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Knowledge, attitude, and practice (KAP) of primary health physicians towards glucose self-monitoring in patients with type2 diabetes mellitus in Palestine

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Abstract

Background Type 2 Diabetes Mellitus (T2DM) stands as a significant global health challenge for individuals and societies. In the context of Palestine, T2DM affects about 9.2% of the Palestinian population and contributes to a relatively high complication rate. Effectivemanagement strategies including glucose self- monitoring need to be optimized to improve patient outcomes and alleviate the strain on the healthcare system. One of the physicians' roles in T2DM management is explaining and guiding patients towards the integration of glucose self-monitoring into their personal diabetes management routine.

This study investigates the knowledge, attitudes, and practices of primary health care physicians who care for (T2DM) patients in the West Bank regarding glucose self-monitoring.

Methods A cross-sectional study was conducted among physicians working in PHC centers. The study period was from January to March 2024. Data was collected through a self-administered questionnaire.

Results Five hundred ten medical doctors were surveyed and 300 of them replied, giving a response rate of 58.8%. The median age of the respondents was 35.0 [30.0, 41.0] years. Of the respondents, 180 (60.0%) were males. The median duration of practice as a doctor was 9.0 [5.0, 15.0] years. Most, 252 (84.0%), were general practitioners, 38 (12.7%) family medicine specialists, and 10 (3.3%) other specialties. Female respondents and those who saw more patients reported better knowledge ($p < 0.05$). The majority believed that glucose self-monitoring can improve patient outcomes, knew values of glucose self-monitoring that corresponded to HbA1c control and the microvascular complications of diabetes, and realized the importance of glucose self-monitoring for patients. However, 40% of them are not confident or somewhat confident about interpreting data and adjusting treatment plans.

Regarding the respondent's practices, 39.3% of the doctors stated that they would recommend glucose- self monitoring to newly diagnosed type 2 diabetes patients more than one time a day.

Conclusion There was a positive attitude toward glucose self-monitoring among the respondents in the primary healthcare clinics. Conversely, the clinicians' glucose self-monitoring practices were suboptimal. Future research should examine the knowledge, attitudes, and practices of physicians who provide patient care in the private sector.

Keywords Type 2 diabetes mellitus, Glucose monitor, Primary healthcare

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Introduction

Diabetes Mellitus Type 2 (T2DM) has a major impact on the health of individuals and societies worldwide [1]. In 2021, the global cost of diabetes was $966B/year taking into account the cost of treating conditions caused by diabetes, which ultimately led to death [2].

In Palestine, T2DM is a major public health concern affecting 9.2% of the general population [3]. In addition, T2DM complications in Palestine are relatively high, with microvascular complications affecting 38.7%, and macrovascular affecting 15.7% of diabetic patients [4]. The high rate of T2DM complications in Palestine suggests a clear deficiency in disease management in Palestine and the need for more management strategies. One of these strategies is glucose self -monitoring. [5, 6].

Glucose self-monitoring refers to the practice where individuals with diabetes measure their own blood glucose levels using a personal glucose meter [5, 7, 8]. Through the past years, and with more effort being put into managing T2DM, glucose self-monitoring became the cornerstone for diabetes self-management and has been shown to be effective in improving diabetes outcomes [5].

New research emphasizes the importance of glucose self-monitoring in T2DM management [9]. As T2DM is prevalent in Palestine, and many patients suffer from its complications [3, 4], the research team investigated a cornerstone of T2DM self-management, glucose self-monitoring. Many studies investigate patients' KAP in T2DM management. The research team wanted to examine the other aspect of any disease management, the primary healthcare physicians' approach toward incorporating it into their practices. Sufficient knowledge, appropriate attitudes, and comprehensive practice by physicians are critical to giving the patients the tools and skills to incorporate glucose self-monitoring into their self-diabetes management.

To date, little is known about the knowledge, attitude, or practice among primary health physicians in Palestine regarding the use of glucose self-monitoring for T2DM patients.

The findings of this study may help to define the key barriers and facilitators that influence the adoption of glucose self-monitoring in clinical settings among primary health physicians and to suggest actionable strategies to address the identified barriers, and promote the identified facilitators, to ensure improved adoption and implementation of glucose self-monitoring for T2DM management in Palestine.

Material and methods

Study design and settings

The study was designed as a cross-sectional survey targeting primary physicians in public primary health care centers and United Nations Relief and Works Agency for Palestine Refugees. (UNARWA) clinics in the West Bank. The study duration was January to March 2024.

Population

Primary health physicians actively practicing in the West Bank who managed or had the potential to manage patients with T2DM were potential participants. This included general practitioners (GPs), family medicine specialists, and other specialists who manage patients with T2DM. Palestine had 765 primary healthcare centers, of which 606 centers were in the West Bank [3].

Sample size and sampling technique

According to the Palestinian Ministry of Health, there are approximately 510 physicians [3, 4]. The sample size was calculated using a 95% confidence level, and a 0.05 absolute precision. Because the prevalence of the dependent variable was unknown, we assumed the effect size to be 50%, which was the maximum variability. Sample size was calculated with Raosoft software. A non-probability, convenient sampling technique was used.

Measurement tools and data collection

The questionnaire was derived from the literature, and reviewed and modified several times by the research team [2, 7]. The questionnaire was piloted with 30 primary health physicians to evaluate the tool's comprehensibility, validity, and estimated completion time. Refinements were made to the questionnaire based on the feedback. The Cronbach's Alpha was calculated at 0.79, indicating acceptable internal consistency of the questionnaire. These rigorous steps in the questionnaire's development, piloting, and refinement ensured the tool's validity. The tool's accessibility and reach were increased by using web link to an online self-reported questionnaire using "Google Forms", Facebook, WhatsApp and other social media. Through the primary care physicians operating in the diabetes clinics within the targeted facilities, we disseminated the information. The characteristics of non-respondents were not studied.

The online questionnaire was distributed to potential participants invited to participate in the study. Those who agreed to participate in the questionnaire respond accordingly.

Data analysis

Knowledge scores were calculated as percentage of correct answers. Similarly, attitude and practice scores were calculated as percentages of ideal attitude and practice, respectively. The data collected were entered into a statistical software package (Statistical Product and Service Solutions SPSS). Descriptive statistics like frequencies,

Table 1 Detailed practice and demographic variables of the respondents (*n* = *300*)

Sociodemographic and professional data	Frequency (%)
Age (years)	
< 35	139 (46.3)
≥ 35	161 (53.7)
Gender	
Male	180 (60.0)
Female	120 (40.0)
Duration of practice as a doctor (years)	
< 10	158 (52.7)
≥ 10	142 (47.3)
Specialt	
GP	252 (84.0)
Family medicine	38 (12.7)
Other	10 (3.3)
On average, how many diabetic patients do you see in your clinic each week for management and treatment of their condition?	
< 10	25 (8.3)
11–20	91 (30.3)
21–30	86 (28.7)
31–40	45 (15.0)
> 40	53 (17.7)
When was the last time you attended a diabetes education workshop after graduation?	
Never	30 (10.0)
More than 5 years	161 (53.7)
In the past 3–4 years	73 (24.3)
In the past 1–2 years	36 (12.0)

percentages, medians, and interquartile range [Q1, Q3] were calculated. Differences in the knowledge scores were tested using Mann–Whitney U test and Kruskal Wallis test. A p of < 0.05 was considered statistically significant.

Ethical consideration

The participants were informed about the purpose of the study, their rights to decline or withdraw at any point, and the confidentiality of their responses. The Institutional Review Board (IRB) at An Najah National University approved the study with ref. number: Med. Oct.2023/82.

Results

Characteristics of the participants

A total of 300 respondents participated in this study giving a response rate of 58.8%. The median age of the respondents was 35.0 [30.0, 41.0] years. Of the respondents, 180 (60.0%) were males. The median duration of practice as a respondent was 9.0 [5.0, 15.0] years. Of the respondents, 252 (84.0%) were general practitioners, 38 (12.7%) were family medicine specialists, and 10 (3.3%) were of other specialties. More than 90% of the doctors stated that they see more than 10 diabetic patients in their clinics per week for management and treatment of their condition. Of the respondents, 30 (10.0%) reported never having attended a diabetes education workshop after graduation. The characteristics of non-respondents were not studied and so we were unable to compare them with respondents.

The detailed sociodemographic and professional data of the respondents are shown in Table 1.

Sources of information used by the respondents to obtained knowledge about diabetes

Of the respondents, 227 (75.7%) stated that they used sources published by the WHO and 168 (56.0%) stated that they used UpToDate. The sources stated by the doctors are shown in Table 2.

All doctors listed 3 signs of hyperglycemia. Of the respondents, 186 (62.0%), 65 (21.7%), and 49 (16.3%) thought that false-positive hyperglycemia was caused by contaminated gluco-check slides, patient over use, and post prandial rise in blood glucose, respectively.

The respondents answered a knowledge test about the fasting blood glucose, random blood glucose, glycated hemoglobin HbA1c, and glucose self—monitoring. The

Table 2 Sources of information used by the respondents to obtain knowledge about diabetes

#	Source	Frequency (%)[a]
	Professional associations and international organizations	
1	The World health Organization (WHO)	227 (75.7)
2	American Diabetes Association	118 (39.3)
3	American Academy of Family Physicians (AAFP)	68 (22.7)
4	American College of Endocrinology	54 (18.0)
5	American Association of Physician Assistants (AAPA)	19 (6.3)
6	American Association of Clinical Endocrinologists (AACE)	11 (3.7)
7	American Association of Nurse Practitioners (AANP)	7 (2.3)
	Medical information databases	
1	UpToDate	168 (56.0)
2	DynaMed	13 (4.3)
	Continuing medical education sources	
1	Journal articles/reviews	39 (13.0)
2	Pharmaceutical industry representatives	34 (11.3)
3	Live Continuing Medical Education	15 (5.0)

[a] Doctors could provide more than one source; therefore, the percentages do not sum to 100%

answers of the doctors are shown in Table 3, the correct answers are shown in bolt type.

Attitudes of the respondents towards glucose self—monitoring

The doctors regarded glucose self—monitoring as beneficial to the quality of life of the patient. Only 8.0% of the respondents stated that they would not routinely recommend glucose self -monitoring to their patients. Similarly, the majority believed that glucose self-monitoring improved patient outcomes, believed that the values of glucose self-monitoring correspond to HbA1c control and microvascular complications of diabetes. The majority were confident in their ability to educate the patients about the use of glucose self—monitoring devices. See (Table 4).

Respondents' glucose self-monitoring practices

Regarding the respondent's practices, (39.3%) stated that they would recommend glucose self-monitoring to newly diagnosed type 2 diabetes patients more than one time a day. More than half (54.0%) of the doctors stated that they would educate and coach patients on proper glucose self- monitoring techniques during follow-up visits. More than a third, (40.0%) stated that they always give their patients glucose level goals for self-monitoring, and (25.3%) stated that they always reviewed the glucose self-monitoring data during consultations. When asked about their confidence in their ability to interpret glucose- self monitoring data and modify treatment plans accordingly, (12.3%) of the doctors stated that they were very confident. More than half (58.0%) offered training or instructional courses to their patients about glucose self-monitoring. More than half stated that (25%) of their patients returned to clinics with diabetes-related complications. Less than half reported that their patients highly or very highly adhered to the prescribed treatment plan. See (Table 5).

Association between the respondent's variables with knowledge, attitude, and practice

There were significant differences in the knowledge scores of the doctors in relation to gender, the average number of diabetic patients seen per week, and attending an education workshop after graduation. Female respondents and those that see more patients demonstrated higher knowledge. The associations are shown in (Table 6). On the other hand, attitudes were associated with gender, duration of practice, number of patients seen per week, and attending a diabetes education workshop. Moreover, practice scores were associated with gender and attending a diabetes education workshop. Association between sociodemographic data and knowledge score are shown in (Table 7).

Discussion

This study was conducted to assess the knowledge, attitudes, and practices about glucose self-monitoring of primary care physicians in the West Bank who care for T2DM patients. Our study shows that the majority agreed that self-monitoring of glucose enhances patient outcomes and that glucose monitoring levels improve HbA1c levels and reduce microvascular complications of diabetes. This aligns with a study that showed

Table 3 Answers of the knowledge test

#	Knowledge item	Frequency (%)
1	**What is the cut-off value for diabetes in "Fasting blood glucose" test (mg/dl)?**	
	< 100	3 (1.0)
	100–125	15 (5.0)
	≥ 126	**282 (94.0)**
2	**What is the cut-off value for pre-diabetes in "Fasting blood glucose" test (mg/dl)?**	
	< 100	19 (6.3)
	≥ 100	**281 (93.7)**
3	**What is the cut-off value for diabetes in "Random blood glucose" test (mg/dl)?**	
	< 140	13 (4.3)
	140–200	36 (12.0)
	≥ 200	**251 (83.7)**
4	**What is the cut-off value for pre-diabetes in "Random blood glucose" test (mg/dl)?**	
	95	2 (0.7)
	100	13 (4.3)
	126	32 (10.7)
	140	**113 (37.7)**
	146	122 (40.7)
	149	1 (0.3)
	199	5 (1.7)
	200	12 (4.0)
5	**What is the cut-off value for diabetes in "Glycated Hemoglobin HbA1c" test (%)?**	
	< 5.7	8 (2.7)
	5.7–6.4	25 (8.3)
	≥ 6.5	**267 (89.0)**
6	**What is the cut-off value for pre- diabetes in "Glycated Hemoglobin HbA1c" test (%)?**	
	< 5.7	24 (8.0)
	≥ 5.7	**276 (92.0)**
7	**Which of the following glucose monitor values is considered an emergency and necessitates immediate medical attention?**	
	130	2 (0.7)
	200	25 (8.3)
	≥ 350	**273 (91.0)**
8	**What is the definition of glucose self -monitoring?**	
	A technique for patients to monitor their own blood glucose levels at home	**232 (77.3)**
	A method of measuring blood glucose levels with a continuous monitoring device	59 (19.7)
	A laboratory test used to determine the body's insulin levels	9 (3.0)
9	**What is the difference between glucose self-monitoring and laboratory-based glucose testing?**	
	glucose self-monitoring provides immediate results, whereas laboratory testing takes longer	**253 (84.3)**
	There is no distinction between glucose self—monitoring and laboratory-based testing	13 (4.3)
	glucose self—monitoring is more precise than laboratory testing and it is not commonly used in clinical practice	34 (11.3)
10	**Which of the following is NOT a commonly used technique for glucose self -monitoring by type 2 diabetes patients?**	
	Urine glucose testing	**196 (65.3)**
	Flash Glucose Monitoring (FGM)	20 (6.7)
	Continuous Glucose Monitoring (CGM)	39 (13.0)
	Fingerstick blood glucose testing	45 (15.0)
11	**According to your knowledge, glucose self-monitoring helps in reducing the chance of which of the following complications?**	
	Incomplete/incorrect answer	**128 (42.7)**
	Cardiovascular disease, kidney failure, blindness	172 (57.3)
	Knowledge score (%), Median [Q1, Q3]	**70.0 [60.0, 80.0]**

Table 4 Doctors' attitude about glucose self -monitoring

#	Item	Frequency (%)
1	**How beneficial do you think glucose self -monitoring is for increasing patients' quality of life?**	
	Somewhat beneficial	28 (9.3)
	Beneficial	201 (67.0)
	Extremely beneficial	71 (23.7)
2	**Would you recommend glucose self -monitoring to all of your T2DM patients on a regular basis?**	
	No	24 (8.0)
	Yes, but only for certain cases	143 (47.7)
	Yes, for all	133 (44.3)
3	**I strongly believe that glucose self -monitoring improves patient outcomes in type 2 diabetes therapy by allowing for improved glycemic control and lowering the risk of complications**	
	Disagree	7 (2.3)
	Neutral	35 (11.7)
	Agree	174 (58.0)
	Strongly agree	84 (28.0)
4	**Rate your belief that your patients' glucose self -monitoring values correspond to their HbA1c control and microvascular complications of diabetes**	
	Not sure	10 (3.3)
	Poor	18 (6.0)
	Good	174 (58.0)
	Strong	98 (32.7)
5	**I am confident in my abilities to educate patients on the use of glucose self -monitoring devices**	
	Disagree	9 (3.0)
	Neutral	63 (21.0)
	Agree	144 (48.0)
	Strongly agree	84 (28.0)
6	**I realize the importance of glucose self -monitoring not only as a diagnostic and therapeutic tool, but also as an important component of patient education, assisting patients in understanding the impact of lifestyle choices on diabetes care**	
	Disagree	11 (3.7)
	Neutral	41 (13.7)
	Agree	181 (60.3)
	Strongly agree	67 (22.3)
7	**I recognize the importance of glucose self-monitoring in improving patient compliance and medication adherence, and I am committed to resolving any impediments or challenges that my patients may have in efficiently using these monitoring methods**	
	Disagree	13 (4.3)
	Neutral	43 (14.3)
	Agree	194 (64.7)
	Strongly agree	50 (16.7)
	Attitude score (%), Median [Q1, Q3]	**79.3 [72.4, 86.2]**

Self-glucose monitoring has been shown to be effective in reducing HbA1c levels and achieving glycemic control in T2DM patients who were not insulin [10]. In addition, T2DM patients who self-monitor their blood glucose levels were expected to have higher awareness of the impact of lifestyle on blood glucose levels and achieving glycemic control [11]

In the study, most respondents indicated that the publications from the WHO and UpToDate were their primary sources of information for T2DM. UpToDate is a primary clinical decision support system that delivers evidence-based information to healthcare professionals. The WHO offers healthcare professionals essential tools and publications regarding T2DM. The primary objective of these resources is to assist clinicians in the prevention, management, and treatment of T2DM. The principal publications of the WHO encompass global reports on diabetes, as well as definitions, diagnosis, and classification of diabetes and its associated consequences, among others. The use of such publication was due to availability

Table 5 Respondents answer on the practice items

#	Item	Frequency (%)
1	**How often do you recommend glucose self-monitoring to newly diagnosed type 2 diabetes patients?**	
	Never	4 (1.3)
	Only during specific circumstances (e.g., illness, medication changes)	40 (13.3)
	At every visit	27 (9.0)
	Several times a week	36 (12.0)
	Once a day	75 (25.0)
	More than one time a day	118 (39.3)
2	**How frequently do you educate and coach your patients on proper glucose self-monitoring techniques?**	
	Never	17 (5.7)
	At the time of diagnosis only	41 (13.7)
	During follow-up visits as needed	162 (54.0)
	Regularly during scheduled diabetes education sessions	41 (13.7)
	I refer patients to diabetes educators for this purpose	39 (13.0)
3	**Do you give your patients particular goal glucose levels for self-monitoring (e.g., fasting, pre-meal, post-meal) to help their monitoring effort?**	
	No, never	7 (2.3)
	No, not usually	44 (14.7)
	Yes, in specific cases	129 (43.0)
	Yes, always	120 (40.0)
4	**During consultations, how frequently do you review your patients' glucose self-monitoring data?**	
	Never	4 (1.3)
	Rarely	26 (8.7)
	Sometimes	64 (21.3)
	Often	130 (43.3)
	Always	76 (25.3)
5	**How confident are you in interpreting glucose self-monitoring data and modifying treatment plans accordingly?**	
	Not confident	30 (10.0)
	Somewhat confident	88 (29.3)
	Confident	145 (48.3)
	Very confident	37 (12.3)
6	**Do you offer glucose- self monitoring training or instructional courses to your T2DM patients?**	
	No	126 (42.0)
	Yes	174 (58.0)
7	**How many of the patients diagnosed with diabetes at your facility have returned with diabetes-related complications?**	
	I'm not sure/not appropriate	36 (12.0)
	No diabetic patients have returned with complications	9 (3.0)
	Less than 25% of diabetic individuals have returned with difficulties	98 (32.7)
	Between 25 and 50% of diabetic patients have returned with problems	129 (43.0)
	More than half of the diabetic individuals returned with difficulties	28 (9.3)
8	**How would you assess the adherence of your diabetic patients to their prescribed treatment plans on average?**	
	None of the patients adhere	7 (2.3)
	Low: Only a few patients continuously adhere to their treatment plans	43 (14.3)
	Moderate: Approximately half of the patients stick to their treatment plans	131 (43.7)
	High: The vast majority of patients follow their treatment plans	105 (35.0)
	Very high: Most patients adhere to their treatment plans religiously	14 (4.7)
	Practice score (%), Median [Q1, Q3]	**74.3 [62.9, 80.0]**

Table 6 Association between the variables of the respondents with knowledge, attitude, and practice

	Knowledge score (%)		Attitude score (%)		Practice score (%)	
Variable	**Median [Q1, Q3]**	***p*-value**	**Median [Q1, Q3]**	***p*-value**	**Median [Q1, Q3]**	***p*-value**
Age (years)						
< 35	70.0 [50.0, 80.0]	0.146	79.3 [72.4, 86.2]	0.079	71.4 [64.3, 77.1]	0.633
≥ 35	80.0 [60.0, 80.0]		79.3 [72.4, 86.2]		74.3 [62.9, 80.0]	
Gender						
Male	70.0 [50.0, 80.0]	**< 0.001**	75.9 [72.4, 86.2]	**0.011**	71.4 [62.9, 77.1]	**0.003**
Female	80.0 [60.0, 80.0]		82.8 [72.4, 86.2]		77.1 [64.3, 80.0]	
Duration of practice as a doctor (years)						
< 10	70.0 [50.0, 80.0]	0.973	79.3 [72.4, 86.2]	**0.001**	74.3 [65.7, 80.0]	0.221
≥ 10	70.0 [60.0, 80.0]		75.9 [69.0, 86.2]		72.9 [60.0, 80.0]	
Specialty			0.0 [0.0, 0.0]		0.0 [0.0, 0.0]	
GP	80.0 [60.0, 80.0]	0.374	79.3 [72.4, 86.2]	0.207	74.3 [62.9, 80.0]	0.324
Family medicine	70.0 [60.0, 80.0]		79.3 [75.9, 86.2]		77.1 [68.6, 80.0]	
Other	70.0 [50.0, 80.0]		81.0 [75.9, 86.2]		74.3 [65.7, 77.1]	
On average, how many diabetic patients do you see in your clinic each week for management and treatment of their condition?						
< 10	80.0 [60.0, 80.0]	**0.018**	79.3 [75.9, 86.2]	**0.002**	65.7 [60.0, 74.3]	0.070
11–20	70.0 [50.0, 80.0]		72.4 [69.0, 82.8]		74.3 [65.7, 77.1]	
21–30	80.0 [60.0, 80.0]		81.0 [69.0, 86.2]		74.3 [62.9, 80.0]	
31–40	80.0 [50.0, 80.0]		79.3 [72.4, 86.2]		68.6 [57.1, 80.0]	
> 40	70.0 [60.0, 80.0]		82.8 [75.9, 89.7]		74.3 [65.7, 80.0]	
When was the last time you attended a diabetes education workshop after graduation?						
Never	80.0 [80.0, 80.0]	**0.001**	77.6 [72.4, 86.2]	**< 0.001**	65.7 [54.3, 77.1]	**0.001**
More than 5 years	80.0 [80.0, 80.0]		79.3 [72.4, 86.2]		74.3 [68.6, 80.0]	
In the past 3–4 years	80.0 [80.0, 80.0]		79.3 [69.0, 86.2]		74.3 [62.9, 80.0]	
In the past 1–2 years	80.0 [70.0, 80.0]		72.4 [62.1, 79.3]		61.4 [57.1, 75.7]	

of the access in the Palestinian context. The respondents in this trial were cognizant of the indicators of hypoglycemia. Identifying the indicators of hyperglycemia can enable prompt intervention and the commencement of treatment or management.

In addition, recognition of signs of hyperglycemia can also help prevent severe hyperglycemia, diabetic ketoacidosis, which is a medical emergency [12, 13], Moreover, recognition of signs of hyperglycemia can help physicians individualize the treatment for each patient case that ensures preventing the long-term T2DM-related complications [13].

The majority of the respondents who were surveyed in this study were aware of the cut-off values for T2DM in fasting blood glucose, random blood, and HbA1c tests. Recognizing these cut-off values can help physicians effectively and timely diagnose patients with T2DM and those at risk for developing T2DM [14]. It is important to mention that failure to diagnose T2DM can delay initiating treatment and can increase the likelihood of developing T2DM-related complications.

The majority of the respondents in this study were also aware of glucose self-monitoring, the difference between glucose self-monitoring and laboratory-based glucose testing, the types of glucose self-monitoring techniques, and the benefits of glucose self-monitoring. The findings reported in this study were not surprising as the respondents included were those who provided care for T2DM patients [14, 15]. Female respondents performed better than reported compared to male respondents in this study. A previous study failed to detect a difference in the quality of care received by T2DM patients who were treated by female or male physicians [16]. Moreover, knowledge was also affected by the number of patients with T2DM cared for. These findings were not surprising as knowledge is expected to increase with the increasing interactions with patients with T2DM.

The respondents demonstrated positive attitudes regarding glucose self-monitoring in this study. The respondents endorsed the advantages of glucose self-monitoring to improve patient quality of life and outcomes. The respondents demonstrated a positive attitude towards endorsing glucose self-monitoring for their patients and instructing them on its use. These positive attitudes could be leveraged to enhance and advance glucose self-monitoring among patients. Upon inquiry regarding their practices, the surveyed physicians

Table 7 Association between sociodemographic data and knowledge score

Variables	Knowledge score	
	Median [Q1-Q3]	*p*-value[a]
Age (years)		
< 35	70 [50–80]	0.146[b]
≥ 35	80 [60–80]	
Gender		
Male	70 [50–80]	**< 0.001[b]**
Female	80 [60–80]	
Duration of practice as a doctor (years)		
< 10	70 [50–80]	0.973[b]
≥ 10	70 [60–80]	
Specialty		
GP	80 [60–80]	0.374[c]
Family medicine	70 [60–80]	
Other	70 [50–80]	
On average, how many diabetic patients do you see in your clinic each week for management and treatment of their condition?		
< 10	80 [60–80]	**0.018[c]**
11–20	70 [50–80]	
21–30	80 [60–80]	
31–40	80 [50–80]	
> 40	70 [60–80]	
When was the last time you attended a diabetes education workshop after graduation?		
Never	80 [80–80]	**0.001[c]**
More than 5 years	80 [80–80]	
In the past 3–4 years	80 [80–80]	
In the past 1–2 years	80 [70–80]	

[a] the bold values indicate $p < 0.05$

[b] Statistically significant values were calculated using the Mann–Whitney U test

[c] Statistically significant values were calculated using the Kruskal–Wallis test

reported inadequate recommendations for frequent glucose self-monitoring for newly diagnosed patients, regular training sessions on glucose self-monitoring, consistent establishment of target glucose levels, routine review of monitored glucose levels, confidence in adjusting treatment plans based on monitored glucose levels, and provision of monitoring training. These data suggest that enhancements are necessary in the practices of physicians managing T2DM patients in Palestine concerning glucose self-monitoring [16, 17].

Limitations

This study was conducted as a cross-sectional survey. Cross-sectional studies are merely observational and compared to interventional studies, the conclusions drawn from observational studies are less rigorous, but it can provide us with significant snapshot information about current practice. The respondents who care for patients with T2DM in primary healthcare clinics were included in this study. The characteristics of non-respondents were not studied and so we were unable to compare them with respondents. The study does not examine patient outcomes related to effective management of diabetes. Future studies should include physicians in private clinics as a considerable percentage of the patients with T2DM in Palestine could be care for by physicians in the private sector. Moreover, the data collected in this study were self-reported. These data could be affected by recall bias and desirability bias.

Conclusion

The respondents in the primary healthcare clinics had adequate knowledge and positive attitudes towards glucose self-monitoring. On the other hand, the practices of the respondents with regard to glucose self-monitoring was less than optimal. The response rate was 58.8%. Characteristics of non-respondents were not studied so the responses here may not be typical of all practicing doctors in Palestine. Future studies should investigate knowledge, attitudes, and practices of physicians who care for the patients in the private sector.

Authors' contributions
All authors are contributes same to the research work.

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Data availability
The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
An-Najah National University institutional review board approved the study with ref. number: Med. Oct.2023/82. All subjects involved in the study were invited to participate on a voluntary basis after the study purpose, risk, and advantage of participation were clarified. Informed consent was obtained from all participants. Interviews were carried out in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Competing interests
The authors declare no competing interests.

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