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Accessibility to Primary Health Services and Quality of Life in Patients with Type 2 Diabetes Mellitus in Mountainous Greece

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Abstract: Type 2 diabetes mellitus (T2DM) has a negative impact on the quality of life (QoL) of patients. We evaluated the health status and quality of life (QoL) in relation to accessibility to primary health care (PHC) units among patients with T2DM in mountainous Greece. We analyzed data obtained from 340 patients with diabetes living in the region of Epirus, Greece. The diabetes-specific quality of life was assessed with the Audit of Diabetes-Dependent Quality of Life questionnaire (ADDQoL-19) and the generic health status with the 12-item Short-Form Health Survey (SF-12). Ninety-three percent of the respondents reported that diabetes had a negative impact on their QoL. Lower scores were seen in relation to "leisure activities" (-1.200 ± 1.251) and "freedom to eat" (-1.088 ± 1.058). The mean physical (PCS) and mental (MCS) component scores were 45.6 ± 8.0 and 43.9 ± 8.0, respectively. According to the linear regression analysis, health status was related to the accessibility to the nearest hospital or health care unit, exercise, blood glucose level, and HbA1c level. The QoL was related to the accessibility to the nearest hospital and diet. T2DM has a negative impact on patients' QoL. Accessibility to PHC units and hospitals as well as the efficient management of patients with diabetes by said PHC units are imperative to control T2DM's course and improve patients' generic health status.

Keywords: quality of life; type 2 diabetes mellitus; health status; primary health care; accessibility

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1. Introduction

Diabetes mellitus (DM) is potentially the most important health challenge of the twenty-first century [1]. According to the International Diabetes Federation (IDF), almost 5% of the world population suffers from diabetes, and the number of patients with diabetes will continue to increase over the next decades [2]. Diabetes mellitus is classified as type 1 and type 2 depending on the ability (type 2 diabetes mellitus, T2DM) or lack thereof (type 1 diabetes mellitus, T1DM) of pancreatic β-cells to produce insulin. Type 2 diabetes mellitus is also characterized by insulin resistance in peripheral tissues. A study recently highlighted that T2DM is a heterogeneous disease that can be stratified into five subgroups; each subgroup is characterized by disease progression and the risk of diabetic complications [3]. A detailed stratification could favor the precision management of patients with diabetes and consequently have a positive impact on their QoL.

According to the World Health Organization (WHO), the definition of health is a "state of complete physical, mental, and social well-being not merely the absence of disease". Moreover, the WHO defined QoL as the "individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns" [4]. T2DM is a chronic metabolic disease that usually presents slow progress and, at some stage (if dietary interventions fail), requires treatment (antidiabetic agents, insulin, or a combination). Consequently, the QoL of patients with diabetes is impaired. Several studies indicate that the QoL is lower in patients with T2DM compared to the general population [5,6]. In addition, at some point, T2DM leads to the development of complications that further burden the QoL. Amongst them, the most common is coronary arterial disease, followed by renal failure, blindness, the combination of micro- and macrovascular complications, and, in some studies, sexual dysfunction [7]. T2DM coexists with other comorbidities such as obesity, hypertension, dyslipidemia, depression, and arthritis that can further deteriorate a patient's QoL [7]. Other variables that have been associated with QoL in diabetes include the type of treatment and the duration of disease [8], age and income [9], gender [8,10], educational level [11], and the frequency of health care visits [12].

T2DM is a highly prevalent condition globally and is often managed within primary health care settings, making it a relevant model for studying the delivery of care and health outcomes. Moreover, this population often experiences complex care needs due to the interplay of comorbidities and lifestyle factors, which are critical to address in primary care research. However, accessibility in the mountainous region of Epirus, Greece, is particularly challenging due to its rugged terrain and scattered settlements. The distances between villages are often substantial, with narrow, winding roads adding to the travel difficulty and time. Health care facilities are sparse, with small health centers [primary health care (PHC) units] serving local needs, while hospitals are located in urban areas like Ioannina, requiring significant travel for specialized care. Recently, Greece started to implement a reform plan for PHCs that follows WHO policy recommendations. The current structure of the PHC system in Greece dates back to the late 1980s. The objective of this study was to evaluate QoL and health status, measured by means of the ADDQOL and SF-12 questionnaires, in patients with type 2 diabetes living in Epirus, Greece, where accessibility to PHC units is not easy. Moreover, QoL and health status were associated with specific demographic and disease-specific criteria.

2. Materials and Methods

2.1. Study Population

This study was designed as a questionnaire-based cross-sectional trial of patients with type 2 diabetes living within the regional unit of Ioannina (Epirus region), in Western Greece. The regional unit of Ioannina is inhabited by almost 170,000 residents. Two-thirds of the population live in the city of Ioannina and 1/3 (55,660 people) in the other six municipalities. Patients with diabetes in these territories rely mainly on community primary health care units to monitor their health status, specifically on 58 regional infirmaries and 6 health centers. The regional infirmaries and health centers serve a population of 55.660 people, of whom an estimated 10% [13] are affected by T2DM. Consequently, the total number of patients with diabetes is approximately 5566. We used Raosoft Software (Raosoft, Inc. Seattle, WA, USA) to calculate a sample size with a 95% confidence interval for a population of people with diabetes totaling 5566 members; the representative study sample required amounted to 360 patients with T2DM (Image S1). The sample size was then distributed between each municipality according to their population in order to obtain a representative sample. Patients were informed in detail regarding the study objectives, and participation

was voluntary. Patients had the right to refuse to participate. Informed consent was mandatory before enrolment in the study. This study was approved by the 6th Regional Health Administration of Peloponnese, Ionian Islands, Epirus, and Western Greece. The inclusion and exclusion criteria are listed in Table 1. The definition of patients with T2DM was based on the ADA's current clinical practice recommendations [14].

Table 1. Patient selection criteria.

	Inclusion Criteria
1	Patients with T2DM diagnosed at least 5 years prior to the initiation of the study
	Exclusion Criteria
1	Patients with type 1 diabetes
2	Patients with insulin resistance (prediabetes, glucose levels 100–125 mg/dL)
3	Patients with T2DM diagnosed less than 5 years prior to the initiation of the study
4	Patients with a coexistent chronic disease that burdens their health quality (cancer, chronic obstructive pulmonary disease, kidney disease, etc.)

2.2. Quality of Life and Health Status Measurement

Several instruments have been developed to measure QoL, many of them being disease-specific. These instruments are used by medical practitioners, researchers, and policymakers.

The 12-item Short-Form Health Survey (SF-12) was used to access the patients' generic health status. In brief, this instrument was developed as a shorter alternative to the SF-16 questionnaire [15] and consists of two components summaries that measure functional health and well-being from the patient's point of view, including both physical (physical component summary, PCS) and mental (mental component summary, MCS) dimensions. Scores are rated on a 0 to 100 scale (0 for lowest and 100 for the highest level of health) [15]. The validity of SF-12 summary scores in the Greek population was assessed previously by Kontodimopoulos et al. (2007) [16].

The diabetes-specific QoL was evaluated by means of the ADDQoL [17] obtained from the Health Psychology Research LTD (license number CB796, 17 April 2018). The instrument includes two items: the first one measures the generic QoL and the second one the impact of diabetes on specific aspects of life. The latter consists of 19 life domains through which the respondents evaluate how their life would be if they did not have diabetes. The impact of diabetes is rated on a 5-point scale, from −3 to +1 (the lowest rating stands for the maximum negative impact of diabetes), while the importance of the domain is rated on a 4-point scale, from 0 to +3 (where 0 stands for not important and 3 for very important). The two items are multiplied to produce a weighted score ranging from −9 (maximum negative impact of diabetes and, thus, a lower QoL) to +3 (maximum positive impact of diabetes and, thus, a better QoL) for each of the 19 life domains and a mean weighted impact score (ADDQOL score) for all applicable domains.

In addition to the above instruments, we constructed a questionnaire to address the participants' (a) socio-demographic characteristics (age, gender, education, occupational status, and income), (b) accessibility to health units, (c) health status and risk factors (physical activity, current/former smoker, and diet), and (d) diabetes-specific characteristics (duration, type of treatment, HbA1c level, blood glucose level, family history of diabetes, and presence of complications) (Questionnaire S2).

2.3. Data Analysis

Statistical analysis was performed using the SPSS statistical package (SPSS 23.0, Chicago, IL, USA). Data are presented as the mean ± standard deviation (STDEV). Linear

regression analysis was used to evaluate the impact of various factors on QoL domains and the overall score as well as on physical and mental health status. $p < 0.05$ was considered statistically significant (Data Analysis S3).

3. Results

3.1. Study Population Characteristics

A total of 340 patients with T2DM participated in this study (168 males and 172 females). Their mean age was 68.7 ± 8.8 years. The demographic characteristics of the participants are shown in Table 2.

Table 2. Characteristics of the study population.

		N	%
Socio-demographic Characteristics			
Gender	Male	168	49.4
	Female	172	50.6
Siblings	Yes	317	93.2
	No	23	6.8
Education	Illiterate	38	11.2
	Primary school	192	56.5
	Secondary school	39	11.5
	High school	26	7.6
	University	45	13.2
Occupational Status	Part-time	5	1.5
	Unemployed/disabled/at home	29	8.5
	Retired	254	75
	Full-time	52	15
Income	Low	176	51.8
	Median	128	37.6
	High	36	10.8
Accessibility to health centers			
Distance from home	<2 km	145	42.6
	2–5 km	109	32.1
	>5 km	86	25.3
Transportation	Taxi	6	1.8
	Car	201	59.1
	Bus	38	11.2
	Other	95	27.9
Accessibility	Easy	80	23.5
	Difficult	260	76.5

Table 2. *Cont.*

		N	%
Health status			
Current smoker	Yes	57	16.8
	No	283	83.2
Former smoker	Yes	138	40.6
	No	202	59.4
Physical activity (walking)	Yes	159	46.8
	No	181	53.2
Frequency (days per week)	1–3	37	10.9
	>3	122	35.9
Time (min)	<30	28	8.2
	30–60	113	33.2
	>60	18	5.3
Diet	Yes	193	56.8
	No	147	43.2

The clinical characteristics of the patients with diabetes in this study are presented in Table 3. Most of the patients had HbA1c higher than 6.5% (83%) and a blood glucose level higher than 125 mg/dl (56%). The most common treatment of choice was oral antidiabetic agents (78%).

Table 3. Clinical characteristics.

		N	%
Diabetes			
Years	5–10	223	65.6
	10–20	100	29.4
	>20	17	5.0
Family history of diabetes	Yes	233	68.5
	No	107	31.5
HbA1c	<6.5%	58	17.1
	>6.5%	281	82.9
Blood glucose (mg/dl)	<100 mg/dL	24	7.1
	100–125 mg/dL	127	37.4
	>125 mg/dL	189	55.6
Type of treatment	Oral antidiabetic agents	266	78.2
	Insulin	13	3.8
	Combination	45	13.2
	Diet	16	4.7

Table 3. *Cont.*

		N	%
Complications			
	Hypertension	290	30.1
	Hyperlipidemia	289	30.0
	Arthropathy	137	14.2
	Coronary heart disease	89	9.2
	Peripheral vascular disease	60	6.2
	Stroke	32	3.3
	Chronic respiratory failure	24	2.5
	Retinopathy	16	1.7
	Neuropathy	12	1.2
	Nephropathy	8	0.8
	Other	5	0.5
	Foot ulcer	2	0.2

3.2. Health Status and QoL Associated with T2DM

The mean PCS and MCS scores were 45.6 ± 8.0 and 43.9 ± 8.0, respectively. The mean overall ADDQoL represented by the total ADDQoL score was negative (−0.608 ± 0.469). All weighted impact scores for the 19 domains of the ADDQoL were negative. The least negative scores were recorded for "working life" (−0.208 ± 0.459) and "physical appearance" (−0.209 ± 0.624), while the lowest negative scores were for "leisure activities" (−1.200 ± 1.251), "freedom to eat" (−1.088 ± 1.058), and "freedom to drink" (−0.962 ± 0.987) (Figure 1).

According to 68% and 58% of the respondents, diabetes had a negative impact on their leisure-time activities and freedom to eat, respectively. Only 13% and 19% of the patients believed that diabetes had a negative impact on their physical appearance and working life, respectively. Overall, 93% of the study population reported that diabetes had a negative impact on their QoL.

Table 4 shows the associations between the specific measures and the health status or QoL in the patients with diabetes included in this study. According to these results, the QoL was related to the accessibility to the nearest hospital and a healthy diet. The generic health status was influenced by more factors; patients with diabetes treated with a diet or pills had better physical health than those on pills and insulin. Those who were on a healthy diet and exercised regularly had better mental health. Accessibility to the nearest hospital or PHC unit and better glycemic control were associated with a better health status (physical and mental).

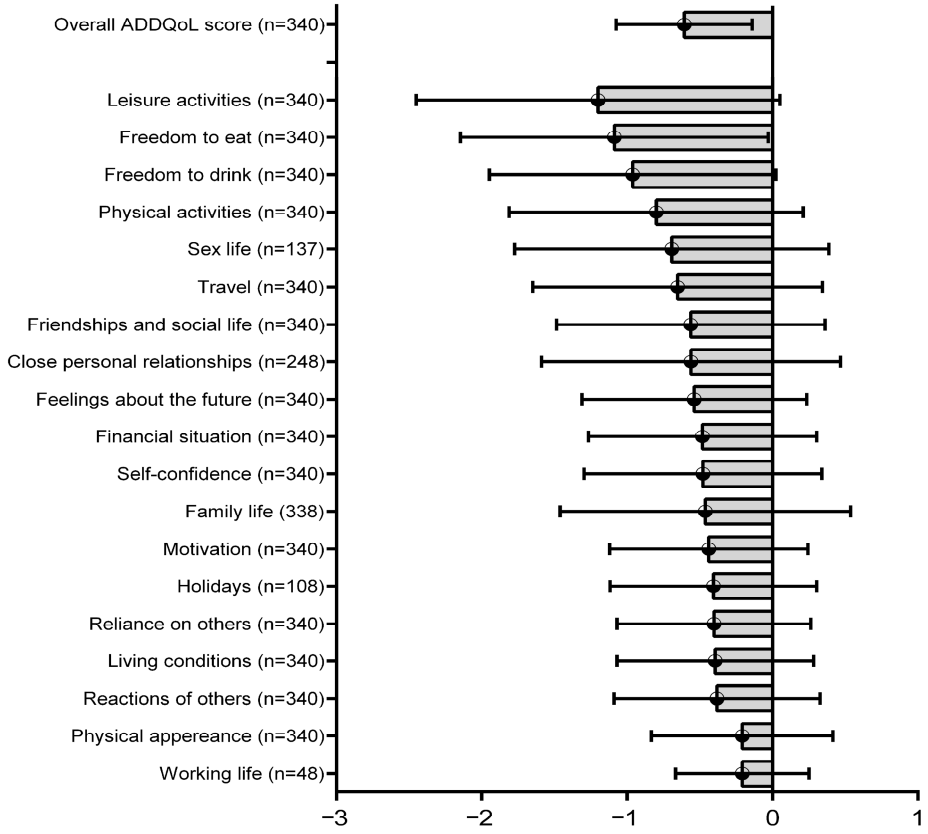


Figure 1. T2DM's impact on the 19 domains of the ADDQoL score.

Table 4. Linear regression analysis.

	b-Coefficient	95% Confidence Intervals	*p*-Value
ADDQoL			
Accessibility (nearest hospital)	0.113	0.001–0.225	0.049
Diet (monitored dietary intake)	0.215	0.101–0.329	0.000
Frequency of health visits	−0.507	−1.410–0.096	0.051
PCS			
Accessibility (nearest hospital)	3.416	1.573–5.260	0.000
Treatment (diet vs. pills and insulin)	5.520	2.033–10.108	0.019
Treatment (pills vs. pills and insulin)	3.097	1.402–5.792	0.024
Accessibility (nearest PHC unit)	3.208	1.103–5.504	0.019
HbA1c	−2.756	−1.262–−4.251	0.000
Blood glucose	0.051	0.019–0.084	0.002
MCS			
Accessibility (nearest hospital)	2.218	1.464–3.972	0.013
Diet (monitored dietary intake)	1.867	1.082–3.652	0.040
Exercise (walking)	2.586	1.401–4.171	0.001
Accessibility (nearest PHC unit)	2.820	1.227–5.014	0.003
HbA1c	−3.960	−2.533–−5.388	0.000
Blood glucose	0.077	0.046–0.108	0.000

4. Discussion

Type 2 diabetes mellitus had a negative impact on the QoL of the patients living in the mountainous region of Epirus, Greece. The respondents reported that diabetes negatively affected their leisure activities, freedom to eat and drink, and physical activities. The patients with diabetes also reported lower scores related to their physical and mental functioning and well-being than those recorded in the general population of Greece [16]. The population included in this study featured people who live in a region of Greece where accessibility to PHC units is not easy. This drawback was illustrated by the regression

analysis; accessibility to the nearest hospital or the nearest health care units was positively correlated with the QoL (ADDQoL) and health status (PCS and MCS) of the respondents. In total, eight factors were associated with lower PCS and MCS scores and a negative impact on the QoL: accessibility to the nearest hospital, accessibility to the nearest health care unit, diet, exercise (walking), type of treatment, blood glucose, and HbA1c level.

Our findings are in accordance with other studies that have reported a negative impact of diabetes on QoL; however, in the current study, we observed a higher QoL overall (least negative overall ADDQoL score). Specifically, the QoL of the population comprising people with diabetes in Italy [18], Australia [19], USA [20], and Switzerland [21] was lower, as expressed using the same instrument—the mean overall ADDQoL score. The domain "leisure activities" was reported as the one that was affected the most by the presence of diabetes in our population, and this result is in contrast with previous studies. Most of these studies report that T2DM's largest negative impact was observed in relation to "freedom to eat" [21,22]. Two recent Greek studies, one which gathered data from two large hospitals in Piraeus [7] and one featuring primary care sites [23], also showed that freedom to eat and freedom to drink were the two domains with the largest negative impact for patients with diabetes. The impact of diabetes on the QoL was also much higher in the two Greek studies above (-2.7 and -2.0, respectively) in relation to the one reported in the present paper (-0.6). A plausible explanation could be found in the occupation of our population. Most of the respondents were retired; they were living in the countryside and spent their time mainly carrying out leisure activities. Thus, they felt that the impact of diabetes was larger in this domain.

Treatment was significantly associated with the physical health of the respondents. Patients on insulin or on insulin and oral antidiabetic agents had lower values of physical health, while those on oral antidiabetic agents or a diet had better scores. Nevertheless, the impact of therapy and, especially, insulin treatment was not correlated with a poorer QoL, a finding which had also been reported by other researchers [7,24]. Moreover, no correlations were established between diabetic complications and the QoL and/or health status of the study population. Papazafiropoulou et al. (2015) also failed to show a connection between QoL and diabetic complications and attributed this finding to the low prevalence of diabetic complications [7]; this is a plausible explanation that we can also implement in our study. However, there are several studies that have shown a better QoL among patients with fewer diabetic complications [24–27].

The health status but not the diabetes-specific QoL was independently associated with HbA1c and blood glucose levels. On the other hand, Kuznetsov et al. (2014), in a multicenter study of 1876 patients with type 2 diabetes, reported that diabetes-specific QoL but not health status was independently associated with HbA1c, urging practitioners to consider the complex relationship between diabetes-specific QoL and glucose, particularly regarding dietary behavior [28]. Recently, it was shown that poor glycemic control is correlated with a lower QoL among older home-dwelling primary care patients with diabetes [29]. An early Greek study also found no association between glycemic control, defined as HbA1c, and QoL [23], alongside many previous studies [30]. Although this finding could be related to the adequate glycemic control practiced by the patients, this was not the case in our population, where four out of five patients had abnormal HbA1c.

Diet and exercise play important roles in the management of diabetes mellitus. Patients with diabetes are obliged to follow a restricted diet (for example, to avoid foods with a high glycemic index or high in saturated fatty acids), monitor their food intake (calculate calories), and incorporate exercise in their daily activities. A recent metanalysis showed that a low-glycemic-index diet can contribute to the management of HbA1c and blood glucose compared to a higher-glycemic-index diet or a control diet in patients with type

2 diabetes [31]. These self-management interventions could be useful for the prevention of the deterioration of health. According to our results, patients that were on a diet to manage diabetes had better QoL and mental health. Those who were exercising regularly also reported higher mental health scores.

Our study had advantages and disadvantages. To our knowledge, this is the first study to address quality of life in patients with diabetes living in the region of Epirus, Greece. The use of two validated instruments (a generic tool and a disease-specific one) to measure health status and QoL strengthens our results. The sample size was distributed between each municipality according to their population in order to obtain a representative sample of patients with diabetes. The sample size was determined using a survey tool. Clinical data that are used as disease markers in DM (blood glucose and HbA1c) were included in the analysis. Since most of the respondents were retired and living in the countryside, the results cannot be generalized to the entire population, especially to those residing in big cities where the lifestyle differs greatly. Moreover, since most of the data were self-reported, the risk of under- and over-reporting complications or comorbidities by the patients was high. Lastly, this research was designed as a cross-sectional study; thus, we cannot draw conclusions regarding causal factors, QoL, and generic health status.

5. Conclusions

Our results show that limited accessibility to health units (hospitals and primary care units) has a negative impact on the QoL and health status of patients with type 2 diabetes. A healthy diet was also a key factor independently associated with the QoL. Meanwhile, blood glucose control, HbA1c, type of treatment, diet, and exercise were the key factors independently associated with health status.

Supplementary Materials: The supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/sci7010009/s1.

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Informed Consent Statement: Informed consent was obtained from all the subjects involved in this study.

Data Availability Statement: The dataset is available upon request from the authors.

Conflicts of Interest: The authors declare no conflicts of interest.

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