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Adherence to ADA Clinical Guidelines in Type 2 Diabetes Management in Public Health Clinics in Palestine

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Background: The prevalence of type 2 diabetes is a significant global public health concern. Adherence to established guidelines is essential for effective management of this metabolic disease.

Objective: This study aimed to evaluate the current practices of physicians in Palestine regarding their adherence to ADA guidelines for type 2 diabetes management.

Methods: A retrospective, cross-sectional, multicenter study was conducted by reviewing patients' medical records. This study included 362 patients aged ≥ 18 years diagnosed with type 2 diabetes for at least one year and receiving treatment at multiple outpatient clinics in Palestine. Adherence to ADA guidelines was assessed by selecting an appropriate antidiabetic agent based on patient confounding factors and comorbidities, frequency of diabetes monitoring, screening, glycemic control, and optimization of hypertension and dyslipidemia medication.

Results: Half of the participants were female. 53% of the participants did not achieve their A1c target goal. Adherence to ADA guidelines for selecting the preferred antidiabetic medication was only 32.22%. Very low adherence to prescribing GLP1 agonists (0.5%) and SGLT2 inhibitors (7%) when indicated. Biguanides were the most prescribed medications (83.1%), followed by sulfonylurea (35.1%), and insulin (28.2%). Only 43% and 66% of the patients were on appropriate lipid and hypertension medications, respectively, as recommended by ADA guidelines. Foot assessment and eye examinations were performed in only 27% and 55% of the patients, respectively. Age, atherosclerotic cardiovascular disease, and sulfonylurea use were significantly associated with lower glycemic control.

Conclusion: This study demonstrated that Adherence to ADA guidelines for diabetes management is suboptimal in selecting appropriate antidiabetic medication based on patient confounding factors, potentially contributing to the high prevalence of complications and comorbidities observed in patients with diabetes in Palestine. Medical associations and health institutions must adopt programs to increase professional education and awareness of the current guidelines to improve outcomes.

Keywords: diabetes, diabetes adherence, diabetes management, diabetic medications, diabetes clinical guidelines

Introduction

Diabetes mellitus is a group of chronic metabolic disorders characterized by tissue resistance to insulin combined with a relative deficiency in insulin secretion.[1] Uncontrolled diabetes is associated with multiple microvascular and macrovascular complications that can lead to significant mortality and morbidity; approximately 6.5 million people die between the ages of 20 and 79 years from diabetes and its complications.[1,2] These complications include neuropathy, nephropathy, retinopathy, end-stage renal disease, and non-traumatic lower-limb amputation.[3] Studies have estimated that

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approximately 25% of patients newly diagnosed with type 2 diabetes mellitus have microvascular complications at the time of diagnosis, demonstrating that the initial diagnosis of diabetes is delayed by six–seven years.[4]

According to the World Health Organization (WHO), nearly 422 million people worldwide are living with diabetes.[5] According to the International Diabetes Federation, 537 million adults currently live with diabetes worldwide. Globally, the prevalence of diabetes is projected to increase to 643 million by 2030 and 783 million by 2045.[6]

This global trend is particularly alarming in Arabic countries, and a high prevalence of type 2 diabetes has been reported in several Arab countries, which has dramatically increased over the past two decades.[6,7] The Middle Eastern and North African regions have the highest rate of increase in diabetes worldwide, and the number of individuals with diabetes is anticipated to increase by 96.2% by 2035.[7] Egypt ranks among the top ten countries in the world with a high prevalence of diabetes.[6] Additionally, epidemiological studies have reported that the populations of Qatar, UAE, and Saudi Arabia have early onset T2DM.[8]

Similar to many low-and middle-income countries, Palestine faces the significant burden of diabetes.[9] In Palestine, the prevalence is projected to increase from 18.4% in 2015 to 21.5% by 2030.[10] The percentage of people aged 40–69 years with diabetes is approximately 20.8% of the total Palestinian population by 2022.[11] Studies have shown that DM is one of the leading causes of morbidity and mortality in occupied Palestine and is a significant health problem affecting the country.[12] Glycemic control in patients with diabetes is very poor in Palestine, with one in five patients achieving their HbA1c goal.[13] Mortality directly attributable to diabetes mellitus is difficult to define and ascertain, and according to the last annual report of the Ministry of Health (MoH), the total number of reported deaths due to diabetes complications was 1231 cases in Palestine in 2021.[14]

The treatment goals in the management of diabetes are to optimize medication therapy to control blood glucose levels, prevent complications, improve patients' overall quality of life, and decrease healthcare costs.[15,16] Many clinical practice guidelines have been published to achieve target glycemic levels and prevent and control long-term microvascular, macrovascular, and neuropathic complications associated with diabetes, providing high-quality, evidence-based recommendations to ensure optimal patient care.[16,17]

ADA provides a practical approach to diabetes management and screening. According to the ADA, the A1c target is <7% in most patients and a less stringent goal of <8% in patients with limited life expectancy and who are at risk of hypoglycemia. Furthermore, the ADA recommends selecting an antidiabetic agent based on patient characteristics, comorbidities, weight, A1C goals, and cost.[18] Metformin is recommended in patients without renal impairment, and combination therapy is recommended if A1c is ≥1.5% above goal, which is usually a combination of metformin and another agent. In patients with cardiovascular disease, congestive heart failure, or renal disease, agents with renal and cardiovascular benefits, such as sodium-glucose cotransporter 2 (SGLT2) inhibitors in patients with heart failure or kidney disease, and glucagon-like peptide 1 (GLP-1), liraglutide, and semaglutide in patients with cardiovascular disease. Furthermore, The ADA recommends starting a moderate-intensity statin for diabetics 40–70 years old, and a high-intensity statin in patients with additional cardiovascular risk factors with an LDL goal of <70 mg/dL.[18]

However, adherence to these guidelines can vary and potentially affect patient outcomes. A recent study conducted in Pakistan showed that only 41.6% of prescriptions followed the recommendations of the American Diabetes Association (ADA).[19] Another study conducted in the United States demonstrated very low adherence to ADA guidelines for antidiabetic treatment modification among adult patients with type 2 diabetes; only 39% had their antidiabetic treatment modified according to ADA guidelines.[20]

The healthcare system in Palestine faces many challenges that preclude it from optimizing health outcomes and adapting clinical guidelines in medical practice because of the ongoing armed conflict affecting health resources, access to healthcare, socioeconomic status, and quality of life.[21] There is also a lack of skilled healthcare providers and newer, more effective medications.[22,23]

While many studies have examined adherence to clinical practice guidelines in various healthcare settings globally, to the best of our knowledge, published studies on diabetes management and control in Palestine are lacking despite its high prevalence and suboptimal services. Therefore, this study aimed to identify gaps in clinical practice in managing type 2 diabetes according to ADA clinical guidelines in outpatient clinics in Palestine. Adherence to ADA guidelines was

assessed by selecting an appropriate antidiabetic agent based on patient confounding factors and comorbidities, frequency of diabetes monitoring, screening, glycemic control, and optimization of hypertension and dyslipidemia medication.

Method

This retrospective cross-sectional study was conducted in the West Bank of multiple public clinics in Palestine by retrieving patients' medical records. The study included all patients older than 18 years who had been diagnosed with T2DM for at least one year. Patients with incomplete documentation, missing laboratory test results, or who had been diagnosed with diabetes for less than one year were excluded from the study.

A data collection form was developed based on a thorough review of ADA guidelines-2024. The data collection form included four sections. The first section included patient demographics, including age, sex, weight, smoking status, and date of diagnosis. The second section documented comorbidities and medical/clinical history, which encompassed common diseases such as hypertension, dyslipidemia, Clinical ACVD diseases, documented high ACVD risk, heart failure, osteoporosis, chronic kidney disease, and other factors that should be considered while being treated with diabetes medications such as UTI, allergies, history of falls, personal or family history of medullary thyroid carcinoma and pancreatitis, and microvascular complications with documented dates. The third section included labs and vital signs, including HbA1c levels in the last two visits, blood pressure, serum creatinine, lipid profile (total cholesterol, LDL, HDL, TG), urine analysis, and frequency of testing for each test. The last section featured patients' medications, including oral and injectable antidiabetic medications and other documented medications.

The medical records of the three main public clinics in Ramallah were reviewed and all files that met the inclusion criteria were selected. Data were collected between May 14 and May 30, 2024. Depending on the registered number of patients among public clinics and the prevalence of diabetes mellitus among the population, the sample size was calculated using the Raosoft calculator 2024, and the minimum sample size was 272 patients with 90% confidence level and 5% error margin.[23] The final sample comprised of 362 patients. The collected data were then entered into a Microsoft Excel 365 spreadsheet, where they were organized, cleaned, and subsequently imported into the Statistical Package for Social Science (SPSS) version 29. Data recoding was performed to appropriately categorize variables as necessary. Descriptive statistics were used for the data analysis. The mean and standard deviation (SD) were calculated for normally distributed data, whereas the median and interquartile range (IQR) were used for data that did not follow a normal distribution. Categorical data are reported as frequencies and percentages.

Depending on the data type, Pearson's chi-square test and univariate logistic regression were performed to identify patients with a higher risk of uncontrolled glycemia. Statistical analysis was performed using 95% confidence intervals (CIs), and the level of significance was defined as $P < 0.05$.

Ethical Considerations

This study was approved by the Ethical Committee of Birzeit University (Reference # BZUPNH2333). Moreover, obtaining written patient consent was waived because this was a retrospective study and patient information was anonymized. All collected information was confidential and protected from unauthorized access, use, alteration, theft, or loss. The study complied with the ethical guidelines of the Declaration of Helsinki and patient data.

Results

Demographics and Characteristics

As shown in Table 1, 362 DM2 patients, with equal numbers of males and females, were included in the study. The mean age of the patients was 63.76 years with an STD of ±10.205, and 72% had normal body weight. 82% had diabetes for more than five years, and 33% had more than two comorbidities. Peripheral neuropathy (9.9%) and retinopathy (9.4%) were the most common diabetic complications, and more than half of the patients (56.6%) were at a high risk for arteriosclerotic cardiovascular disease (ACVD).

Table 1 Sociodemographic and Clinical Characteristics of Patients (N = 362)

Variable	Category	Frequency	Percentages
Age (mean ± STD)		63.76 ± 10.205	
Gender	Female	181	50
	Male	181	50
Weight (n = 353)	Normal	257	72.8
	Overweight*	96	27.2
Counseling for Diet and exercise (n = 353)		222	62.9
Smoking History Reported (n=344)	Current Smokers	61	17.7
	Offered Smoke Cessation Counseling	43	86
Duration of diabetes	1 year	9	2.5
	1–5 years	56	15.5
	> 5 years	297	82.0
High risk of ASCVD		205	56.6
Comorbidities	None	22	6.1
	1–2	219	60.5
	> 2	121	33.4
Complications	Retinopathy	34	9.4
	Nephropathy	12	3.3
	Peripheral Neuropathy	36	9.9
	Other complications (hypoglycemia/amputation/gastroparesis)	10	2.8

Notes: * Females > 90 kg and males > 95 kg. ASCVD: atherosclerotic cardiovascular disease.

As shown in Figure 1, hypertension was the most prevalent disorder, affecting 72.9% of the participants, followed by dyslipidemia (47.8%), and chronic kidney disease (CKD) (22.1%). A detailed breakdown of the CKD stages revealed that 11.6% were stage 3a, 6.4% were stage 3b, 3.6% were stage 4, and 0.6% were stage 5. Clinical ASCVD was observed in 21.5% of the cases.

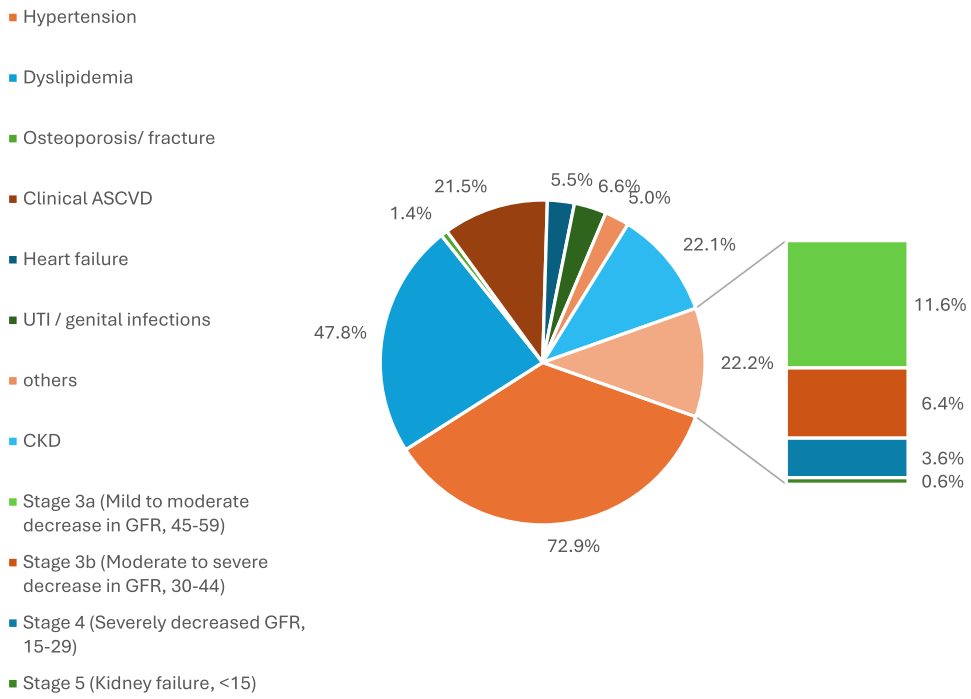

Figure 1 Comorbidities distribution.

Clinical Labs Values and Monitoring Adherence

More than half of the participants had uncontrolled diabetes mellitus. The HbA1c median level was 7.6%, with an interquartile range of 6.6–8.9%, based on the definition used in the current study. LDL cholesterol levels, with a median of 99.8 mg/dL, were within the 80–129 mg/dL range. A total of 357 (98.6%) and 351 (97%) patients were negative for urine ketone and glucose levels, respectively. Adherence to routine screening was low, with only 11.6% of patients receiving foot screenings and 54.7% receiving eye examinations. (Table 2).

Treatment Modalities and Prescribed Antidiabetics

Figure 2 shows the distribution of treatment modalities among the patients. Most participants (71.5%) primarily received non-insulin therapy, including injectable GLP-1 receptor agonists (GLP-1 RAs). Only a small number (8.0%) of

Table 2 Lab Values and Adherence to Patient Monitoring and Follow-Up (N=362)

Variable	Category	Frequency	Percentages
HbA1c (median (IQR))		7.6 (6.6–8.9)	
LDL (median (IQR))		99.8 (80–129)	
TG (median (IQR))		141 (101–182)	
HDL (median (IQR))		38 (32–45.9)	
Total cholesterol (median (IQR))		173 (143–207)	
Ketonuria	Present	5	1.4
	No	357	98.6
Glucose in urine	Present	11	3.0
	No	351	97.0
Albuminuria	Present	12	3.3
	No	350	96.7
Screening and Monitoring			
HbA1c	Controlled*	170	47
	Not Controlled**	192	53
Screenings	Foot screening	131	36.2
	Eye exam	86	23.8
Adherence to ADA Guidelines			
HbA1c testing frequency adherence		101	27.9
Adherence to ADA guidelines for screening: foot	Adherent	42	11.6
	Nonadherent	320	88.4
Adherence to ADA guidelines for screening: eye exam	Adherent	198	54.7
	Nonadherent	164	45.3
Albuminuria testing frequency adherence	Adherent	279	77.1
	Nonadherent	83	22.9

Notes: * HbA1c < 7 (for patients with DM) or < 8 (for those at risk for severe hypoglycemia, with limited life expectancy, or with advanced vascular complications). ** HbA1c ≥ 7 (for DM patients) or ≥ 8 (for those at risk for severe hypoglycemia, with limited life expectancy, or with advanced vascular complications).

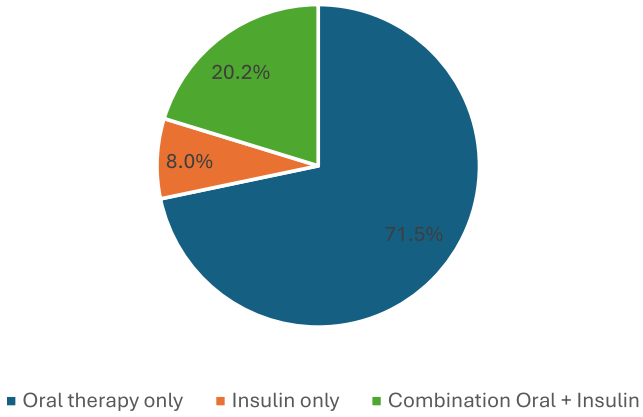

Figure 2 Treatment Modalities.

participants received insulin monotherapy. 20.2% of patients were on combination treatment with insulin and other oral/injectable antidiabetic medications.

Biguanides were the most prescribed medications for type 2 diabetes in this study (83.1%), followed by sulfonylurea (35.1%), and insulin (28.2%). GLP1 receptor agonists and TZD were prescribed to only one patient (0.3%). Figure 3

Diabetes Management: Prescribing Adherence and Glycemic Control

Table 3 illustrates prescribing adherence to diabetic medication. In the insulin group, 19.6% required dosage adjustment, whereas insulin was indicated in 7.2% of participants and was not prescribed. Only 32.2% of non-insulin treatment patients received the preferred agent, as recommended by the ADA guidelines. Furthermore, 45.9% of the patients who were not on a preferred agent had suboptimal control. Ten (2.8%) patients were prescribed the preferred agent but required a higher dose, and 43 (11.9%) patients were on the maximum dosage of the preferred agent and required additional agents to achieve glycemic control.

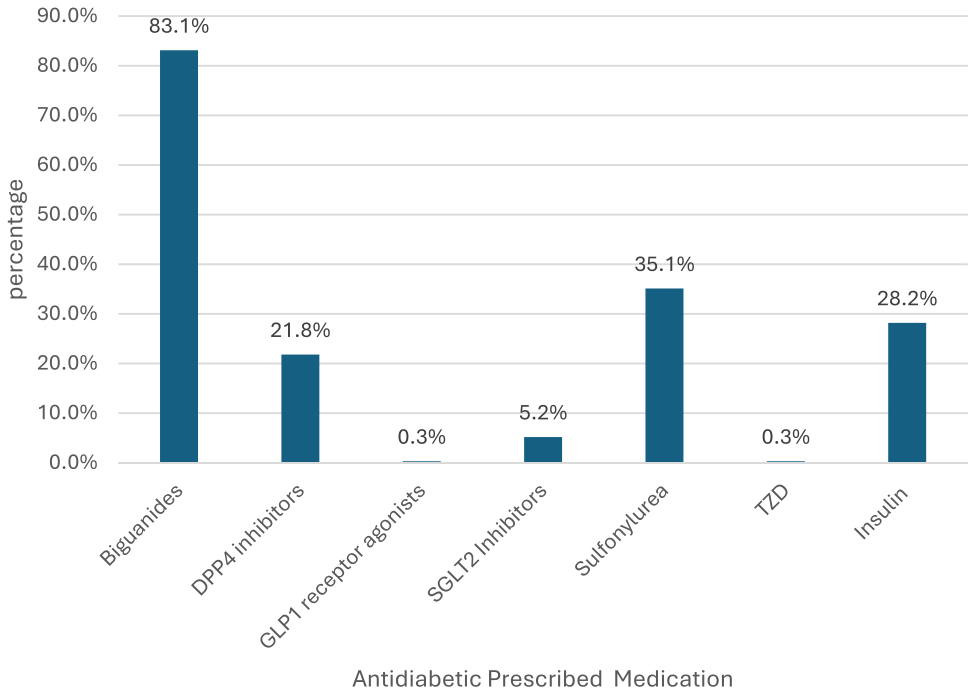

Figure 3 Frequency of each prescribed antidiabetic.

Table 3 Prescribing Adherence and Glycemic Control

Variable	Adherence/Glycemic control status	Frequency n/N	Percentages
Insulin Treatments			
Patient Insulin status	Controlled on Insulin	31/362	8.6
	Not controlled on insulin	71/362	19.6
	Insulin is indicated and not prescribed	26/362	7.2
Oral/ GLP-1 RA diabetic drugs			
Prescribing adherence to oral/ GLP-1 RA diabetic drugs (n=332)			
On preferred agent	Controlled	54/332	16.3
	Not controlled (Requires Additional Therapy)	43/332	13
	Not Controlled (Needs Dosage Increase)	10/332	3
Not on Preferred Agent	Not Controlled	119/220	54.1
	Controlled	101/220	45.9
Takes Contraindicated agents		5/332	1.4
Patients with complications and not controlled		34/68	50
Potentially Inappropriate Prescribing			
Potential Inappropriate Prescribing (PIMs)	Metformin with eGFR < 30	5/301	1.7
	Metformin and b12 deficiency	7/301	9.1
	Aged > 65 on Sulfonylurea	60/127	47.2
	Combination of insulin and sulfonylurea	16/102	15.7
	Diabetics on high-intensity statin and should be Moderate	92/362	25.4
	On Moderate intensity statin should be high	2/362	0.6
Potential Prescribing Omissions (PPOs)	Diabetic: Not on statins GFR < 60 and not on SGLT2	110/362 77/80	30.4 96.3
	CHF and not on SGLT2	17/20	85
	Clinical ACVD and not on SGLT2	73/78	93.6
	High risk ASCVD and not on SGLT2	191/205	93.2
	Clinical ASCVD and not on GLP-1 RA	78/78	100
	High risk ASCVD and not on GLP-1 RA	204/205	99.5
Adherence to Other Medications			
Prescribing Adherence to lipid medication (n = 362)	Good adherence	158	43.6
	Not on statins	110	30.4
	Moderate should be high	2	0.6
	High should be moderate	92	25.4

(*Continued*)

Table 3 (Continued).

Variable	Adherence/Glycemic control status	Frequency n/N	Percentages
Prescribing Adherence to HTN medication (n = 260)			
Adhered	Controlled	55	21.2
	Not controlled	118	45.4
Not adhered	Controlled	22	8.2
	Not controlled	65	25

Abbreviations: GLP-1 RA, GLP-1 receptor agonist; eGFR, estimated glomerular filtration rate; CHF, congestive heart failure; ACVD, atherosclerotic cardiovascular disease; SGLT2 inhibitors, sodium-glucose cotransporter-2 inhibitors; HTN, hypertension.

Potential inappropriate prescribing was also identified; 60 (47.2%) of elderly patients aged over 65 years were on sulfonylurea, and (1.7%) of patients were taking metformin with an eGFR of less than 30 mL/min/1.73m². Additionally, (85%) of patients with CHF and (93.3%) of patients with high ASCVD risk were not prescribed SGLT2 inhibitors, and most patients were not on GLP1 agonists.

A total of 158 patients (43.6%) were prescribed statins of the correct intensity. However, 110 patients (30.4%) did not receive statins, as recommended by ADA. For hypertension management, 118 patients (45.4%) were prescribed appropriate antihypertensive medications, but their blood pressure remained uncontrolled.

Variables Associated with Glycemic Control

As shown in Table 4, males had a glycemic control rate of 48.1%, which was slightly higher than that of females (45.9%), with no significant statistical difference (OR, 0.915; 95% CI: 0.606–1.383, P = 0.674). As age increased, the

Table 4 Glycemic Control Analysis Results (N=170)

Factor	Status	Controlled n (%)	Unadjusted OR (95% CI)	P value
Sex	Male	87 (48.1%)	0.915 (0.606–1.383)	0.674
	Female	83 (45.9%)		
Age			1.036 (1.012–1.061)	**0.002**
Comorbidities				
Hypertension	No	39 (39.8%)	1.490 (0.930–2.386)	0.097
	Yes	131 (49.6%)		
Hyperlipidemia	No	84 (44.4%)	1.236 (0.817–1.869)	0.316
	Yes	86 (49.7%)		
Heart Failure	No	162 (47.4)	0.900 (0.295–2.755)	0.855
	Yes	8 (40.0%)		
Clinical ASCVD	No	124 (43.7%)	1.855 (1.116–3.084)	**0.017**
	Yes	46 (59.0%)		
CKD (eGFR Less Than 60)	No	130 (46.1%)	1.169(0.711–1.922)	0.537
	Yes	40 (50.0%)		
Osteoporosis/Fracture	No	167 (46.8%)	1.707 (0.282–10.337)	0.561
	Yes	3 (60.0%)		

(*Continued*)

Table 4 (Continued).

Factor	Status	Controlled n (%)	Unadjusted OR (95% CI)	P value
UTI/Genital Infections	No	157 (46.4%)	1.362 (0.594–3.127)	0.466
	Yes	13 (54.2%)		
Other Diseases	No	162 (47.1%)	0.899 (0.346–2.332)	0.826
	Yes	8 (44.4%)		
Complications				
Retinopathy	No	154 (46.95%)	1.004 (0.495–2.038)	0.99
	Yes	16 (47.06%)		
Nephropathy	No	164 (46.86%)	1.134 (0.359–3.585)	0.83
	Yes	6 (50.00%)		
Neuropathy	No	152 (46.63%)	1.145 (0.575–2.279)	0.7
	Yes	18 (50.00%)		
Hypo/Amputation/GI	No	165 (46.88%)	1.133 (0.322–3.984)	0.845
	Yes	5 (50.00%)		
Medications				
Biguanides	No	23 (37.7%)	1.577 (0.896–2.775)	0.114
	Yes	147 (48.8%)		
DPP4 Inhibitor	No	141 (50.2%)	0.545 (0.325–0.914)	**0.021**
	Yes	28 (35.4%)		
SGLT2 Inhibitor	No	161 (46.9%)	1.017 (0.403–2.566)	0.971
	Yes	9 (47.4%)		
Sulfonylurea	No	125 (53.2%)	0.483 (0.310–0.753)	**0.001**
	Yes	45 (35.4%)		

Note: bold type=values that are significant at p<0.05.
Abbreviations: ASCVD, atherosclerotic cardiovascular disease; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; UTI, urinary tract infection; GI, gastrointestinal; DPP4 inhibitors, dipeptidyl peptidase-4 inhibitors; SGLT2 inhibitors, sodium-glucose cotransporter-2 inhibitors.

likelihood of disease control increased by 3.6% (OR: 1.036, 95% CI: 1.012–1.061, P = 0.002). Patients with clinical atherosclerotic cardiovascular disease had nearly twice the chance of their diabetes being controlled effectively compared to those without ASCVD (OR: 1.855, 95% CI: 1.116–3.084, P = 0.017).

Patients not using DPP4 inhibitors had a significantly higher glycemic control rate (50.2%) than those using them (35.4%) (OR, 0.545; 95% CI: 0.325–0.914, P = 0.021). Patients who did not use sulfonylurea had a higher control rate (53.2%) than those who did (35.4%) (OR, 0.483; 95% CI: 0.310–0.753, P = 0.001). (Table 4).

Discussion

Many clinical practice guidelines have been published for the management of diabetes to achieve target glycemic levels and prevent and control long-term complications associated with uncontrolled diabetes to provide evidence-based medical practice recommendations to ensure optimal patient care.[16,17] Physician adherence to clinical guidelines and

optimized diabetes treatment are essential for controlling the disease state and improving patient outcomes; however, in this study, there was a gap in diabetes management compared with the ADA guidelines.

In this study, only one-third of the prescribed antidiabetic medications followed the ADA guideline recommendations. This adherence is much lower than that in a recent study conducted in Pakistan, which showed that only 41.6% of prescriptions followed the recommendations of the American Diabetes Association (ADA).[19] Another study conducted in the United States demonstrated low adherence to ADA guidelines for antidiabetic treatment modification among adult patients with type 2 diabetes; only 39% had their antidiabetic treatment modified according to ADA guidelines.[20] In contrast, a comparatively greater proportion (54.2%) of patients with diabetes received guideline-compliant prescriptions in Turkey.[24]

This low adherence may be due to several factors including deficiencies in the healthcare system and limited medication formularies, which can hinder guideline adherence. For example, some newer classes of medications recommended by the ADA, such as GLP-1 receptor agonists (eg, liraglutide), and SGLT2 inhibitors (eg, dapagliflozin), are currently not included in the Palestinian Ministry of Health (MOH) list of registered medications and the list used in public clinics.[25] This limited availability restricts physicians' ability to implement recommendations fully. Furthermore, the structure of the healthcare system in Palestine further complicates adherence to clinical guidelines, especially in chronic disease management, where it relies on donations from international organizations and humanitarian aid for health resources and medications that are focused on acute illness and emergency situations instead of chronic disease state management such as diabetes.[26] Lack of awareness and familiarity can affect physicians' knowledge of the guidelines.[27] Additionally, physicians' attitudes can be barriers, such as lack of agreement, self-efficacy, outcome expectancy, and inertia regarding previous practices.[28]

Furthermore, the underutilization of clinical pharmacists may be another contributing factor. Since 2003, the ADA has included pharmacists in an ideal diabetes care team.[29] Their expertise in medication management and patient education can significantly improve adherence to these guidelines. However, based on our observations in public clinics, clinical pharmacist (PharmD) degrees are not commonly employed. The majority of pharmacy staff appeared to be pharmacy assistants.

ADA guidelines recommend metformin as the first-line therapy for type 2 diabetes in patients with no contra-indications. Metformin is a common medication that is considered safe, effective and has a very attractive cost; however, it is contraindicated in patients with estimated glomerular filtration rates (eGFR) less than 30 mL/min/1.73 m ^{1}. The high percentage of metformin prescriptions in our study is consistent with these recommendations. Of concern, 1.7% of the patients were prescribed metformin despite having an eGFR below 30 mL/min/1.73 m². This potentially inappropriate medication (PIM) may cause lactic acidosis, which is a rare but potentially fatal side effect.[2] During data collection, we noticed that eGFR was often not documented or readily available in patients' files, necessitating calculation. This lack of documentation could potentially lead physicians to overlook the eGFR when making treatment decisions.

According to ADA guidelines, sulfonylureas are considered a third-line agent due to their lack of cardiovascular benefit, weight gain, and high risk of hypoglycemia, especially in elderly patients as recommended by Beers Criteria.[30] In this study, glimepiride was among the most prescribed medications, particularly among elderly patients. A recent study conducted in Palestine revealed that the majority of healthcare professionals had a low level of awareness of PIMs and Beers criteria. This lack of awareness could contribute to the continued use of glimepiride despite potential safety concerns.[31]. Although glimepiride is affordable and readily available, it has been registered with the Palestinian Ministry of Health since 2012.[32] Glimepiride affordability (between 15–30 NIS) compared to newer medications such as Forxiga (dapagliflozin, costing 173 NIS) might influence prescription decisions, especially considering the average daily wage of 103.9 NIS (approximately $27.5) in Palestine.[33,34]

The recent ADA guideline update emphasizes patient assessment and management based on clinical evidence and considers patient comorbidities and characteristics when initiating and managing diabetes. ADA guidelines recommend starting a drug with proven benefits for patients with clinical ASCVD, heart failure, or chronic kidney disease, regardless of the HbA1c level.[18] Patients with clinical ASCVD or high-risk patients, such as those aged > 55 years with two or more additional risk factors, including obesity, hypertension, smoking, dyslipidemia, or albuminuria, SGL T2i with benefits (empagliflozin, canagliflozin, or dapagliflozin), or GLP-la with benefits (dulaglutide, liraglutide, and SC semaglutide)

should be initiated.[35] In this study, there was a gap between these recommendations and clinical practice: most patients with clinical ASCVD, high-risk ASCVD, or CKD were not prescribed appropriate medications such as SGLT2i or GLP-RA. The same trend was observed in patients with heart failure, of whom 80% were not on the recommended medications (empagliflozin, canagliflozin, or dapagliflozin). The CVD-REAL study proved that SGLT2 inhibitors are more effective in the prevention of cardiovascular diseases than other glucose-lowering drugs, and SGLT2 inhibitors have been shown to be effective in decreasing overall morbidity and mortality in such patients.[36]

According to the ADA guidelines, HbA1c levels should be evaluated every 3 months until the goal is reached and then every 6 months.[35] In this study, only 27.9% of patients underwent A1c testing within the recommended ADA timeframe. Appropriate monitoring is essential for optimizing medication therapy, preventing hyperglycemia, and reducing the risk of complications. Prevention and reduction of microvascular complication progression require intensive glucose management and monitoring.[37] While a study conducted in the US reported even lower adherence rates, only 7% of the patients were fully adherent for one year.[20]

In addition to HbA1c testing, ADA emphasizes the importance of specific complication screening to identify potential issues early. These screenings include yearly comprehensive foot evaluations with more frequent checks (every visit) for those with known sensory loss or a history of prior ulcerations or amputation. Unfortunately, only 11.6% of the patients underwent testing as frequently as recommended. This finding aligns with a systematic review analyzing foot care interventions, highlighting that foot examinations were often not performed by healthcare providers, contributing to increased foot ulceration rates and other complications, such as foot infections and lower limb amputation.[38] Dilation eye examinations are another crucial screening tool that is recommended every 1–2 years. Similar to national data from the Healthcare Effectiveness Data and Information Set (HEDIS), which shows that 35–50% of known diabetics receive annual retinal exams,[39] our study found that 54.7% of patients underwent testing as frequently as recommended. Achieving yearly eye examinations might be challenging owing to various factors, including a fragmented healthcare network, lack of referral and reinforcement from busy physicians, and failure of diabetes patients to understand the need for eye screening. However, a complete discussion of these issues is beyond the scope of this study. Regardless, early detection and treatment of diabetic retinopathy, a potential complication of diabetes, are crucial to prevent vision loss.[35]

Effective management of type 2 diabetes is beyond the scope of glycemic control. Interventions targeting smoking cessation, BP control, lipid management, antiplatelet therapy, and lifestyle changes (including diet and exercise) can reduce the risk of cardiovascular events and are as important as glycemic control in the management of patients with DM.[18]

ADA standards of medical care address many common comorbid conditions and complications that result from the progression of DM.[1] The ADA guidelines recommend obtaining a lipid profile at the time of diabetes diagnosis, at least every 5 years if under the age of 40, and when otherwise indicated (ie, at statin initiation, 4–12 weeks after statin initiation or dose change, and annually thereafter).[35] The ADA guidelines also outline specific dyslipidemia pharmacotherapy recommendations for patients with DM. STATIN prescription was according to ADA guidelines in two-thirds of the participants, whereas the rest of the participants were either not prescribed statins or prescribed the wrong intensity STATIN. A recent study conducted in Palestine indicated similar trends regarding adherence to the ADA Guidelines on STATIN Prescribing: 74% of patients were prescribed appropriate statin therapy, and 24% of patients had inappropriate statin therapy or needed statins.[40] Adherence to dyslipidemia management is essential to prevent macrovascular complications.

Another cardiovascular risk factor that the ADA guidelines address is hypertension. The ADA guidelines set BP goals based on risk, recommending a goal of less than 130/80 mm Hg for those with a 10-year ASCVD risk of greater than or equal to 15% and a goal of less than 140/90 mm Hg for those with 10-year ASCVD risk less than 15%.[1] In this study, 72.9% of patients with diabetes mellitus had hypertension, and only 30.4% of these patients achieved the ADA-recommended blood pressure goals. According to the Korean Diabetes Fact Sheet 2021, 58.6% of patients with diabetes mellitus have hypertension, and only 55.5% of them have hypertension controlled with a BP of 140/85 mm Hg.[41] In addition to managing glycemic control, blood pressure, and cholesterol levels, ADA recommends antiplatelet therapy for certain patients with diabetes to further reduce their cardiovascular risk. All patients with a history of cardiovascular disease should be prescribed aspirin 75–162 mg/day as a secondary preventive strategy. Clopidogrel is an option for

patients with atherosclerosis who are allergic to aspirin.[35] Adherence to aspirin prescription was evident in this study, whereas the majority of patients with a history of clinical ASCVD were prescribed aspirin as recommended by the ADA for the secondary prevention of cerebrovascular and cardiovascular events in all diabetic patients, and studies have shown that antiplatelet therapy reduced the incidence of vascular events by 23% in patients with clinical ASCVD.[42]

Prevention of diabetic complications is an essential goal in diabetes management, as it has a great effect on patient quality of life and increases health care costs. The risk of developing microvascular complications of diabetes depends on both the duration and severity of hyperglycemia. Two landmark trials, the Diabetes Control and Complications Trial (DCCT) and the United Kingdom Prospective Diabetes Study (UKPDS), showed that lowering BG levels decreased the risk of developing chronic complications.[43,44] This study found that all patients with microvascular complications developed complications within one year of diagnosis or earlier. Studies have estimated that approximately 25% of patients newly diagnosed with type 2 diabetes mellitus have microvascular complications at the time of diagnosis.[4] In this study, 25.4% of the patients had microvascular complications. This is perhaps unsurprising, given that only 47% of the patients achieved their glycemic goals. Other studies have shown that achieving good blood sugar control in diabetic patients is challenging, ranging from 23.4 to 60%.[45,46]

This study also found a statistically significant positive association between age and glycemic control. This may be explained by ADA's recommendations for relaxed glycemic targets in older adults. The ADA suggests a more relaxed target of less than 8% to be employed for those who are older, have numerous medical conditions limiting life expectancy, are at an increased risk for hypoglycemia, or have had T2DM for a long period.[35] In this study, these factors were considered when assessing glycemic control, and we also implemented a target HbA1c of less than 8% for all participants over 75 years of age. This aligns with the ADA's recommendations and acknowledges the lower life expectancy in Palestine, which is 73.6 years old, according to the World Health Organization (WHO) 2023 data.[47]

Limitations

The major limitation of this study is the effect of other factors on adherence to guidelines, such as patient non-adherence to appointments and medications. Furthermore, this study was conducted in only two public clinics. While these clinics serve a significant portion of the diabetic population, focusing on only two locations limits the generalizability of our study. Additionally, the retrospective nature of this study has inherent limitations associated with relying on pre-existing patient data.

Conclusion

This study revealed a concerning trend in diabetes management in Palestine, and there was an apparent gap between clinical practice and ADA guidelines. This deviation was evident in selecting the appropriate antidiabetic medication for glycemic control and complication prevention, frequency of A1C monitoring, screening to prevent diabetic complications, and management and prevention of ASCVD. Consequently, a significant proportion of the diabetic population suffers from complications and comorbidities.

These findings highlight the importance of improving diabetes management through medical organizations' and governmental institutions' interventions by implementing policies and adapting protocols for clinical guidelines and overcoming the challenges and barriers to improving diabetes management by optimizing available personal and medical resources. Expanding the medication formulary in public health clinics to include newer agents' availability, such as SGLT2 inhibitors and GLP1 agonists; providing continuous education in diabetes management for healthcare providers; and utilizing clinical pharmacists in public clinics for medication therapy management, patient follow-up, and monitoring. Furthermore, utilizing telehealth for follow-up appointments might be a way to overcome healthcare access in a country in a conflict zone, such as Palestine, where movement is restricted and can be dangerous.

Disclosure

The authors report no conflicts of interest in this work.

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