal medication adherence is estimated to contribute to over 1.1 million hospital bed-days and 200 000 early deaths annually. Pharmacist-led interventions targeting adherence—such as personalized counseling, medication reminders, and regular follow-up—have proven effective in mitigating this problem. A recent systematic review of randomized trials found that about 69% of studies reported significant improvements in medication adherence with pharmacist-led interventions across chronic diseases.[6] These interventions ranged from 1-on-1 counseling and patient education to tailored compliance programs and use of telehealth or digital reminders. The review concluded that pharmacist-led strategies (especially those combining multiple approaches) can markedly enhance adherence, thereby improving long-term disease control. This is particularly relevant for diabetes, where taking medications as prescribed (whether oral agents or insulin) is critical to avoiding complications. Improved adherence facilitated by pharmacists has downstream benefits, including better glycemic control and fewer complications.[6]

Pharmacists' clinical interventions have been shown to significantly improve diabetes outcomes beyond medication adherence. Evidence from randomized controlled trials demonstrates that pharmacist-led care enhances both clinical and patient-centered outcomes. A recent meta-analysis found that in patients with diabetes and hypertension, pharmacist interventions lowered systolic blood pressure by about 7 mmHg and diastolic by 4 mmHg, with patients nearly twice as likely to reach target levels.[7] Similarly, systematic reviews report HbA1c reductions of 1.4%-1.8%. These results from pharmacist-led care are comparable in magnitude to adding a new diabetes medication to therapy. Additional benefits include improvements in fasting glucose, lipid profile, BMI, and patient knowledge, as well as better quality of life and satisfaction.[16]

Evidence from Türkiye and nearby regions supports these findings. A randomized trial in Northern Cyprus showed

that integrating a clinical pharmacist into an outpatient diabetes clinic significantly improved glycemic control and other health indicators. Over 12 months, patients receiving pharmacist-led care achieved an additional 0.7% HbA1c reduction compared to usual care (−0.74% vs −0.04%, $P < .001$).[9] The pharmacist group also had greater improvements in blood pressure, weight loss, adherence, and self-care.[9] Similarly, a recent Turkish cohort study found that after only 3 months of pharmacist intervention (medication review and education), patients showed significant reductions in blood glucose, HbA1c, cholesterol, and weight, alongside improved diabetes knowledge and illness perception. Notably, those with the poorest glycemic control at baseline benefited most from pharmacist support, achieving rapid risk factor improvements.[22]

Although strong evidence supports pharmacists' roles in diabetes care, this potential remains underused in Türkiye's community pharmacies. Pharmacists are still largely seen as medication dispensers rather than clinical care providers, and services such as medication therapy management or chronic disease counseling are not yet standard. Most pharmacist-led diabetes interventions in Türkiye have been limited to pilot or academic studies, often in hospital settings, showing positive results but lacking national implementation.[8]This highlights a persistent gap between evidence and practice—pharmacists have demonstrated the capacity to improve outcomes, yet their role in routine diabetes management within community care remains constrained.

Several barriers contribute to the limited role of pharmacists in diabetes care in Türkiye. A key issue is the adequacy of clinical training and competency. Although pharmacy faculties have incorporated clinical pharmacy courses in recent years, practical training in diabetes care remains inconsistent. Many practicing community pharmacists graduated before clinical pharmacy became a major focus, leaving them underprepared for patient counseling and monitoring. This educational gap, along with limited continuing education opportunities in chronic disease management, has hindered proactive pharmacist involvement. To address this, the Turkish Pharmacists' Association launched the "SMART Pharmacist Program" (2019-2021)—the first nationwide continuing professional development initiative for community pharmacists. About 24% of pharmacists received training in diabetes and other chronic conditions, yet only ~5% (approximately 21% of them, equating to only ~5% of all community pharmacists) implemented these services.[5] Those who did reported significant improvements in patient outcomes, confirming the program's potential. However, limited uptake highlights persistent challenges such as lack of reimbursement, time constraints, and workflow barriers. Moreover, pharmacists face systemic issues, including inadequate recognition of their role, restricted access to patient data, and insufficient collaboration with physicians.[10]The regulatory framework for clinical pharmacy is still evolving, but without supportive policies or formal service models, most community pharmacists cannot routinely provide medication reviews, diabetes coaching, or follow-up care. These educational, systemic, and policy limitations collectively restrict the contribution of Turkish pharmacists to diabetes management in community settings.

Overcoming these barriers in Türkiye requires coordinated efforts in pharmacy education reform and health policy. Strengthening pharmacists' clinical training is essential. Pharmacy schools should modernize curricula with more experiential learning in clinical settings (e.g., diabetes clinics) and include topics such as diabetes technology. Familiarity with continuous glucose monitoring and emerging tools is increasingly important, and pharmacy graduates should be prepared to advise on their use.[23] Studies show that focused diabetes training improves students' knowledge and confidence, with long-lasting effects, producing pharmacists more ready for clinical roles. Expanding postgraduate certifications and Continuing Professional Development (CPD) modules will help practitioners gain advanced skills. Türkiye's CPD initiative was a positive step; broadening such programs will strengthen pharmacists' clinical capacity and promote continuous learning in chronic disease management.[5]

To achieve these benefits broadly, key challenges must be addressed. Clinical pharmacy services still need clearer definition and formal integration into Türkiye's healthcare system. Effective pharmacist-led diabetes care requires supportive policies—recognition of pharmacists as care providers, reimbursement for cognitive services, and collaborative agreements with physicians.[6,8,9,17]Continuous professional development in chronic disease management should be promoted, while pharmacy curricula and practical training must be strengthened to better prepare future pharmacists. Governmental and institutional support will be essential to ensure these services are effectively implemented and sustained.

Finally, ongoing research is essential to guide future developments. Studies in Türkiye should focus on pragmatic and implementation research to determine how pharmacist-led diabetes care can be efficiently integrated into community settings and whether it is cost-effective. Exploring personalized pharmacist interventions that address individual barriers to adherence or glycemic control would enhance their impact.[6]Comparative studies of different service models—such as individual counseling, group education, or digital follow-up—could identify the most effective approaches. Moreover, large-scale outcome and economic evaluations are needed to demonstrate how pharmacist involvement can reduce complications and healthcare costs, supporting policy and payer investment in these services.

This study has several limitations that should be considered when interpreting the findings. First, the research was conducted in a single community pharmacy located in

Istanbul, which may limit the generalizability of the results to other regions or settings within Türkiye. Cultural, socioeconomic, and educational differences across geographic areas may influence both diabetes knowledge and pharmacist–patient interactions. Second, the cross-sectional design captures knowledge levels at a single time point and does not allow for assessment of changes over time or causal relationships between variables. Third, although the structured DMKT provided valuable insight into patient understanding, it focused primarily on factual knowledge and may not fully capture patients' behavioral skills, attitudes, or confidence in self-management. Additionally, responses were self-reported during face-to-face interviews, which may have introduced social desirability bias, potentially leading participants to overstate their knowledge. Lastly, while the study aimed to explore the potential role of community pharmacists, actual interventions or follow-up education sessions were not implemented or evaluated, limiting the ability to directly assess pharmacist impact. Despite these limitations, the study provides foundational evidence for designing future educational interventions and expanding the clinical role of pharmacists in diabetes care within community settings in Türkiye.

In conclusion, leveraging clinical pharmacists in diabetes care represents a promising strategy to combat the growing diabetes epidemic in Türkiye. By focusing on patient-centered services delivered through community pharmacies, the healthcare system can capitalize on pharmacists' accessibility and expertise. The evidence from local and regional studies is compelling—pharmacists' involvement leads to better glycemic control, enhanced patient knowledge, and mitigation of drug-related problems, all of which contribute to healthier outcomes for patients with diabetes. As the prevalence of diabetes continues to rise, incorporating pharmacists more fully into diabetes management teams could significantly improve chronic care delivery. With appropriate training, policy backing, and interdisciplinary collaboration, community pharmacists in Türkiye can help bridge gaps in diabetes care and education, ultimately reducing complications and improving the quality of care for patients with T2DM.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Bezmialem Vakif University (Approval No: 18/362; Date: October 27, 2020).

Informed Consent: Written informed consent was obtained from all participants who agreed to take part in the study.

Peer-review: Externally peer-reviewed.

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References

1. World Health Organization. *Diabetes*. 2025. Available at: https://www.who.int/health-topics/diabetes#tab=tab_1. Accessed November 3, 2025.
2. International Diabetes Federation. Global diabetes data & statistics. *IDF Diabetes Atlas*. 2025. Accessed November 3, 2025. Available at: https://diabetesatlas.org/.
3. Birinci S, Sur H. Cost of diabetes mellitus and related macrovascular complications in Turkiye. *North Clin Istanb*. 2023;10(4):418-427. **[CrossRef]**
4. Diabetes UK. Complications of diabetes | Type 1 and type 2 diabetes; 2025. Diabetes UK. Available at: https://www.diabetes.org.uk/about-diabetes/looking-after-diabetes/complications. Accessed November 3, 2025.
5. Apikoglu S, Selcuk A, Ozcan V, et al. The first nationwide implementation of pharmaceutical care practices through a continuing professional development approach for community pharmacists. *Int J Clin Pharm*. 2022;44(6):1223-1231. **[CrossRef]**
6. Farhana L, Rahayu FP, Sholihah S, Sweileh W, Abdulah R, Alfian SD. Effectiveness of pharmacist-led intervention on medication adherence in chronic diseases: A systematic review of randomized controlled trials. *Patient Prefer Adherence*. 2025;19:2161-2178. **[CrossRef]**
7. Gastens V, Tancredi S, Bonnan D, et al. Pharmacist interventions to improve hypertension management among patients with diabetes: a systematic review and meta-analysis of randomized controlled trials. *BMC Health Serv Res*. 2025;25(1):1-11. **[CrossRef]**
8. Kara E, Kelleci Çakir B, Sancar M, Demirkan K. Impact of clinical pharmacist-led interventions in turkey. *Turk J Pharm Sci*. 2021;18(4):517-526. **[CrossRef]**
9. Korcegez EI, Sancar M, Demirkan K. Effect of a pharmacist-led program on improving outcomes in patients with type 2 diabetes mellitus from Northern Cyprus: a randomized controlled trial. *J Manag Care Spec Pharm*. 2017;23(5):573-582. **[CrossRef]**
10. Sendekie AK, Belachew EA, Limenh LW, et al. Roles and barriers of community pharmacy professionals in the prevention and management of noncommunicable diseases in Ethiopia: a systematic review. *Front Public Health*. 2025;13:1485327. **[CrossRef]**
11. Turnacilar M, Sancar M, Apikoglu-Rabus S, Hursitoglu M, Izzettin FV. Improvement of diabetes indices of care by a short pharmaceutical care program. *Pharm World Sci*. 2009;31(6):689-695. **[CrossRef]**
12. Mustikaningtias I, Widayanti AW, Samodro P, Yasin NM. Effective education methods to improve glycemic control in type

2 diabetes mellitus patients: A systematic review. *J Prev Med Public Health*. 2025;58(5):453-464. **[CrossRef]**
13. Pousinho S, Morgado M, Falcão A, Alves G. Pharmacist interventions in the management of type 2 diabetes mellitus: A systematic review of randomized controlled trials. *J Manag Care Spec Pharm*. 2016;22(5):493-515. **[CrossRef]**
14. Abdulrhim S, Sankaralingam S, Ibrahim MIM, Awaisu A. The impact of pharmacist care on diabetes outcomes in primary care settings: an umbrella review of published systematic reviews. *Prim Care Diabetes*. 2020;14(5):393-400. **[CrossRef]**
15. Agudelo R, Granados J, Ceballos M, Pereañez JA. Design and development of a mobile application for drug information and other health data for users and patients of pharmacies and outpatient pharmaceutical services. *Explor Res Clin Soc Pharm*. 2025;20:100661. **[CrossRef]**
16. Bakhsh HT. Impact of pharmacist interventions on health outcomes of patients with type 2 diabetes mellitus in the Middle East: A systematic review. *Integr Pharm Res Pract*. 2025;14:85-98. **[CrossRef]**
17. Craske ME, Hardeman W, Steel N, Twigg MJ. Components of pharmacist-led medication reviews and their relationship to outcomes: a systematic review and narrative synthesis. *BMJ Qual Saf*. 2024;33(12):808-822. **[CrossRef]**
18. Santschi V, Chiolero A, Paradis G, Colosimo AL, Burnand B. Pharmacist interventions to improve cardiovascular disease risk factors in diabetes: a systematic review and meta-analysis of randomized controlled trials. *Diabetes Care*. 2012;35(12):2706-2717. **[CrossRef]**
19. Eldin AG, Nogid A. Integrating continuous glucose monitoring into pharmacy elective curriculum: A practical learning experience. *J Pharm Technol*. 2025:87551225251379742. **[CrossRef]**
20. Cashmore BA, Cooper TE, Evangelidis NM, Green SC, Lopez-Vargas P, Tunnicliffe DJ. Education programmes for people with chronic kidney disease and diabetes. *Cochrane Database Syst Rev*. 2024;8(8):CD007374. **[CrossRef]**
21. Morello CM, Fricovsky ES. Long-term impact of sustained knowledge, confidence, and clinical application following a first-year student pharmacist diabetes self-care Education Program. *Pharmacy (Basel)*;13(2):42. **[CrossRef]**
22. Kutluay NB, Bektay MY, Sumbul-Sekerci B, Sekerci A, Izzettin FV. Impact of clinical pharmacist integration on diabetes management: a prospective cohort. *BMC Health Serv Res*. 2025;25(1):107. **[CrossRef]**
23. Litten K, Folz H, Lobkovich A, Sherrill CH, Berlie H. Integrating continuous glucose monitoring into Doctor of Pharmacy curricula. *J Am Coll Clin Pharm*. 2025;8(2):129-135. **[CrossRef]**