



Prevalence and Risk Factors of Poorly Controlled Diabetes Mellitus in a Clinical Setting in Guayaquil, Ecuador: A Cross-Sectional Study

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Abstract

Objective: This study aimed to explore the prevalence of and factors associated with poorly controlled diabetes mellitus (PCDM) in a clinic setting in Ecuador.

Methods: A single-center, cross-sectional study conducted in the outpatient endocrinology clinic in Guayaquil, Ecuador registered 209 participants with type 2 diabetes mellitus, tested for glycosylated hemoglobin and interviewed face-to-face using questions from the Instrument to Measure Lifestyle in Diabetics (IMEVID) Questionnaire. Logistic regression analysis was conducted to identify factors associated with PCDM.

Results: The prevalence of PCDM was 80%. Multivariate logistic regression indicated that age >50 years (OR: 2.20; 95% CI: 1.08-4.50) and lack of seeking diabetes knowledge in newspapers, journals etc. (OR: 2.34; 95% CI: 1.19-4.67), were independently associated with PCDM.

Conclusion: There is a high prevalence of PCDM at this clinic in Ecuador. Risk factors for poorly controlled diabetes include age over 50 years old and lack seeking diabetes knowledge from newspapers or journals. Interventions in similar populations in Ecuador may be targeted at patients age >50 years and encourage self-directed diabetes education.

Keywords

Type 2 diabetes mellitus, Glycemic control, Poorly controlled, HbA1c, Ecuador, Prevalence, Risk factors

Introduction

Worldwide, 347 million people have diabetes, from which 80% live in low- and middle-income countries. The largest increase (92%) has been projected for countries in the lowest income group. The World Health Organization projects that diabetes will be the 7th leading cause of death in 2030. In Ecuador, 414,414 people are affected by type 2 diabetes mellitus (T2DM) however only 100,000 are receiving treatment. The prevalence of T2DM in Ecuadorian patients older than 30 years is approximately 10.3%, with an annual incidence of 115 cases per 100,000 persons [1-3]. Moreover, diabetes is the leading cause of death in Ecuador and according to Instituto Nacional de Estadísticas y Censos (INEC) a Spanish acronym [2], in 2013, 4,695 people died because of this chronic disease [1-3].

Glucose control is a major step in the management of the T2DM. American Diabetes Association: Standards of Medical Care recognizes as targets of well-controlled diabetes: HbA1c of 7%, preprandial capillary plasma glucose between 80-130mg/dL and peak postprandial capillary plasma glucose of 180mg/dL [4]. These targets have demonstrated a reduction in microvascular complications of diabetes, and, if implemented soon after the diagnosis of diabetes, it is associated with long-term reduction in macrovascular disease. Without appropriate treatment, T2DM leads to high morbidity and mortality due to cardiac and renal complications. If patients are not able control their diabetes, even with appropriate treatment, factors associated with poorly controlled diabetes mellitus (PCDM) should be detected in order to propose possible solutions [4,5]. Poorly controlled diabetes is defined as having a glycosylated hemoglobin (HbA1c) of >7%, pre-prandial capillary plasma glucose >130mg/dl and peak postprandial capillary plasma glucose of >180mg/dl [4].

Glycemic control is determined by the interaction of genetic and environmental factors also known as risk factors, among which lifestyle plays a fundamental role [3-6]. A risk factor is defined as a factor that is associated with a given outcome, but is not necessarily a cause [7]. Risk factors affecting diabetes control including diet, physical activity, alcohol and tobacco consumption, and diabetes medication compliance can be difficult to manage [4,8-16]. Research shows that the majority of patients with diabetes face challenges eating a healthy diet, exercising regularly, and remembering to take their medications [9-18]. Furthermore, other factors have also been shown to impact diabetes control including age, gender, race, insurance status, marital status, comorbidities, duration of the diabetes and source of diabetes education [6,19-22].

Despite the fact that T2DM is a leading cause of death in Ecuador, there is limited description of risk factors associated with poorly controlled diabetes in Ecuador. Guayaquil was chosen to perform this study because it is the most populated city in Ecuador, with approximately 2.69 million people and it is also the most nationally representative city as a major financial and business center, people from all over the country migrate to Guayaquil for work. Luis Vernaza Hospital is a national reference hospital providing subspecialty care such as Endocrinology, which many other hospital in Ecuador lack. Guayaquil receives patients from all over the country making this

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city the best location to capture a population that most resembles Ecuadorian demographic and clinical characteristics [20].

The aim of this study was to identify the prevalence of patients with poorly controlled diabetes and the factors related to poorly controlled diabetes among Ecuadorian patients at the outpatient endocrinology clinic at Luis Vernaza Hospital. This is one of the first studies to evaluate risk factors for poorly controlled diabetes in Ecuador and will provide insights into risk factors that may be targeted to design improved diabetes care for this population. Demographic, lifestyle factors and diabetes knowledge are risk factors associated with poorly controlled diabetes in Ecuadorian patients.

Methods

Study settings

Guayaquil is the largest and the most populous city in Ecuador and hosts the nation's main port. It is located on the western bank of the Guayas River, which flows into the Pacific Ocean. In this study, subjects were recruited from a well-established outpatient Endocrinology clinic at Luis Vernaza Hospital. This clinic receives 330 endocrine patients every week of which 80% have diabetes (seeing approximately 260 patients with diabetes per week). The hospital is located in the center of the city, which provides care to low-income patients, with average daily attendance of 66 patients. This study used American Diabetes Association diagnostic and management guidelines [4].

Ethical guidelines

Approval of the institutional ethics committee from the Luis Vernaza Hospital was received (Protocol HLV-DOF-CCI-026) and informed consent was obtained to collect data from patients with diabetes and to gather information about their lifestyle. There was no significant risk during the interventions to the patients, besides laboratory testing and survey completion. No other interventions were applied. After obtaining consent, a self-administered, questionnaire: Instrument to Measure Lifestyle in Diabetics (IMEVID) [6] was filled out.

Study design, subjects and eligible criteria

From June 3, 2014 to January 6, 2015 a single center, cross-sectional study was performed in the outpatient Endocrinology clinic of Luis Vernaza Hospital in Guayaquil. This study aimed to determine the prevalence of poorly controlled diabetes defined as a glycosylated hemoglobin (HbA1c) of >7%, pre-prandial capillary plasma glucose >130mg/dL and peak postprandial capillary plasma glucose of >180mg/dL and to identify demographic, clinical, and lifestyle factors associated with poorly controlled diabetes. Poorly controlled diabetes is different from the diagnosis of T2DM, in that the diagnosis of T2DM is defined as A1C >6.5% or Fasting plasma glucose (FPG)>126mg/dL Fasting is defined as no caloric intake for at least 8h or 2h plasma glucose (PG) >200mg/dL during an oral glucose tolerance test (OGTT) or in a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose >200mg/dL [4,18].

Inclusion criteria included age 30 and older with a diagnosis of T2DM for at least one year. Patients with type1 diabetes, gestational diabetes, under the age of 30, incomplete records, mental health problems and dialysis were excluded [9-11,14]. Of 270 patients evaluated, 209 met the inclusion criteria and 61 patients were excluded: 10 (dialysis), 21 (incomplete records), 20 (unable to answer the questionnaire), 2 (type 1 diabetes mellitus) and 8 (diagnosis of T2DM <1 year). Type1 diabetes and gestational diabetes patients were referred from other hospitals with these diagnoses and confirmatory labs were not performed [14-18].

Study conduct and assessments

At the outpatient Endocrinology clinic, treating physicians identified potentially eligible patients and referred them to the coordinator of the study in order to get the informed consent. After obtaining consent each patient completed 14 questions from the IMEVID Questionnaire [6] (Annex 1). The questions were selected to obtain information regarding: lifestyle (diet, exercise, habits) as

Annex 1: Lifestyle Questionnaire used to assess lifestyle in T2DM adapted from the Instrument to Measure Lifestyle in Diabetics (IMEVID) Questionnaire [20].

Modified IMEVID Questionnaire about lifestyle factors in T2DM control				
Instructions				
<p>This is a questionnaire to know about the lifestyle of diabetics. We thank you to read carefully the following questions and answer what you consider reflects more accurately your lifestyle in the last 3 months. Placing a cross in the answer chosen</p>				
<p>Answer all questions</p>				
1. How frequently you eat vegetables and/or fruits?	Everyday	Sometimes	Never	
2. How many pieces of bread do you eat per day?	0 to 1	2	3 or more	
3. Do you add sugar to your food or drinks?	Almost never	Sometimes	Frequently	
4. Do you add salt to your food while you are eating?	Almost never	Sometimes	Frequently	
5. Do you eat between meals?	Almost never	Sometimes	Frequently	
6. Do you eat food outside the home?	Almost never	Sometimes	Frequently	
7. How frequently do you do 15 minutes of exercise per day? (Walking fast, running or other)	3 or more times per week	1 or more times per week	Almost never	
8. Do you smoke?	No	Yes		
9. Do you drink alcohol?	No	Rarely		
10. How many lectures about diabetes have you received?	4 or more	1 to 3	None	
11. Do you consume a diabetic diet?	Almost always	Sometimes	Almost never	
12. Do you try to get information about diabetes from journals, newspapers, etc.?	No	Yes		
13 Do you forget to take your medicine for diabetes?	Almost never	Sometimes	Frequently	

The answers of the questionnaire were coded with a favorable lifestyle response according to the ADA and WHO recommendations valued as 1 and partially favorable or unfavorable lifestyle response were valued with 0 [16].

well as disease control (regular consumption of medication, diabetes knowledge seeking behaviors). The IMEVID Questionnaire [6] was developed in Mexico and we adapted it for use in Ecuador. The logical and content validity of the IMEVID was evaluated by expert consensus, by a multidisciplinary panel of 16 health professionals composed of internists, endocrinologists, clinical psychologists, family doctors, nutritionists and clinical researchers who evaluated the instrument independently and blinded, all with more than five years experience in the care of patients with diabetes [6]. 14 questions were selected out of 25 because some questions were not relevant to our study or culturally appropriate. For example, the IMEVID asks, "How many times do you eat tortillas?" This is not culturally appropriate as tortillas are not part of the staple diet in Ecuador. The other questions excluded were related to depression and mood changes. Therefore, we report only associations between the individual question variables and poorly controlled diabetes as opposed to an IMEVID score.

Measures evaluated during a single outpatient clinic visit included reported age in years, male or female gender, marital status as with or without partner, economic activity including work, trade, or employment defined as paid or unpaid, age at diagnosis with T2DM defined as less than 5 years, 5-10 years and over 10 years ago, type of diabetes treatment including 1: diet and exercise, 2: oral, medications, 3: insulin, 4: diet plus oral medications, 5: insulin and diet, educational level as no education, basic education, high school education, and higher education, and measured body mass index (BMI), blood pressure, fasting blood glucose, and HbA1c (Table 1). Healthy diet was self-reported and defined as a low sugar and salt intake, high protein and low fat and carbohydrates intake. Adequate physical activity was also self-reported and defined as 30 minutes of exercise at least 3 times per week [6]. Diet was self reported and defined as a low sugar and salt intake, high proteins and low fat. Physical activity was self reported and was considered positive if 15 minutes of exercise 3 or more times per week [6]. The body mass index (BMI) is the ratio between weight and height, expressed in kg/m² and is considered normal weight: 18.5-25, overweight: 25.1-30 and obesity >30 [18]. Fasting blood glucose was measured in mg/dL with normal fasting glucose <100mg/dL and abnormal fasting glucose >100mg/dL. The HbA1c reveals blood glucose levels over the past three months defined as controlled diabetes when <7% and poorly controlled if >7% [17,23-29].

Sample size

A probabilistic sample size of 278 patients was obtained by statistics parameters based on the following assumptions: an expected prevalence of poorly controlled diabetes of 50% probability among patients with diabetes, a 5% type I error, a power of 80%, a confidence interval of 95%, and a population of patients with diabetes over the age of 30 of 100,000 persons.

Statistical analysis

Statistical analysis was performed using STATA software version 11.2 for Windows and Excel for Mac 2011 with an alpha set to 5%. Basic descriptive statistics were used to calculate mean and standard deviation of quantitative variables such as age, BMI, fasting blood glucose, HbA1c, blood pressure and years with T2DM. Qualitative categorical variables such as gender, economic activity, education level, marital status and questionnaire responses are reported as frequencies and percentages [8,15] (Table 1). Qualitative and quantitative variables were compared using the chi-square and Fisher test. For ordinal qualitative variables Kruskal-Wallis was obtained to correlate the variables with control or poorly controlled diabetes.

Univariable and multivariable logistic regression models were used to estimate the unadjusted and adjusted OR between potential risk factors and poorly controlled diabetes respectively. First, univariable logistic regression models were fitted for each potential risk factor. The significance level for a risk factor to enter or stay in the model was set at 0.50. These variables were included in a multivariable logistic regression model.

Results

209 patients met inclusion criteria and were included in this

study. Demographic analysis indicated that 68% of study sample was female, 63% had a basic education, 78% did not have an income and 67% were in a stable couple marital relationship. The age of the study sample ranged between 38 and 85 years, with a mean of 61.6 years old [95% CI: 59.9-63.2] (Table 1). Men and women had similar age ranges and mean ages.

As for the clinical characteristics, 88 patients (42%) were overweight, with an average BMI of 27.3 and 143 patients (68%) maintained a fasting blood glucose >130mg/dL with an average of 120mg/dL. 68 patients (32%) had a HbA1c <7% and 141 (68%) had a HbA1c >7%. The average HbA1c was 8.5%.

In terms of years with T2DM diagnosis, 44% had 1-5 years of diagnosis with T2DM with an average of 9 years. 28% had 5-10 years and another 28% over 10 years. Men and women had similar ages at diagnosis. Regarding treatment, 104 patients (50%) were receiving oral diabetes medication, 66 patients (32%) on insulin, 20 patients (10%) were dieting and receiving oral diabetes medication, 18 patients (9%) were dieting and doing exercise and 1 patient was on insulin and dieting (0.5%).

Among patients with controlled diabetes, 29 (14%) were women, 27 (13%) had basic education, 24 (11%) had a marital partner, 24 (11%) were age between 30-59 years old, 34 (16%) were unpaid, 13

Table 1: Characteristics of the patients with T2DM attending the Guayaquil, Ecuador outpatient endocrinology clinic

Sociodemographic characteristics	n=209	%
Gender		
Female	141	67.5
Male	68	32.5
Level of education		
No education	12	5.7
Basic education	131	62.7
High school	58	27.8
Higher education	8	3.8
Marital status		
With a couple	69	33.0
Without a couple	140	67.0
Age		
30-59 years	96	45.9
60-79 years	94	45.0
80-99 years	19	9.1
Economic activity		
Paid	47	22.5
Unpaid	162	77.5
Clinical characteristics		
BMI		
Ideal weight	70	33.5
Overweight	88	42.1
Obesity	51	24.4
Blood pressure		
Normal blood pressure	149	71.3
Hypertension	60	28.7
Preprandial capillary plasma glucose		
<130mg/dl	66	31.5
>130mg/dl	143	68.4
HbA1c		
<7%	68	32.5
>7%	141	67.5
Time with T2DM diagnosis		
1-5 years	92	44.0
5-10 years	58	27.8
>10 years	59	28.2
Treatment		
Diet and exercise	18	8.6
Oral antidiabetics	104	49.8
Insulin	66	31.6
Diet and oral antidiabetics	20	9.6
Diet and insulin	1	0.5

(6%) were overweight, 23 (11%) had 1-5 years of T2DM diagnosis, 19 (9%) were treated with oral diabetes medications, 26 (12%) did

Table 2: Characteristics associated with control versus uncontrolled diabetes in a cohort of patients from Guayaquil, Ecuador (N=209)

	Controlled Diabetes n=68	Uncontrolled Diabetes n=141	p-value
Gender, n (%)			0.62
Female	29 (13.9%)	112 (53.6%)	
Male	12(5.7%)	56 (27.8%)	
Level of education, n (%)			0.88
No education	2 (1.0%)	8 (3.8%)	
Basic education	27 (12.9%)	108 (51.7%)	
High school	9 (4.3%)	43 (20.6%)	
Higher education	3 (1.4%)	9 (4.3%)	
Marital status, n (%)			0.78
With a couple	24 (11.9%)	116 (55.5%)	
Without a couple	17 (8.2%)	52 (24.9%)	
Age, n (%)			0.03
30-59	24 (11.5%)	72 (34.5%)	
60-79	16 (7.7%)	78 (37.3%)	
80-99	1 (0.5%)	18 (8.6%)	
Economic activity, n (%)			0.58
Paid	7 (3.3%)	40 (19.1%)	
Unpaid	34 (16.3%)	128 (61.2%)	
BMI, n (%)			0.54
Ideal body weight	11 (5.3%)	59 (28.2%)	
Overweight	13 (6.2%)	75 (35.9%)	
Obesity	17 (8.1%)	34 (16.3%)	
Time with T2DM diagnosis, n (%)			0.06
1-5 years	23 (11.0%)	69 (33.0%)	
5-10 years	8 (3.8%)	50 (23.9%)	
>10 years	10 (4.8%)	49 (23.4%)	
Treatment, n (%)			0.42
Diet and exercise	7 (3.3%)	11 (5.3%)	
Oral antidiabetics	19 (9.1%)	85 (40.7%)	
Insulin	14 (6.7%)	52 (24.9%)	
Diet and oral antidiabetics	1 (0.5%)	19 (9.1%)	
Insulin and diet	0 (0%)	1 (0.5%)	
Exercise, n (%)			0.65
Yes	26 (12.4%)	100 (47.9%)	
No	15 (7.2%)	68 (32.5%)	
Diet, n (%)			0.78
Yes	30 (14.4%)	127 (60.8%)	
No	11 (5.3%)	41 (19.6%)	
Sought Knowledge about T2DM from newspapers or journals, n (%)			0.016
Yes	25 (12.0%)	103 (49.3%)	
No	16 (7.7%)	65 (31.1%)	
Forgetting to take the medicine, n (%)			0.54
Yes	22 (10.5%)	99 (47.4%)	
No	19 (9.1%)	69 (33.0%)	

Table 3: Unadjusted and adjusted odds ratios (OR) from logistic regression for factors associated with uncontrolled diabetes mellitus among patients with T2DM

Characteristic	Comparison	Unadjusted OR OR (95% CI)	P value	Adjusted OR OR (95% CI)	P value
Education level	Primary vs. secondary	1.39(0.61-3.14)	0.42	1.67(0.74-3.75)	0.21
Marital status	With a partner vs. without	1.21(0.75-1.95)	0.42	1.17(0.72-1.92)	0.51
Age	50 vs. >50	2.72(1.25-5.94)	0.01	2.20(1.08-4.50)	0.03
Economic activity	Paid vs. not paid	1.46(0.42-5.05)	0.54	-	-
BMI	Normal weight vs. overweight	1.19(0.98-2.99)	0.54	1.07(0.72-1.30)	0.21
Time of diagnose of T2DM	<5 years 5-10 years >10 years ago	0.55 (0.28-1.08) 0.79 (0.60-1.04)	0.34	0.57 (0.30-1.07) 0.80 (0.62-1.03)	0.55
Treatment	Pharmacologic vs. non pharmacologic	1.11(0.46-2.65)	0.80	-	-
Exercise	Yes vs. no	1.02(0.42-2.49)	0.95	-	-
Diabetic Diet	Yes vs. no	0.72(0.28-1.88)	0.51	0.95(0.33-2.77)	0.92
Sought Diabetes Knowledge from newspapers or journals etc.	Yes vs. no	2.02(1.09-3.73)	0.02	2.34(1.17-4.67)	0.02
Forgetting to take diabetes medicine	Yes vs. no	1.14(0.47-2.78)	0.76	-	-

exercise, 30 (14%) dieted, 25 (12%) sought knowledge about T2DM and 22 (11%) reported forgetting to take medication ([Table 2](#)).

Among patients with poorly controlled diabetes, 112 (54%) were women, 108 (52%) had basic education, 116 (56%) had a marital partner, 78 (38%) had an age between 60-79 years old, 75(36%) were overweight, 69 (33%) had 1-5 years of T2DM diagnosis, 85 (41%) were treated with oral diabetes medications, 100 (48%) did exercise, 127 (61%) dieted, 103 (49%) sought knowledge about T2DM in newspapers, journals etc. and 99 (47%) reported forgetting to take medication.

Only 41 patients (20%) had controlled diabetes, while 168 (80%) had poorly controlled diabetes. It was observed that patients with poorly controlled diabetes were mainly overweight women, with basic education, that lived with a marital partner, with an age between 60-79 years old, who did not receive any income, and reported forgetting to take their medication. In univariate analysis, the variables that were statistically related to poorly controlled diabetes were age >50 years old (OR: 2.72; 95% CI: 1.25-5.94) and lack of seeking diabetes knowledge from sources such as newspapers, journals, etc. (OR: 2.02; 95% CI: 1.09-3.73) and these relationships remained robust after adjustment for educational level, marital status, BMI, and time of diabetes diagnosis with adjusted odds ratios: age >50 years old (OR: 2.20; 95% CI: 1.08-4.50) and lack of seeking diabetes knowledge from sources such as newspapers, journals, etc. (OR: 2.34; 95% CI: 1.19-4.67). Variables such as time with the diagnosis of T2DM (OR: 0.96 CI: 0.90-1.03), systolic blood pressure (OR: 0.97 CI: 0.94-1.02), BMI >25kg/m² (OR: 1.19; 95% CI: 0.98-2.99), eating outside the home (OR: 0.58 CI: 0.29-1.14), eating between meals (OR: 1.25 CI: 0.69-2.26) among others, were not statistically significant ([Table 3](#)).

Discussion

This is one of the first studies to evaluate risk factors for poorly controlled diabetes in Ecuador. Our primary findings were that the prevalence of PCDM at this clinic in Ecuador was 80% and that lack seeking diabetes knowledge in newspapers, journals etc. was a modifiable risk factor for poorly controlled diabetes in this population. This finding is relevant to making improvements in quality of diabetes care in Ecuador as targeted diabetes education and encouragement of self-education efforts with in newspapers, journals and other resources at the time of visit may be beneficial to address poorly controlled diabetes in this population.

Across the literature there are variations in the results obtained from studies of poorly controlled diabetes [[14-16](#)]. The present study demonstrated a very high prevalence of poorly controlled diabetes in the patients attending the Endocrinology clinic, the high prevalence of poorly controlled diabetes can be partially explained because the majority of the patients with diabetes had only basic education and were mostly unemployed. These findings are relevant, because they indicate that many of these patients are barely able to read and write and are often unable to pay for their medications, which create a challenge to optimal care. We also found that lack of seeking knowledge about diabetes was

related to poorly controlled diabetes, likely because the educational level of our patient population is so basic, they have difficulties understanding what diabetes mellitus is and are thus ill-equipped to search for more information about diabetes in newspapers or journals. Newspapers and journal targeted for patients can aid patients with diabetes to understand what diabetes is and how they can control it. Furthermore, self-education can prompt patients to ask doctor questions, improve self-efficacy, and control their disease. Another finding that was not surprising given that the majority of patients with diabetes are between ages 40-50 is that patients over 50 years old are the most poorly controlled. We also found that the majority of our patients were overweight as opposed to obese indicating that minimal weight management techniques may help patients achieve their target BMI. Another interesting finding is that the poorly controlled patients in our study were between 1 to 5 years of diagnosis. This means that there is a great opportunity for lifestyle interventions and counseling early in the disease process that may alter their disease course.

This study is similar to other studies in that patients with controlled diabetes did not differ significantly from patients with poorly controlled diabetes in terms of their gender and ethnicity [14,16,28]. However, this study differed in that age over 50 was associated with higher risk of poorly controlled diabetes. On the other hand, the definition of poorly controlled diabetes that this study selected was: HbA1c of >7%, which is the one cited in the recommendations from the Standard of Diabetes Care (glycemic targets) [18] and studies such as Chan et al. [14]. Other studies such as Ko et al. [15] used HbA1c >9% for diagnosis of poorly controlled diabetes. Regardless, the characteristics associated with poorly controlled diabetes in this study were similar to Ko et al. [15] regarding BMI association; however we did not find a relationship between hypertension or high-fat diet as they did. Siddiqui et al. [16] found similar associations regarding diabetes education, indicating that those patients who received information through lectures or other additional sources had better diabetes control. Levels of HbA1c correlated positively with age in the study of Chan et al. [14] as well as in the present study. The duration of diabetes and physical activity has been previously reported to be a factor in determining the level of control however in this study we did not find statistically significant relationship [14-16,29-31].

This study had some limitations. In the exclusion criteria, type1 diabetes and gestational diabetes were diagnosed at outside hospitals and confirmatory labs were not performed. Although the IMEVID questionnaire was validated in Mexico, many of the questions were not relevant to an Ecuadorian population. Additionally, this population was predominantly married women age 30-59 years with a basic level of education without a salaried income. Therefore our results are most applicable to this patient population and may not be generalizable to very different populations. Further, the sample size of 209 was large enough to identify some relationships however a larger sample may have elucidated further relationships of variables related to poorly controlled diabetes. Finally, the lifestyle question responses were self-reported which makes the study vulnerable to social desirability bias to answer with a response that portrays them in a good light. Further research is needed in other Ecuadorian populations, with larger sample sizes and consideration of objective measures of lifestyle factors.

Conclusion

In this study, we found that the vast majority of Ecuadorian patients seen at the Luis Vernaza Hospital at the Endocrinology clinic have poorly controlled diabetes and the risk factors for poorly controlled disease include age over 50 years old and seeking diabetes knowledge from newspapers or journals. Diabetes education and encouragement for seeking further educational information from sources outside the health center should be considered as a potential intervention to improve quality of diabetes care among similar populations in Ecuador.

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