RJNMSR
Review Journal of Neurological & Medical Sciences Review

Volume 4, Issue 3, 2026

KNOWLEDGE-PRACTICE GAPS IN TYPE 2 DIABETES SELF-MANAGEMENT AMONG ADULTS ATTENDING A TERTIARY-CARE CLINIC IN RAWALPINDI, PAKISTAN: A CROSS-SECTIONAL STUDY

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Acknowledgement: The authors Acknowledge the cooperation of all participants who participated in the study.

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DOI: https://doi.org/10.5281/zenodo.21961786

Received	Accepted	Published
12 Feb, 2026	26, March 2026	**27 March**, 2026

ABSTRACT

Background: *Type 2 diabetes mellitus (T2D) is a condition that is largely managed by the decisions made by patients and families on a daily basis. The burden of diabetes is very high in Pakistan and the evidence from the country and regions suggests that adherence to medication is generally better than lifestyle and preventive self-care. There is a need for granular evidence on how knowledge relates to routine practice for the design of feasible diabetes self-management education and support (DSMES).* ***Objectives:*** *To (1) evaluate participants' knowledge of T2D self-management; (2) document their views on recommended self-management behaviors; (3) document reported practices in medication use, hypoglycemia management, glucose monitoring, diet, physical activity, and foot care; and (4) identify barriers and domain-specific knowledge-practice gaps relevant to culturally appropriate clinic-based support.* ***Methods:*** *Descriptive cross-sectional study was carried out in a facility from August to October 2016. Systematic sampling was done to recruit clinic attendees with clinically diagnosed T2D. A target sample of 107 was determined based on an assumed 50% proportion, 95% confidence, 10% absolute precision and a 10% nonresponse allowance. The questionnaire was pilot tested and administered by the researchers and included questions on sociodemographic characteristics, medication use, hypoglycemia, blood glucose monitoring, diet, physical activity, and foot care. The data obtained from 105 respondents were analysed descriptively using SPSS 20.* ***Results:*** *The mean age of the participants was 49.89 years (SD = 12.36), 62.0% were female and 63.0% were uneducated. 100% of the participants were on diabetes medication. While 97.1% thought that glucose monitoring was important, 47.0% felt it should be done when they were feeling unwell, and 46.7% said they self-monitored. The majority (88.0%) had been given dietary advice, but only 20.0% reported a special diet, 92.2% reported that there was no special meal prepared at home and 63.0% used herbal supplements. 94.3% believed that physical activity was beneficial, and 36.2% indicated that they did not exercise. Knowledge of foot-care was high (97.1%) and adherence to recommendations was high (96.5%) with only 1.0% reporting regular foot inspection.* ***Conclusions:*** *Self-management knowledge was significantly higher than the performance of a number of specific behaviors, especially planned glucose monitoring, dietary adaptation, physical activity and daily foot inspection. Clinics providing DSMES should employ low literacy communication, behavioral goal setting, demonstration, family involvement, and structured follow-up, and not just information provision.*

Keywords: type 2 diabetes mellitus, self-management, self-care, health literacy, diet, physical activity, foot care, Pakistan

Introduction

Type 2 diabetes mellitus (T2D) is a chronic condition, and a lot of the treatment is done outside of the clinic. Those with T2D have to make many decisions on how to use medication, how to eat, how to exercise, how to monitor glucose, how to prevent and treat hypoglycemia, how to protect their feet, and when to seek professional care. These tasks are interdependent and influenced by knowledge, confidence, symptoms, complexity of treatment, household routines, finances, social expectations and access to ongoing support. Thus, diabetes self-management education and support (DSMES) is an integral and ongoing part of diabetes care, rather than a one-time information session at diagnosis (American Diabetes Association Professional Practice Committee for Diabetes, 2026a; Powers et al., 2020).

In Pakistan, effective self-management is particularly important. According to the International Diabetes Federation, in 2024, there were 34.5 million adults (aged 20-79 years) in Pakistan with diabetes, with a prevalence rate of 31.4% (age-standardized). Pakistan was ranked as the fourth largest number of adults suffering from diabetes in the world and had the highest adult prevalence in IDF country comparison (International Diabetes Federation, 2025). Previous national survey data has already reported diabetes and prediabetes to be a significant burden in both urban and rural communities (Basit et al., 2018). The clinical and economic burden goes beyond specialist services – complications lead to additional hospital needs, and the cost of medicines, testing, transport, diet and lost working hours are largely shouldered by patients and households.

There are not consistent levels of self-management performance across behavioral domains. A systematic review and meta-analysis of studies conducted in South Asia revealed pooled estimates of adherence to blood glucose monitoring of 65%, medication use of 64%, physical activity of 53%, diet of 48% and foot care of 42%, with significant variation in definitions and methods of measuring adherence across studies (Paudel et al., 2022). An even newer Pakistan-specific meta-analysis of 65 studies from 2003 to 2025 found the overall self-care adherence to be 47%. The highest adherence rate was seen for medication (74%), while the lowest was for physical activity (37%), with significant variability between studies (Azizpour et al., 2026). These modern observations indicate that the main issue is not just whether or not patients have received diabetes advice, but whether diabetes actions can be translated into stable routines in real-life contexts.

It has been demonstrated in Pakistan that there is a correlation between diabetes knowledge and self-care behaviour but not equivalence. Cross-sectional studies have shown that higher levels of diabetes knowledge and greater frequency of self-care activities are associated with improved glycemic control, and that there are significant gaps in diet, exercise, monitoring and preventive care (Ahmed et al., 2016; Bukhsh et al., 2018, 2019). A patient might know that exercise is important, but not have a safe, acceptable or socially viable exercise routine; know that food affects glucose, but eat from a common meal that he/she has little control over; or know that foot care is important, but not realize that checking the feet daily is a separate preventive behavior. For example, broad questions like "Do you follow foot care?" may elicit positive answers that mask the lack of specific foot care behaviors.

Qualitative research is used to explain why information is not enough. Common challenges faced by all South Asian populations are misconceptions, poor communication with health professionals, lack of culturally appropriate nutrition and activity recommendations and poor family engagement (Sohal et al., 2015). Financial difficulties, work pressure, physical disability, harsh climate conditions, social events, food preferences, fear of needles, and lack of support from family and health services have been reported as challenges to self-care in Pakistan (Ansari et al., 2021; Bukhsh et al., 2020). Recent studies have also demonstrated that dietary change is a process that is negotiated within cultural norms and family relations, and not undertaken by an isolated individual (Tariq et al., 2024). In a cross-sectional study conducted in Karachi, dietary nonadherence was found to have the following key dimensions: lack of dietary knowledge, situational barriers,

limited family support, stress-related eating, perceived monotony, cost, and work conditions (Shabbir et al., 2024).

These findings are in line with a change from advice-giving to structured behavioral support. The current standards emphasize that DSMES should be culturally and socially appropriate, tailored to the individual's needs and preferences, provided at diagnosis, when the annual review or failure to meet targets occurs, when complications or psychosocial issues arise, and during transitions in life or care (American Diabetes Association Professional Practice Committee for Diabetes, 2026a). There is evidence of improvement in Pakistan, which shows that it can be done. A randomized trial led by a pharmacist resulted in enhanced diabetes knowledge, self-care, and glycemic outcomes (Bukhsh et al., 2022), and a large multicenter, nurse-led, theory-informed, culturally tailored intervention led to improvements in self-efficacy and self-care behaviors and a modest improvement in HbA1c at three months (Asmat et al., 2024). These interventions are relevant because they focus on capability, confidence, problem-solving and follow-up, and not on the notion that knowledge leads to behavior change.

Study Objectives

1. To assess participants' knowledge of T2D self-management, including healthy eating, physical activity, prevention and management of hypoglycemia and hyperglycemia, prevention of complications, foot care, medication use, and blood glucose monitoring.
2. To describe participants' views and perceptions regarding recommended T2D self-management behaviors.
3. To document existing reported self-management practices across medication use, glucose monitoring, diet, physical activity, and foot care.
4. To identify reported barriers, inconsistencies, and domain-specific knowledge-practice gaps that could inform culturally appropriate clinic-based DSMES.

Methods and Materials

Study Design and Reporting

The study was descriptive cross sectional study with quantitative approach. The manuscript was written according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cross sectional studies, as far as was possible given the archived study record (von Elm et al., 2007).

Setting and Study Period

The study was carried out at the diabetic clinic, District Headquarters Hospital, a district level tertiary care hospital in Rawalpindi, Punjab, Pakistan. The clinic was for people who had diabetes and were being treated by an outpatient clinic and was a valuable source of information on medication review and self-management. Data collection was collected in three months (August to October 2025).

Study Population and Eligibility

Patients with clinically diagnosed T2D who visited the diabetic clinic during the study period were the source population. The inclusion criteria included clinic attendees with clinical diagnosis of T2D. Patients labeled as mentally ill, very weak or with impaired hearing were excluded from the original protocol. The criteria are reported as recorded in the original thesis; there was no standardization of the clinical definitions or screening procedures for these exclusions in the archived thesis. The age of the people enrolled ranged from 32 to 70 years (all were adults).

Sampling and Sample Size

Participants were recruited from the clinic and systematic sampling was used. No sampling frame, patient-flow estimate, random starting point or sampling interval were provided in the archived report and these cannot be verified. The sample size was determined using the formula for a single-population proportion and. the minimum calculated was approximately 97 participants, with an expected proportion of 50%, a 95% confidence level (Z = 1.96), and 10% absolute precision. The target was increased by 10% to account for the possibility of nonresponse, resulting in a target of 107. 105 persons were able to complete the

questionnaire. This number is 98.1% of the target sample, but should not be viewed as a traditional response rate as the total number approached was not reported.

Questionnaire and Measures

Structured questionnaire was designed for the study and data were collected by one researcher. Pilot testing and revision of the instrument was done prior to field use. The questionnaire covered sociodemographic characteristics, distance to the clinic, transport to the clinic, accompaniment to the clinic, duration of diabetes, family history of diabetes, comorbid conditions, knowledge of diabetes and hypoglycemia, routine consultation, name of medication, dose of medication, time of taking medication, perceived need to change the medication regime, blood glucose monitoring, knowledge of food, advice about food, food restrictions, sweets, supplements, knowledge of physical activity, type of physical activity, frequency of physical activity, duration of physical activity, time of physical activity, perceived barriers to physical activity, and foot-care knowledge and behaviour. The majority of items were binary, categorical or open-ended.

Diabetes self-management was measured using individual reported behaviors and not a validated composite score. These domains were medication use, self-monitoring of blood glucose, dietary practices, physical activity and foot care. Knowledge was indicated by answers to questions regarding the importance, benefits, or recommended performance of these behaviors. A knowledge-practice gap was descriptively interpreted when a high level of awareness of a behavior was accompanied by appreciably lower levels of reporting of the specific practice. This was an interpretive pattern, rather than a predetermined numerical index or inferential outcome.

Data Collection and Quality Considerations

The questionnaire was administered by a single researcher, which might have minimized interviewer variation and facilitated completion of the questionnaire by less-literate participants. Meanwhile, interviewer administration might lead to social-desirability or acquiescence bias, especially for behaviors that are seen as desirable medically. Because only one interviewer was used, interviewer training, standardized probing, private interview conditions, duplicate data entry, field supervision, and formal checks for inter-rater reliability were not described in the archived report. These omissions should be taken into account in the interpretation of highly positive self-reports from around the world, such as self-reported compliance to medication and foot-care recommendations.

Data Management and Statistical Analysis

Data cleaning, coding and entry were done in SPSS. The analysis was univariate and descriptive. Means, standard deviations (where clearly reported) and ranges were used to summarize continuous variables. Frequencies (n) and percentages (%) were used to summarize categorical variables, with the denominator (N) being the total sample (N = 105) unless otherwise or overlapping response structure is specified. In the thesis no hypothesis tests, confidence intervals, regression models or adjusted associations were reported. Due to the lack of the participant-level data set for this manuscript revision, no additional inferential analyses, denominator-specific recalculations or multivariable modeling were conducted.

Ethical Considerations

The study was approved by the Institutional Research Forum of Rawalpindi Medical College and Health Services Academy, Islamabad. All participants gave informed consent and it was explained that participation was voluntary and that they could withdraw at any time without penalty. Confidentiality, anonymity and privacy were respected.

Results

Participants' Characteristics

A total of 105 adults with T2D were included in the study. Mean age was 49.89 years (SD = 12.36; range = 32-70 years). Women comprised 65 (62.0%) participants and men 40 (38.1%). Most participants were married (n = 96; 91.4%), 66 (63.0%) had no formal education, and 96 (91.4%) lived in urban areas. Almost three-quarters (n = 76; 72.4%) were within about 30 minutes' walk of the clinic, 21 (20.0%)

walked for about 1 hour and 8 (7.7%) walked for more than 1 hour. Around 67 (63.8%) used public transport and around 16 (15.0%) walked to the clinic. The mean duration since the diagnosis of T2D was 9.64 years (SD = 2.16). Hypertension was reported by approximately 25 (23.8%), cardiac disease by 4 (3.8%), hepatitis C by 2 (1.9%), and renal disease by 1 (1.0%) (see Table 1).

Table 1

Participant Characteristics and Frequencies (N = 105)

Characteristic	Frequency (n)	Percentage (%)	Summary
Age, years			49.89 (SD 12.36); range 32-70
Women	65	62.0	
Men	40	38.1	
Married	96	91.4	
No formal education	66	63.0	
Primary education	19	18.0	
Secondary education	14	13.0	
Higher secondary education	3	3.0	
Graduate or above	3	3.0	
Urban residence	96	91.4	
Travel time to clinic: about 30 minutes or less	76	72.4	
Travel time to clinic: about 1 hour	21	20.0	
Travel time to clinic: more than 1 hour	8	7.7	
Used public transport	67	63.8	
Walked to clinic	16	15.0	
Duration of T2D, years			9.64 (SD 2.16)
Hypertension	25	23.8	
Cardiac disease	4	3.8	
Hepatitis C	2	1.9	
Renal disease	1	1.0	

Medication Use, Disease Knowledge, and Hypoglycemia

100% of participants indicated that they were taking diabetes medication; the archived results indicated monthly follow-up at the clinic. According to the archived results, 99.0% of the patients used a sulfonylurea, while 1.0% used sitagliptin. About 57% said they took two tablets per day, 37% said they took three tablets per day and 6% said they took one tablet per day. Over three-quarters (76.2%) understood that a treatment plan can change over time. There was a relatively high level of knowledge about hypoglycemia. In total, 83.8% knew about hypoglycemia and its symptoms, while 81.9% said they could manage hypoglycemia. 50.5% knew sugar/candy as a response to hypoglycemia and 30.5% knew that a meal/food should be consumed. About 10% of the respondents either were not sure or thought that rest was enough. These data indicate potentially clinically relevant minority of incomplete or unsafe responses and useful awareness.

Blood Glucose Monitoring and Clinical Follow-up

Nearly everyone (97.1%) believed that blood glucose monitoring was important for self-management. Over half

(56.2%) said they could monitor glucose, 46.7% said they could self-monitor, 49.5% had glucose checked at the hospital and 3.0% had a family member monitor glucose. These categories may overlap and should not be added together. The perceived appropriate monitoring frequency was widely distributed with 47.0% saying glucose should be checked when they felt unwell, 16.0% saying they should check daily, 16.0% saying they should check 3 times a month, 7.0% saying they should check 2 times a month, 11.0% saying they should check 1 time a month, and 3.0% saying they did not know. 70.5% appreciated routine follow-up to know the current glucose level while 27.6% primarily linked follow-up with getting medication.

Dietary Knowledge and Practices

Dietary advice was often reported but did not necessarily equate to structured dietary practice. 88% reported receiving dietary advice from a doctor and 88.6% felt diet was important in glucose control. However, only 20.0% said they followed a special diet and 92.2% said that a separate meal was not prepared for them at home. 50% reported that they preferred all home-cooked food, 35% reported nothing special and 10% reported avoidance of foods with sugar. Only 7.8% focused on vegetables when it came to daily consumption. Almost two thirds (63.0%) said that they used herbal supplements for T2D. Nearly all (97.0%) reported that a doctor had recommended some dietary restriction. The most frequently reported restriction was sugar and sweets. However, 23.8% admitted to not following the dietary recommendations. Those who did give a reason reported personal preference, frustration or irritation and financial difficulty.

Table 2

Frequencies of Medication, Hypoglycemia, Glucose-Monitoring, and Dietary Indicators

Indicators	Frequency (n)	Percentage (%)
1. Taking diabetes medication	105	100.0
2. Reported sulfonylurea use	104	99.0
3. Reported sitagliptin use	1	1.0
4. Knew medication regimen may change over time	80	76.2
5. Knew hypoglycemia and its symptoms	88	83.8
6. Reported knowing how to manage hypoglycemia	86	81.9
7. Identified sugar or candy for hypoglycemia	53	50.5
8. Identified a meal or other food for hypoglycemia	32	30.5
9. Considered glucose monitoring essential	102	97.1
10. Reported ability to monitor glucose	59	56.2
11. Self-monitored glucose	49	46.7
12. Glucose checked at hospital	52	49.5
13. Glucose checked by a family member	3	3.0
14. Perceived monitoring frequency: when feeling unwell	49	47.0
15. Perceived monitoring frequency: daily	17	16.0
16. Perceived monitoring frequency: three times monthly	17	16.0
17. Perceived monitoring frequency: twice monthly	7	7.0
18. Perceived monitoring frequency: once monthly	12	11.0
19. Did not know appropriate monitoring frequency	3	3.0
20. Received dietary advice from a doctor	92	88.0
21. Considered diet important for glucose control	93	88.6
22. Reported following a special diet	21	20.0

23. No separate meal prepared at home	97	92.2
24. Reported herbal supplement use	66	63.0
25. Advised dietary restrictions	102	97.0
26. Reported nonconformity with prescribed diet	25	23.8

Physical Activity

There was a high level of physical activity knowledge. In total, 94.3% felt that physical activity was good and 91.4% said that they knew the benefits of physical activity. The most common benefit was maintaining blood glucose (72.4%), followed by body fitness (14.3%), leg fitness (6.6%) and weight reduction (4.8%). 95.0% of the participants received exercise information from a doctor. 69.5% thought walking was a safe activity, while 22.9% were not sure of what activity was safe. The reported performance was lower than the awareness. The exercise-routine table revealed that 50.5% (n = 53) exercised daily, 9.5% (n = 10) exercised intermittently, 3.8% (n = 4) exercised regularly, but described it as prayer, and 36.2% (n = 38) exercised none. As far as the length of time, 32.4% said about 30 minutes per day, 17.1% said one hour, 1.9% said over one hour and 36.2% said none, with small percentages of work or prayer being counted as exercise.

Foot-Care Knowledge and Behavior

Global level foot-care awareness seemed to be very high. Nearly all respondents (98.1%) felt that special body care was necessary, the majority (95.2%) felt that the feet were the most important body part to pay attention to and 97.1% indicated knowledge of foot care. The primary source of foot-care information was doctors (82.9%) and newspapers, charts, pamphlets or other media (14.3%). 96.5% claimed to follow foot-care recommendations. The situation was different for certain practices. Although there was general recognition of the need for inspection, only 1.0% reported that they inspected the feet regularly. Nearly all (99.0%) reported washing the feet; 44.8% said that they used warm water and 35.2% said that they used water of a temperature depending upon weather or availability. The majority of the participants (92.4%) felt that they were able to treat their sores or other foot problems at home, with 56.2% stating that they followed a doctor's prescription, others saying they washed with povidone-iodine or with another antiseptic. Sixty-one percent (61.0%) preferred soft, open shoes and 11.4% said they wore the shoes they could afford. 8.6% said they had a foot problem at the time of the study or had had a foot problem at some time.

Table 3

Frequencies of Physical-Activity and Foot-Care Indicators

Indicator	Frequency (n)	Percentage (%)
1. Physical activity considered beneficial	99	94.3
2. Knew advantages of physical activity	96	91.4
3. Identified glucose maintenance as an exercise benefit	76	72.4
4. Identified body fitness as an exercise benefit	15	14.3
5. Identified leg fitness as an exercise benefit	7	6.6
6. Identified weight reduction as an exercise benefit	5	4.8
7. Doctor was source of activity information	100	95.0
8. Daily exercise	53	50.5
9. Intermittent exercise	10	9.5
10. Regular prayer described as exercise	4	3.8
11. No exercise	38	36.2
12. Walking considered safe	73	69.5
13. Did not know which activity was safe	24	22.9

14. Knowledge of foot care	102	97.1
15. Doctor was source of foot-care information	87	82.9
16. Claimed adherence to foot-care recommendations	101	96.5
17. Regular foot inspection	1	1.0
18. Regular foot washing	104	99.0
19. Washed feet with warm water	47	44.8
20. Believed sores or foot conditions could be managed at home	97	92.4
21. Reported following a doctor's prescription for foot problems	59	56.2
22. Preferred soft, open footwear	64	61.0
23. Wore whatever footwear was affordable	12	11.4
24. Reported a current or intermittent foot problem	9	8.6

Overall Pattern

The most obvious trend was a disconnection between general awareness and specific routine behaviors, across domains. The use of medication was universally reported and knowledge of hypoglycemia, monitoring, diet, exercise and foot care were often high. However, there was a significant lack of implementation in symptom triggered glucose checking, structured dietary adaptation, and reported exercise in more than one-third of participants, as well as extremely low regular foot inspection. The greatest discrepancy was in foot care, where 96.5% said they followed the recommendations, but only 1.0% said they regularly inspected.

Discussion

The present study found that there was a knowledge-practice gap among adults at tertiary outpatient diabetes care centers in Rawalpindi, which was consistent. Participants had a fairly high level of awareness of the importance of medication, glucose monitoring, diet, physical activity, and foot care, but there were several concrete behaviors that were significantly weaker. This was not consistent; medication taking was reported by all, lifestyle related and preventive behaviors were not as consistent. Therefore, the results should be interpreted as gaps in capability and implementation rather than lack of knowledge, and are specific to a particular domain. This interpretation is well supported by the Pakistan meta-analysis 2026, which revealed that medication adherence was significantly higher while overall self-care was suboptimal and physical activity was not a concern (Azizpour et al., 2026).

The results are also aligned with the overall evidence base from South Asia. Paudel et al. (2022) reported that diet, physical activity, and foot care were less consistently practiced throughout the region, compared to use of medicines and checking glucose levels. But caution is needed when comparing percentages between studies since there are differences in the definition of self-care, the recall period, the threshold, and the instruments used. In the present study, item level questions were utilized instead of a validated scale, and some of the items asked about what should be done not how much it was done. Its primary value is not therefore an exact estimate of the prevalence of "good self-care", but a clinically interpretable map of where general awareness and specific action were at odds.

The most robust domain reported was medication use. While self-reported medication-taking is universal, this may be because medicines are central to clinic encounters and because people attend clinics monthly, and should not be interpreted as verified adherence. Missed doses over a specific recall period, pharmacy refill history, correct dosing, persistence, treatment satisfaction, adverse effects, and HbA1c were not evaluated. Further, interviewer administration may have led to an increased socially desirable reporting. The results for the use of sulfonylureas (99%) is consistent with the archived 2016 report and should not be interpreted as representative of current prescribing practice. However, the emphasis on medication over lifestyle behaviors is similar to previous studies in Pakistan and the recent national meta-analysis (Ahmed et al.,

2016; Azizpour et al., 2026). DSMES should maintain this strength and broaden the scope of treatment from "taking tablets" to coordinated medication, monitoring, nutrition, activity, risk reduction and problem solving.

Knowledge of hypoglycemia was fairly good but incomplete. The majority of participants was familiar with the condition and felt they could cope with it, but around one in 10 did not know what to do or thought that rest is all that is needed. This minority is clinically important as almost all participants were reported to be taking a class of medications that are associated with a risk of hypoglycemia. Education should include the difference between symptoms and confirmation, immediate treatment with an appropriate rapid acting carbohydrate, rechecking and follow up, and family members who may need to be involved in immediate treatment. Severe events, frequency, nocturnal events, access to glucose testing and carrying a treatment source were not evaluated in the study and are important targets for future evaluation.

The glucose monitoring resulted in a more complicated knowledge-practice relationship. Nearly all participants felt that monitoring was important, and nearly half felt that it should be done when they were feeling unwell. This symptom-driven model can be associated with a delayed diagnosis of asymptomatic hyperglycemia and can be challenging to identify trends. Meanwhile, there are no uniform recommendations for screening for all T2D patients. Blood glucose monitoring should be tailored to treatment, risk of hypoglycemia, capacity to respond to results, cost, preference and clinical situation (American Diabetes Association Professional Practice Committee for Diabetes, 2026b). Hence, it is not appropriate to label all of those who did not test daily as "nonadherent" based on the present data. The more defensible worry is that monitoring was not seen as a component of an individualized plan and the study did not assess whether participants understood target ranges or how the results should guide food, activity, medication or contact with clinicians.

The dietary results show the need for self-management to be understood in the context of the household. Advice had been given to most and they were aware of the importance of diet; only one-fifth said that a special diet was prepared and almost all said that a separate meal was not prepared. Not having a separate meal does not in itself indicate poor care. If appropriate, a shared family meal can be used, provided that composition, portion size, preparation and timing are adjusted. On the other hand, a "diabetic meal" might not be needed, affordable, socially acceptable or nutritionally suitable. The questionnaire did not assess portion sizes, total energy, quality of carbohydrates, fiber, timing of meals, food insecurity or actual nutrient intake. The more important message was that general strategies like avoiding sugar were more important than other aspects of diet. Current counselling should not be limited to the message of "no sugar" but should be culturally recognised, affordable meal planning that can be adopted by the household.

This is supported by contemporary evidence from Pakistan. Tariq et al. (2024) demonstrated that nutritional changes are made within families' practices and cultural norms. Shabbir et al. (2024) found that there are different barriers such as knowledge, social situations, family support, stress related eating, monotony, cost, work conditions, and fear of hunger/weakness. Thus, the finding of the present study that 92.2% did not have a separate meal should be a call for family-inclusive counselling and not blame. Some practical strategies might be modifying typical foods, showing how to use household utensils for portioning, negotiating changes with the food buyer/cook, and planning for social events or religious holidays. The extensive use of herbal supplements also calls for nonjudgmental questions regarding product type, source, cost, perceived benefit, potential adverse effects and interaction with prescribed medication; the present study was lacking in detail to evaluate safety.

Another significant difference was found for physical activity. Over 90% knew that activity was beneficial and the most frequently mentioned benefit was glucose control, but 36.2% reported no exercise. Occupational activity, household work or prayer were considered exercise by some participants. While these answers should not be discounted, as all movement can be beneficial for health, the study did not capture intensity, total weekly duration, sedentary time, or if activities reported were in line with a

therapeutic plan. There may also have been some confusion between the terms "exercise" and routine movement. In Pakistan, qualitative evidence suggests that physical constraints, weather, safety, time, work, and life factors are barriers (Bukhsh et al., 2020); and in the broader South Asian context, culturally appropriate choices and effective communication are important (Sohal et al., 2015). Counselling should turn a general recommendation of "exercise" into a step-by-step, individualized exercise program, for example, safe walking, indoor exercise in extreme weather, short bouts of exercise or supervised exercise if there are complications.

The greatest measurement and behavioral discrepancy was found in foot care. Nearly all the participants reported knowing and compliance, while just 1% reported regular inspection. A specific preventive behavior that is recommended in the current diabetes and diabetic-foot guidance is daily monitoring for early skin changes, especially for individuals who are at risk of developing ulcers (American Diabetes Association Professional Practice Committee for Diabetes, 2026c; Bus et al., 2024). The difference may reflect the fact that participants may have been thinking about washing feet, wearing soft shoes or treating an existing wound, but not looking at healthy feet to avoid injury. It also illustrates the drawbacks of using general yes/no questions like "Do you follow foot-care recommendations?" Future studies and routine assessment should include specific questions regarding inspection, drying between toes, fit of footwear, walking barefoot, care of nails and calluses, identification of warning signs and timely professional review.

It is also important to note that the belief that sores could be managed at home was also taken into consideration. In cases of intact skin, home observation and basic hygiene are appropriate, but if the ulcer is treated with antiseptic alone, without further evaluation, it may delay evaluation. The study failed to describe the severity of the lesions, and it does not differentiate between a minor superficial issue and an ulcer, therefore harmful practices cannot be assumed for all the respondents. However, there should be clear red flags in the structured education that indicate that the skin has broken, it is swollen, red, has discharge, is getting warmer, is discoloured or if there is systemic illness and a fast referral pathway should be set up. Foot-care teaching is best done when combined with demonstration, return demonstration, inspection of the patient's shoes and confirmation that the patient or a family member can see the soles of the feet.

A key element to interpreting the educational profile of the sample. Functional health literacy was not directly measured and 63% had no formal education. Educational attainment should not be assumed to be a proxy for inability; there was a great deal of knowledge in a number of areas. It does, however, make communication techniques that rely on a lot of written instructions more important. Today, the focus is on culturally and socially competent and responsive DSMES that is tailored to the needs of the individual (American Diabetes Association Professional Practice Committee for Diabetes, 2026a). In this context pictorial materials, explanations in the language of preference, demonstration, teach-back, repetition over visits, simple action plans and family involvement are likely to be more useful than a one-off leaflet. Education should evaluate patient knowledge and ability, rather than just the provision of advice.

The primary source of information was doctors for diet, activity and foot care. This dependence poses an opportunity and capacity challenge. While it is important for clinicians to validate and normalize self-management and to address misconceptions, it may be insufficient to have a brief consultation focused on medication to allow for skills training, goal setting, and follow-up. These tasks can be shared across trained nurses, pharmacists, dietitians, diabetes educators and community linked workers in a team based model, without losing the medical oversight. This can be supported by the trials conducted in Pakistan. Pharmacist-led education resulted in improvements in knowledge, self-care and glycemic outcomes (Bukhsh et al., 2022), while a multicenter nurse-led patient-centered intervention led to large improvements in self-efficacy and self-care behavior and smaller, but statistically significant, HbA1c benefit (Asmat et al., 2024). These results indicate that the gaps found in Rawalpindi can be changed if the

support is structured, repeated, culturally adapted and behaviourally focused.

A clinic response could be a short-term, regular DSMES pathway that is feasible. Staff could identify issues with medication, risk of hypoglycaemia, access to monitoring, dietary issues, activity restrictions, foot risk and social support at registration or triage. The consultation could then focus on one or two behaviors, rather than providing all the advice at once, through collaborative goal setting. Practical teaching might involve using a glucose meter, an individual monitoring plan, low glucose management, portioning of common foods, a safe activity prescription and daily foot inspection. Concrete questions e.g. "On how many days did you inspect your feet?" should be used at subsequent visits to review progress, as opposed to global questions e.g. "Do you take care of your feet?". Current DSMES recommendations are that the intensity of referral should be increased if glycemic goals are not met, complications occur, treatment changes, or major life changes occur (American Diabetes Association Professional Practice Committee for Diabetes, 2026a; Powers et al., 2020).

Strengths and Limitations

There are a number of strengths to the study. It covered several domains of self-management in the same patients, systematic recruitment (as described in the protocol) and included a population with long disease duration, and interviewer administration allowed participation for patients with no formal education. The questionnaire was pilot tested and the entire questionnaire and ethical documentation is archived.

There are a number of restrictions on interpretation. The study was performed in a small sample in one urban tertiary-care clinic, which may not be generalizable to rural populations or to primary-care or private services or to individuals not receiving regular care. The description of systematic sampling was inadequate and selection procedures could not be assessed. The exclusions were wide and could have excluded those who had a disability or higher care needs. All behaviors were self-reported, primarily with invalidated questions and were subject to recall, social-desirability, and interviewer effects. There was no validated self-care scale or verified recall period, objective adherence measure, HbA1c, fasting glucose, blood pressure, body mass index, neuropathy assessment, foot-risk classification, or verified complication outcome. No sex, education, duration, income, comorbidity or access analyses were performed in the descriptive analysis. Some of the archived values were internally inconsistent and the original data set was not available for resolving the inconsistencies.

The survey should be replicated in the future at various levels of care with validated Urdu instruments, well-defined recall periods for behavior and objective clinical measures with sufficient power to analyze determinants. A mixed methods design would be especially helpful – quantitative measures would help identify the extent and distribution of gaps, and interviews with patients, family members and health providers would help to understand why behaviors are or are not feasible. Intervention studies should measure knowledge as well as HbA1c, self-efficacy, distress, hypoglycemia, foot-risk behavior, attendance, cost, and sustainability. The acceptability, reach, fidelity, and incorporation into routine workflow will be considered implementation outcomes that will help determine if effective DSMES models can be scaled within resource constrained public services.

Conclusion

The adults at a tertiary-care diabetes clinic in Rawalpindi had a good level of knowledge about diabetes self-management, although this did not always result in actual behaviour. The domain with the greatest reported adherence was medication-taking, while planned glucose monitoring, comprehensive dietary adaptation, physical activity and daily foot inspection were all areas of important gaps. The results challenge the notion of education as an end in itself that leaves the student with advice. Good clinic practice involves checking skills and behaviour, communicating in a low-literacy way, involving people from the household, setting realistic targets, and offering ongoing support by a trained multidisciplinary team.

Implications for Practice and Policy

Structured, repeated DSMES should be included as a part of routine follow-up at public-sector diabetes clinics, focusing on glucose-monitoring plans, hypoglycemia response, culturally appropriate household nutrition, individual physical activity plans, and daily foot inspection. Information should be given orally and visually, by demonstration, teach back and simple behaviour specific goals. When the patient wishes and is able to, family members should be involved, particularly if they play a role in food preparation, transportation, medication support and/or foot inspection.

A multi-disciplinary and task sharing approach is suggested. Physicians should emphasize clinical significance of self-management and skills training and follow-up should be done by trained nurses, pharmacists, dietitians or diabetes educators. Services should record the outcomes of the education provided, not just that it was provided, and should record the outcomes in relation to the behaviour. Validated instruments, HbA1c and complication data, and equity indicators (education, cost, travel burden, access to monitoring supplies) should be used in future local monitoring.

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