PREDICTORS OF GOOD GLYCEMIC CONTROL AMONG TYPE II DIABETES PATIENTS IN PALESTINE

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ABSTRACT

Objectives: The aim of this study is to assess glycemic control and its relationship with patient characteristics, health-care system factors, and self-care management in type II diabetes patients.

Methods: A retrospective cross-sectional study was conducted among 330 type II diabetes patients who met the inclusion criteria and whose medical records covered a period of 1 year. Data concerning patient characteristics, health-care system factors, self-care management, and available last reading of hemoglobin A1c (HbA1c) were collected through personal interviews and a medical records' review using structured questionnaires and data collection forms. Good glycemic control was defined as HbA1c ≤7%. To assess the results, the Statistical Package for Social Sciences (version 16) was used to undertake descriptive, univariate, and multivariate analyses.

Results: The mean±standard deviation age was 60±9.7 years. More than half of the participants were male (51.2%), and the majority had additional chronic diseases (88.5%). Of the total 271 participants whose HbA1c levels have been monitored, 16.7% had good glycemic control. Multivariate analysis showed that unemployment was significantly related to a decreased odds of good glycemic control (odds ratio=0.34; 95% confidence interval=0.12-0.98; p<0.05).

Conclusion: The study noted that the proportion of patients with good glycemic control was low, a result comparable to studies from many countries. Further investigation and improvement of inappropriate health-care system factors and self-care management together with educational programs that emphasize the importance of self-care management and the health-care providers' role would be of great benefit in glycemic control.

Keywords: Hemoglobin A1c, Glycemic control, Type II diabetes, Palestine.

INTRODUCTION

The health-care resources limitations and availability in troubled countries such as Palestine, in addition to the need for efficient scarce resources use, have led to the diabetes prevalence which is high in Palestine and expected to increase further in future [1] as demand for clinical management, treatment, and comprehensive care rises. Diabetes is a costly disease to treat, especially in Palestine where its control and prevention resources are limited. Thus, there is a need for Palestinian authorities and organizations to track not only the disease but also the consequent economic burden placed on their society. The high diabetes incidence in Palestine is affecting the most productive age groups and is associated with significant morbidity, mortality, and economic consequences. To address this, the Palestinian ministry of health has, since 1998, developed strategies to enhance the management and treatment of diabetes in its centers and hospitals [2].

Persistent hyperglycemia is the main feature of diabetes [3]. Patients with diabetes are prone to consequences in both short-term and long-term diabetic complications. This makes diabetes health-care service more complicated and difficult to evaluate than any other diseases because the condition needs long-term assessment and evaluation to guarantee an appropriate health-care service. Thus, the main aim of management and treatment of type II diabetes is to lower fasting blood glucose to near normal levels, to prevent or at least delay the occurrence of diabetic complications. This can reduce the enormous economic costs, but in order to do so, it is very important for those in charge of diabetes primary health-care centers to ensure early diagnosis of diabetes and take into account patient education and regular follow-up

through a well-organized surveillance system [4]. To achieve this, they need to adopt a conceptual model for examining health-care services such as Donabedian's framework [5].

Three categories of Donabedian's framework, namely, structure, process, and outcomes of care can draw information about health-care services. Structure describes how well a program is designed, including hospital buildings, scientific disciplines for health-care professionals, financing, and equipment. The process of care describes how well a program is implemented and the interaction between patients and health-care providers throughout the health-care delivery. Outcomes describe how well the program is evaluated and it refers to the health-care effects [5]. These criteria are closely interrelated and must be taken into account as a single unit, together with components that are interconnected and related to each other. Diabetes control relies heavily on patient self-care management that influences almost all facets of their day-to-day activities. This study, therefore, assesses glycemic control and its relationship to patient characteristics, health-care system factors, and self-care management among type II diabetes patients.

METHODS

Study design

This study was retrospective cross-sectional. Data collection consisted of personal interview and medical records' review for the past 1 year. Glycemic control was determined as an outcome (good versus poor glycemic control) while using sociodemographic, clinical characteristics, health-care system factors, and self-care management as independent

variables. The study instruments have been previously used by other studies [6-16].

Study setting

Ramallah is administrative and political capital of the Palestinian government and is more developed than other Palestinian cities in economic, health, and urban terms. The study was carried out at the National Center for Chronic Diseases and Dermatology in Ramallah, the first Palestinian governmental tertiary health-care center that has a section specializing in providing diabetes care for diabetic patients with governmental health insurance in that city. During the study period, the researcher visited the center daily to recruit potential participants, interview them personally, and review their medical records.

Participants

This study was undertaken with a sample of outpatients recruited using a convenient sampling method from a medical records' list of type II diabetes patients, who visited the study setting regularly and continuously during the past 1 year. Every patient who met the inclusion criteria was asked if he/she would be willing for study participation. The information sheet was used to inform patients about the study aim, and the researcher asked them to read it carefully and sign a consent form to participate in it. Subsequently, the inclusion criteria for this study were: Patients diagnosed with type II diabetes for 1 year or more, with available medical file, currently being under medical care for type II diabetes with at least two outpatient visits during the past 1 year, and those willing for study participation. The main exclusion criteria were those suffering from Type I diabetes or gestational diabetes and those with physical and mental conditions that could interfere with their ability to understand and/or complete data collection requirements.

Sample size

There are no previous publications about glycemic control among Palestinian diabetic patients and the assumption of the maximum rate of good glycemic control in Palestine to be 50%. The study required an adequate sample size from a target population of 1200 type II diabetes patients. The outcome is dichotomous (good vs. poor glycemic control), and the level of confidence was presented with a 95% confidence interval (CI) with the significance level set at 5% (two-tailed) [17]. Calculations estimated that a sample of 292 type II diabetes patients was needed upon using the Daniel formula. However, since the total target population is <10,000, an adjusted sample size of 235 patients was decided [17-19]. To minimize erroneous results and increase the study reliability, the researcher recruited a minimum sample size of 247 type II diabetes patients [20,21].

Ethical approval

This study was approved by the Palestinian Ministry of Health and Research Management Institute at Universiti Teknologi MARA. The researcher provided each participant with an information sheet copy which included a brief explanation about the study and its purposes, along with the consent form which identifies the requirements and condition of study accession, and participant's rights. The researcher also gave an individual oral explanation to participant about the study importance and their rights before asking them to sign the consent form once they agreed to join the study.

Recruitment procedure

The potential participants who met the sampling criteria were screened from the medical records. Each patient in the center's waiting area who met the sampling criteria was asked if he/she was willing to participate in the study. If the patient agreed to talk for possible participation, then a consent form was read to the patient and an approval signature obtained. Following this, the study instruments were presented and explained during the interview, and all participants completed the questionnaires and forms in a center's private area. These were later compared with their medical records. The forms and questionnaires for data collection were: Sociodemographic and health questionnaire, Patient Perception of Diabetes Care Quality Questionnaire (PPDCQ), diabetes professional performance checklist, diabetes self-care management scale, and medical records' checklist.

Instruments

Sociodemographic and health questionnaire

This questionnaire section was designed to collect data about patient characteristics. It included sociodemographic data information concerning age, gender, marital status, household monthly income, educational level, place of residence, occupation, working days and hours, and health insurance. The other part covered patient clinical characteristics data including medical history, type II diabetes duration, body mass index, smoking status, and any medications. The medical history question was presented to the participant as a list of illnesses with a dichotomous (yes/no) response [6,7]. All participants were asked to state their current antidiabetic treatment to investigate the antidiabetic therapy type as well as insulin treatment during the past 1 year. Data concerning the number of medications taken on a daily basis were collected from the medical records.

Patient Perception of Diabetes Care Quality Questionnaire

The attending physician's specialty, details of preventive education, and feedback on patient perception of patient-professional interaction together with satisfaction with this interaction were obtained and measured and using a PPDCQ [8,9]. The physician's specialty was categorized as diabetologist or non-diabetologist. If a participant could not identify the specialty, the researcher asked the physicians personally. Because there is no specific Palestinian system for diabetes care institute accreditation, criteria developed by Taiwanese Association of Diabetes Educators were used in the study after it was found best suited for assessment [22,23].

The preventive education evaluation consists of five dimensions, namely, diet education, exercise education, foot care instructions, self-blood glucose monitoring, and smoking status. The score for each dimension is 10. Therefore, the diabetes preventive education maximum total score is 50. The cumulative preventive education percentage is the mean total score as opposed to the maximum total score. Preventive education was considered inappropriate when the mean total score was lower than the average score (the cumulative percentage is <50%) and appropriate if greater or equal the average score (cumulative percentage ≥50%).

Patient satisfaction with professional scale is the foundation part of the PPDCQ that includes five dimensions referring to physician and four each for nurse and dietician, respectively. Two additional items asked patients if they received education and care from a nurse and/or dietician. Subsequently, the subscales of nurse and dietician were given 0 if the participant did not get any such care and education. Potential rating categories range from never (one) to always (five). Thus, scores for subscales ranged from physician (6-30), nurse (0-25), to dietician (0-25). Consequently, the total patient satisfaction with professional scale score ranged from 6 to 80. The higher the score means, the higher the patient satisfaction with health-care professionals. The mean total patient satisfaction with professional scale score was calculated as opposed to the maximum total score to calculate the cumulative percentage. Appropriate patient-professional relationship refers to a mean total patient satisfaction with professional scale score greater or equal to the average score (cumulative percentage ≥50%) and inappropriate when the total score is lower than the average score (cumulative percentage <50%).

Diabetes professional performance checklist

The quality of follow-up is a health-care system factor represented as a measurement of diabetic complications' risk factors. Data about quality of follow-up were collected from a medical records' review and personal interviews using the diabetes professional performance checklist and the PPDCQ which included blood test evaluation for hemoglobin A1c (HbA1c), fasting blood glucose, lipid profile (cholesterol, triglycerides, high-density lipoprotein, and low-density lipoprotein), blood pressure

checkup frequency, nephropathy assessment (serum creatinine, urine analysis, and microalbumin), feet and fungus examination, and ophthalmoscope examination [10]. The maximum score for each dimension is 10, a total of 70; the maximum quality of follow-up total score. Table 1 shows the quality of follow-up measure. The cumulative percentage is the mean quality of follow-up total score as opposed to the maximum total score. The quality of follow-up was considered inappropriate when the mean total score was lower than the average score (cumulative percentage <50%) and appropriate when greater or equal the average score (cumulative percentage ≥50%).

Self-care management scale
Diabetes self-care management were measured using a questionnaire consisting of four dimensions related to diet, physical exercise, and self-blood glucose monitoring identified the degree of following a diabetic meal plan, a frequency of 30 minutes of daily physical exercise and the number of glucose testing per week [11,24], and the eight-item Morisky Medication Adherence Scale (MMAS-8) that consists of 8 items related to medication adherence [25]. The first seven items were yes/no questions while the eighth item was answered on a 5-point Likert scale. Scores can range from zero to eight, with one score given for each "No" answer except for item number five where one score was given for a "Yes" answer, and the eighth item with zero given for "all the time" and one score for "never/rarely" [6,7,12,13,26].

In the category of self-care management, follow a diabetic meal plan for 3 days or more in the previous 7 days, meant that the participants followed a diabetic meal plan as recommend by the dietician. In addition, participants who reported that they walked 3 days or more in the previous 7 days were considered as being engaged in at least 30 minutes in daily physical exercise. Self-blood glucose monitoring was defined as those who stated that they performed home glucose monitoring for 5 days or more in the previous 7 days [27,28]. Total medication adherence score ranged from zero to eight. Participants were classified as non-adherent if their total score was less than six and adherent for those whose total scores was six or more.

Medical records' checklist
The medical records' checklist was the basic instrument used by the researcher to collect data concerning prescribed medications, therapy-related factors, and quality indicators of diabetes control from medical

records' review [14,16]. A review of these using the checklist was an effective technique in examining the accuracy of participant follow-up by checking the number of recorded visits number. Therapy-related factors consist of the medication profile of type II diabetes patients. Therefore, prescribed medications for type II diabetes, antihypertensive medications, statins, and aspirin were included in the prescribed medications list studied. In addition, the antidiabetic treatment regimen was the main variable used for assessing drug treatment.

Table 2 shows the quality indicators of diabetes control. They were inclusive of HbA1c, fasting blood glucose, cholesterol, triglycerides, high-density lipoprotein, low-density lipoprotein, and blood pressure. The glycemic control status was categorized as good if HbA1c values were ≤7% and poor if HbA1c values were >7% [29]. Hypertriglyceridemia refers to a triglyceride level ≥150 mg/dl. High-density lipoprotein is considered low when the level is <35 mg/dl and excellent when the level is higher than 35 mg/dl. Low-density lipoprotein is considered high when the level is ≥100 mg/dl [30]. Furthermore, patients receiving medications for any of the above conditions were considered as having the condition [27].

Statistical analysis
The Statistical Package for the Social Sciences (version 16) was used to carry out statistical analysis. Data were described as mean±standard deviation (SD) and median (interquartile range: Q1-Q3) for continuous variables and proportions for categorical variables. Binary logistic regression was used to assess statistical significance of the difference in the good glycemic control according to independent variables. Multiple logistic regression was carried out using variables that showed significance in binary logistic regression to identify factors related to good glycemic control. p<0.05 was considered statistically significant.

RESULT

Participants' characteristics
A total of 330 patients were recruited. The mean±SD age of the participants was 60±9.7 (range=28-85) years. More than half of the participants were male (169, 51.2%). 253 participants (76.7%) were married. The majority were low-income participants (228; 69.1%) and held school certificates (220; 66.7%). Approximately half of the participants were city residents (168; 50.9%), and a higher proportion was housewives (130; 39.4%). The mean±SD daily working hours

Table 1: Description of quality of follow-up

Item	Frequency	Data source	Item score	Total score
HbA1c	1 time/year	Medical records	2.5	10
	2 times/year		5	
	3 times/year		7.5	
	4 times/year		10	
Fasting blood glucose	1 time/year	Medical records	2.5	10
	2 times/year		5	
	3 times/year		7.5	
	4 times/year		10	
Lipid profile	1 time/year	Medical records		10
Total cholesterol			2.5	
Triglycerides			2.5	
High-density lipoprotein			2.5	
Low-density lipoprotein			2.5	
Blood pressure measurement	At least 2,	Medical records	5	10
	3-4 times/year		10	
Nephropathy assessment	1 time/year	Medical records		10
Serum creatinine			5	
Urine analysis			5	
Microalbumin (with or without above)			5	
Feet and fungus examination	Yes/No	Medical records+PPDCQ	-	10
Ophthalmoscope examination	1 time/year	Medical records+PPDCQ	10	10
Total score			70	70

HbA1c: Hemoglobin A1c, PPDCQ: Patient Perception of Diabetes Care Quality Questionnaire

and weekly working days were 7.4±2.5 and 5.5±0.9, respectively. The overwhelming majority of participants were covered by governmental health insurance only (306; 92.7%).

Participants reported an average of 1.9±1.7 additional diabetic complications (median=2; Q1-Q3: 0-3) and 1.8±1.8 additional non-diabetic comorbidities (median=2; Q1-Q3: 1-2), respectively. Tuberculosis (265; 80.3%) and hypertension (208; 63.0%) were the most frequently reported additional chronic diseases among the participants. 38 participants (11.5%) reported that they did not suffer from additional chronic diseases while approximately half of the participants reported four or more additional chronic diseases (166; 50.3%). Obesity (body mass index ≥30 kg/m^2) was the most frequently reported (152; 46.1%), and more than half of the participants reported that they were non-smokers (209; 63.3%) while 207 (62.7%) had been diagnosed with type II diabetes for more than 10 years. Participants reported an average of 6.4±2.8 (median=6; Q1-Q3: 5-8) different medications taken on daily basis.

Reported health-care system factors
The majority of the participants reported that the physicians were diabetologists (327; 99.0%). More than half of the participants reported taking a combination treatment of oral hypoglycemic drugs and insulin (181; 54.8%). 74 participants (22.4%) were on insulin only and 74 (22.4%) others received only oral hypoglycemic drugs. Aspirin and statins were prescribed for 188 participants (57%) and 203 participants (61.5%), respectively. In addition, angiotensin-converting enzyme inhibitors were taken by more than half the participants (186; 56.4%) compared to the other prescribed therapies for hypertension taken by the other 53.6%.

The mean±SD quality of follow-up total score was 38.8±13.2 (median=40; Q1-Q3: 32.5-47.5), which was higher than the average score (cumulative percentage=55.4%). The highest quality of follow score was for blood pressure measurement (mean±SD=8.8±3), and HbA1c was found to have the lowest score (mean±SD = 3.8±2.7). The mean±SD preventive education total score was higher than the average score (33.1±16.1; cumulative percentage=66.2%), and the median was 40 (Q1-Q3: 20-50). The mean±SD patient satisfaction with professional scale total score was 38.5±15.9, which was lower than the average score (cumulative percentage=48.1%), and the median was 30 (Q1-Q3: 28-52). 81 participants (24.6%) reported that they received diabetes education from nurses, and 91 (27.6%) received diabetes education from dieticians. The mean±SD physician total score was 27.2±4 (median=29; Q1-Q3: 26-30). The mean±SD nurse and dietician total scores were 22.3±2.6 (median=23; Q1-Q3: 20.5-24) and 21±5.1 (median=24; Q1-Q3: 20-25), respectively.

Reported self-care management

Table 2: Quality indicators of diabetes control

Item	Category
HbA1c	≤7% - good control, >7% - poor control
Fasting blood glucose	90-130 mg/dl - achieved control, >150 mg - did not achieve control
Cholesterol	<200 mg/dl - good control, 200-220 mg/dl - acceptable, >220 mg/dl - poor control
Triglycerides	<150 mg/dl - good control, ≥150 mg/dl - poor control
High-density lipoprotein	>35 mg/dl - good control, <35 mg/dl - poor control
Low-density lipoprotein	<100 mg/dl - optimal control, 100-130 mg/dl - acceptable control, >130 mg/dl - poor control
Blood pressure	<140/90 mg/dl - good control, >140/90 - poor control

HbA1c: Hemoglobin A1c

More than half of the participants followed a diabetic meal plan (182; 55.2%). 179 participants (54.2%) participated in physical exercise, and more than one-quarter tested their blood glucose level at home (86; 26.1%). 250 participants answered the questions regarding medication adherence. The mean±SD MMAS-8 total score was 6.3±1.6, which was higher than the average score (cumulative percentage=78.8%), and the median was 7 (Q1-Q3: 5.5-8). The majority were adherent (180; 72%) while more than quarter (70; 28%) were non-adherent.

Description of quality indicators of diabetes control
HbA1c was not measured for 59 participants (17.9%). The mean±SD HbA1c level was 8.4±1.7 (median=8.1; Q1-Q3: 7.3-9.2). Only 20.3% of the participants who have been pursuing their HbA1c levels achieved good glycemic control, and the glycemic control for 79.7% of them was poor, indicating a need for intensive treatment. Fasting blood glucose was not measured for 47 participants (14.7%). The mean±SD fasting blood glucose level was 182±77.4 (median=165; Q1-Q3: 129-212). Based on the World Health Organization medical standards of diabetes care, less than a quarter of the participants (23.3%) whose fasting blood glucose levels have been monitored were under acceptable control (90-130 mg/dl). The fasting blood glucose level for the rest of them (169; 59.7%) was poor (>150 mg/dl).

Cholesterol level was examined for 261 participants, and only 15 (5.7%) were within the acceptable control (200-220 mg/dl). Interestingly, none of the participants revealed a poor cholesterol level control (>220 mg/dl), and the cholesterol level control of the 246 participants (94.3%) was good (<200 mg/dl). The triglyceride level was not measured for 95 participants (28.8%). 93 participants (39.6%) were within the acceptable triglyceride control (<150 mg/dl). However, the results were not encouraging, considering that almost 61% of those had high triglyceride level (≥150 mg/dl). Both high-density lipoprotein and low-density lipoprotein were examined for a very low proportion of the participants (35, 10.6%; 27, 8.2%, respectively). The blood pressure of 16 participants (4.8%) was not examined. Poor blood pressure control (>140/90) was not noticed among the participants.

Factors relating to good glycemic control
The univariate analysis (Table 3) did show a significant relationship between good glycemic control and marital status, occupation, diabetes duration, and a number of medications and prescribed therapies in terms of insulin-taking and an antidiabetic treatment regimen. Married participants and those who were unemployed were less likely to have good glycemic control ([odds ratio (OR)=0.5; 95% CI of 0.2-0.9] and [OR=0.3; 95% CI of 0.1-0.7] respectively). Participants with long diabetes duration and a high number of medications were less likely to have good glycemic control ([OR=0.95; 95% CI of 0.91-1.00] and [OR=0.9; 95% CI of 0.8-1.0] respectively). Participants who were not on insulin were more likely to be under good glycemic control ([OR=2.5; 95% CI of 1.3-4.7]). Participants whose antidiabetic treatment regimen was a combination treatment of oral hypoglycemic drugs and insulin were less likely to be under good glycemic control ([OR=0.5; 95% CI of 0.3-0.8]). The multivariate analysis (Table 4) showed that unemployment was significantly related to decreased odds of being under good glycemic control. Compared to those employed, unemployed participants were less likely to achieve good glycemic control ([OR=0.34; 95% CI of 0.12-0.98]).

DISCUSSION

The proportion of participants with HbA1c levels ≤7% in this study was lower than that of the studies done in France and Spain [31,32]. In terms of comparison of the study results with that of the Al-Rowais' study of type II diabetes patients conducted in the Kingdom of Saudi Arabia [33], the percentage of participants who obtained acceptable HbA1c levels (6-8%) was almost the same. About 66.7% of the study population in Kuwait had poor glycemic control (HbA1c >7%) [34]. Less than half of patients in Pakistan had HbA1c level >7.5% (46.7%) [35]. Glycemic control in Palestine indicates a need for more research and

Table 3: Univariate analysis of factors related to good glycemic control

Variable	Frequency (%) n=271	Good glycemic control n=55 (20.3%)	Poor glycemic control n=216 (79.7%)	Odds ratio with 95% CI	p value
Age category					
28-37	6 (2.2)	3 (5.5)	3 (1.4)	Reference (1)	0.339
38-47	31 (11.4)	7 (12.7)	24 (11.1)	0.3 (0.05-1.8)	
48-57	91 (33.6)	14 (25.5)	77 (35.6)	0.2 (0.0-1.0)	
58-67	96 (35.4)	20 (36.4)	76 (35.2)	0.3 (0.1-1.4)	
≥68	47 (17.3)	11 (20.0)	36 (16.7)	0.3 (0.1-1.7)	
Gender					
Male	138 (50.9)	23 (41.8)	115 (53.2)	Reference (1)	0.132
Female	133 (49.1)	32 (58.2)	101 (46.8)	1.6 (0.9-2.9)	
Marital status					
Single	65 (24.0)	20 (36.4)	45 (20.8)	Reference (1)	0.018
Married	206 (76.0)	35 (63.6)	171 (79.2)	0.5 (0.2-0.9)	
Income level (JDs)					
<500	187 (69.0)	32 (58.2)	155 (71.8)	Reference (1)	0.054
≥500	84 (31.0)	23 (41.8)	61 (28.2)	1.8 (1.0-3.4)	
Educational level					
Illiterate	28 (10.3)	7 (12.7)	21 (9.7)	Reference (1)	0.183
≤High school	181 (66.8)	31 (56.4)	150 (69.4)	0.6 (0.2-1.6)	
>High school	62 (22.9)	17 (30.9)	45 (20.8)	1.1 (0.4-3.1)	
Occupation					
Employed	103 (38.0)	26 (47.3)	77 (35.6)	Reference (1)	0.036
Unemployed	61 (22.5)	5 (9.1)	56 (25.9)	0.3 (0.1-0.7)	
Housewife	107 (39.5)	24 (43.6)	83 (38.4)	0.9 (0.5-1.6)	
Place of residence					
City	140 (51.7)	32 (58.2)	108 (50.0)	Reference (1)	0.279
Village and refugee camp	131 (48.3)	23 (41.8)	108 (50.0)	0.7 (0.4-1.3)	
Number of chronic diseases	4.0 (2.0-6.0)	3.0 (1.0-5.0)	4.0 (2.0-6.0)	0.9 (0.8-1.0)	0.116
Body mass index					
Normal	45 (16.6)	12 (21.8)	33 (15.3)	Reference (1)	0.500
Overweight	98 (36.2)	18 (32.7)	80 (37.0)	0.6 (0.3-1.4)	
Obese	128 (47.2)	25 (45.5)	103 (47.7)	0.7 (0.3-1.5)	
Diabetes duration	14.0 (9.0-20.0)	12.0 (6.0-16.0)	15.0 (10.0-20.0)	0.95 (0.91-1.00)	0.035
Smoking status					
Smoker	98 (36.2)	22 (40.0)	76 (35.2)	1.2 (0.7-2.3)	0.507
Non-smoker	173 (63.8)	33 (60.0)	140 (64.8)	Reference (2)	
Number of medications	7.0 (5.0-8.0)	6.0 (4.0-7.0)	7.0 (5.0-9.0)	0.9 (0.8-1.0)	0.008
Insulin treatment					
Yes	207 (76.4)	34 (61.8)	173 (80.1)	Reference (1)	0.005
No	64 (23.6)	21 (38.2)	43 (19.9)	2.5 (1.3-4.7)	
Antidiabetic therapy					
Monotherapy	112 (41.3)	31 (56.4)	81 (37.5)	Reference (1)	0.012
Combination	159 (58.7)	24 (43.6)	135 (62.5)	0.5 (0.3-0.8)	
Followed a diabetic meal plan					
Yes	157 (57.9)	32 (58.2)	125 (57.9)	1.0 (0.6-1.8)	0.967
No	114 (42.1)	23 (41.8)	91 (42.1)	Reference (1)	
Physical exercise participation					
Yes	140 (51.7)	31 (56.4)	109 (50.5)	1.3 (0.7-2.3)	0.435
No	131 (48.3)	24 (43.6)	107 (49.5)	Reference (1)	
Self-blood glucose monitoring					
Yes	69 (25.5)	16 (29.1)	53 (24.5)	1.3 (0.7-2.4)	0.489
No	202 (74.5)	39 (70.9)	163 (75.5)	Reference (1)	
Medication adherence					
Adherent	147 (73.1)	35 (77.8)	112 (71.8)	1.4 (0.6-3.0)	0.426
Non-adherent	54 (26.9)	10 (22.2)	44 (28.2)	Reference (1)	
Quality of follow-up score	42.5 (35.0-50.0)	42.5 (35.0-45.0)	42.5 (35.0-50.0)	0.98 (0.96-1.01)	0.188
Preventive education score	40.0 (30.0-50.0)	40.0 (20.0-40.0)	40.0 (30.0-50.0)	0.99 (0.97-1.01)	0.217
PSPS score	30.0 (28.0-52.0)	30.0 (28.0-52.0)	30.0 (28.0-52.8)	1.01 (0.99-1.03)	0.341

n: Valid number, CI: Confidence interval, JDs: Jordanian dinars, PSPS: Patient satisfaction with professional scale

improvement. The fasting blood glucose level for more than half of the participants indicates a need for intensive treatment and a diet regimen. This sheds light to review diabetes care infrastructure and policies to develop awareness of issues concerning diabetes health-care service.

Blood lipid examination was done with each component separately. Hypercholesterolemia and hypertriglyceridemia were major treatable cardiovascular disease risk factors among the participants [36]. Hence, the results proved that steps must be taken to improve their lipid profile control. This is another medical health outcome and part of the diabetes health-care system. The blood pressure can be addressed if both patients and health-care professionals can be made aware of the seriousness of hypertension and the need to provide a test for this as part of diabetes care [37]. In addition, the availability of standard clinical guidelines for blood pressure management, training programs for healthcare professionals which result in the ease of using blood pressure screening device, as well as easy and efficient access to blood pressure management services is desirable [38]. Blood pressure

Table 4: Multivariate analysis of factors related to good glycemic control

Variable	Coefficient (β)	SE	Wald	Odds ratio with 95% CI	p value
Marital status					
Single				Reference (1)	0.065
Married	−0.69	0.37	3.41	0.50 (0.24-1.04)	
Occupation					
Employed				Reference (1)	
Unemployed	−1.08	0.54	4.03	0.34 (0.12-0.98)	0.045
Housewife	−0.28	0.38	0.56	0.76 (0.36-1.58)	0.455
Diabetes duration	−0.02	0.03	0.34	0.98 (0.93-1.04)	0.560
Number of medications	−0.11	0.06	3.28	0.89 (0.79-1.01)	0.070
Insulin treatment					
Yes				Reference (1)	0.726
No	0.18	0.51	0.12	1.20 (0.44-3.27)	
Antidiabetic therapy					
Monotherapy				Reference (1)	0.379
Combination	−0.38	0.44	0.77	0.68 (0.29-1.60)	

SE: Standard error, CI: Confidence interval

examination is the first measurement that should be done.

The finding of the univariate analysis of factors relating to good glycemic control is inconsistent with what is reported by other studies [39,40], but consistent with others [39,41] which noted that a progressive impairment of insulin secretion results from pancreatic β-cell failure, worsening type II diabetes over time, may lead to a negative impact on patient response to diet alone and/or oral hypoglycemic drugs and the need for a combination treatment of oral hypoglycemic drugs and insulin, higher doses, and/or additional medication which increases over time. However, an interrupted insulin supply in some cases and high insulin prices outside the governmental centers and the discomfort of insulin usage compared to oral hypoglycemic drugs could be a causal factor in poor glycemic control due to the insulin supply delay for more progressive type II diabetes patients.

The result of multivariate analysis as with previous studies is attributed to lower income and lack of family support, depression and poor mental health due to the living difficulties, and the lack of minimum basic needs. These or a combination of them have resulted in patient reluctance to visit the clinic regularly, possibly due in part to feeling uncomfortable when asked questions [42-46]. The lack of a significant relationship between self-care management and glycemic control in the study is inconsistent with almost all of the previous studies [27,47-49]. This finding reflects a limited participant's credibility in answering self-care management items. Continuous education is recommended for motivating patients to overcome this and encourage them to tell the truth. This study was the first conducted in Palestine to examine the diabetes health-care services through identifying possible significant predictors for good glycemic control using binary and multiple logistic regression procedures. However, this study is cross-sectional and cannot establish causal and sequential relationships. This study may also be limited by sample and recall bias because its findings concerning self-care management were not congruent with the multiple studies' findings.

CONCLUSION

The quality of follow-up and preventive education was appropriate, but apparently, patient-professional relationship was inappropriate. These findings need further investigation because of the marked disparity of times, at which HbA1c levels were tested among the participants. However, the study is a preliminary indication that diabetes health-care service in Palestine has a great deal of room for research and improvement. A clear health policy is needed in the diabetes management, and it is vital for health-care professionals to focus on unemployed patients with a long diabetes duration, inappropriate health-care system factors, and prescription patterns compatible with a non-interrupted insulin supply which constitutes the most prominent challenge to health-care providers and patients alike. An important initiative that needs to be adopted is the provision of a base for continuous prescription audit in the primary care setting.

The lack of a significant relationship between health-care system factors, self-care management, and good glycemic control is significant indicators of the need for an educational program that emphasizes lifestyle modification and the self-care management importance. The health-care provider's role is also an essential factor in glycemic control. Longitudinal research with multivariate causal models is recommended, as are other factors such as diabetes-related knowledge, belief in medication, and social support, for further investigation.

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