


# Prevalence and risk factors of depression, anxiety, and stress in an Ecuadorian outpatient population with type II diabetes mellitus

## A cross-sectional study (STROBE)

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### Abstract

Type II diabetes mellitus (DM2) is a worldwide disease with an important economic and health impact. Currently, depression, anxiety and stress are common disorders among diabetic populations but their respective prevalence may well be underestimated. So far, Latin American countries have only reported limited information about the impact of mental diseases on DM2 outpatients. The objective of this study was to evaluate the prevalence and risk factors related to depression, anxiety, and stress among ambulatory DM2 populations from two third-level hospitals in Quito, Ecuador. A cross-sectional study based on a random sample was carried out in two hospitals. Patients were evaluated by the 21-item Depression, Anxiety and Stress Scale (DASS-21). In addition, a validated survey was used to grade socioeconomic, demographic, clinical, and comorbidity variables. Descriptive statistics and multiple logistic regression were used to analyze the data. Statistical analysis was performed by SPSS (version 22.0). STROBE guidelines were used for reporting this trial. A total of 208 adult patients with DM2 were included (women 58%; men 42%). The prevalence of depression, anxiety and stress was 31.7% (95% CI, 25.5–38.5%), 33.7% (95% CI, 27.3–40.5%), and 25.0% (95% CI, 19.3–31.5%), respectively. Male gender was associated with a decreased risk for depression (OR 0.39 [95% CI, 0.18–0.81];  $P = .01$ ), anxiety (OR 0.31 [95% CI, 0.16–0.65];  $P = .002$ ), and stress (OR 0.35 [95% CI, 0.15–0.77];  $P = .009$ ). A higher level of education was associated with low risk for depression (OR 0.23 [95% CI, 0.11–0.46];  $P < .001$ ), anxiety (OR 0.47 [95% CI, 0.25–0.90];  $P = .02$ ), and stress (OR 0.24 [95% CI, 0.12–0.49];  $P = .001$ ). In contrast, patients with DM2 complications were more likely to have depression (OR 2.96 [95% CI, 1.32–6.63];  $P = .008$ ) and anxiety (OR 2.56 [95% CI, 1.20–5.48];  $P = .01$ ). Finally, an income higher than the basic salary reduced the risk of depression alone (OR 0.39 [95% CI, 0.16–0.91];  $P = .03$ ). In conclusion, a high prevalence rate of depression, anxiety, and stress was found in the DM2 outpatient population. Thus, more tailored care surveillance for DM2 patients is needed considering the bio-psycho-social environment to provide an integral health management.

**Abbreviations:** 95% CI = 95% confidence interval, DASS-21 = 21-item depression, anxiety and stress scale, DM2 = type II diabetes mellitus, HbA1c = glycosylated hemoglobin, IDF = International Diabetes Federation, OR = odds ratio, SD = standard deviation, SPSS = Statistical Package for the Social Sciences, STROBE = Strengthening the Reporting of Observational Studies in Epidemiology, WHO = World Health Organization.

**Keywords:** DASS-21 scale, Latin America, mental diseases, risk factors

### 1. Introduction

Type 2 diabetes mellitus (DM2) is a chronic metabolic disease characterized by an increase in normal serum glucose levels (hyperglycemia).<sup>[1,2]</sup> In addition, DM2 is due to resistance or deficient secretion of insulin, or both conditions. According to

the American Diabetes Association (2020), DM2 represents 90–95% of all types of diabetes.<sup>[1,3,4]</sup>

In 2016, according to the World Health Organization (WHO), DM2 had duplicated its prevalence over the last 30 years (from 4.7% to 8.5%).<sup>[5]</sup> Moreover, the International Diabetes Federation (IDF) estimated that by 2030, 578 million

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adults will be affected by DM2 and that by 2045 this number will rise to 629 million, reaching a world prevalence of 9.9%.<sup>[6]</sup> According to the IDF (2019), the prevalence of diabetes in South and Central America amounted to 9.4% in adults and around 32 million people were affected. Furthermore, during the same year, Ecuador was among the 20 countries with the highest prevalence of DM2 (5.5%).<sup>[3]</sup>

Several studies have suggested a complex and bidirectional association between depression, anxiety, and stress with chronic diseases, especially DM2.<sup>[7–9]</sup> Moreover, the prevalence of depression, anxiety, and stress in people with DM2 were 13.6%–33.8%, >35%, and 20%–25%, respectively. These statistics have been obtained from studies in Middle East countries, where this association has been frequently studied.<sup>[10–12]</sup> Therefore, patients with DM2 can be at greater risk of depression and anxiety.<sup>[13]</sup>

Currently, in Latin American countries only limited information is available on depression, anxiety, and stress prevalence in patients with DM2. The objective of this study was to evaluate the prevalence of DM2, and risk factors of depression, anxiety, and stress in DM2 ambulatory patients with DM2 from the two most representative third-level hospitals in Quito, Ecuador.

## 2. Materials and Methods

### 2.1. Design and participants

The present cross-sectional study was conducted between April and July 2020 in two tertiary level-of-care hospitals. The population was adult outpatients with DM2 in the age range of 25–85 years old. Patients with a previous history of hospitalization due to DM2, psychiatric illness, cognitive impairment, visual or hearing impairment, illiteracy, and/or illnesses with reduced life expectancy were excluded.

A power calculation based on a prevalence of 17% of depression showed that with 208 DM2 patients in the study the observed prevalence would not depart by more than 5% from the true one with 95% confidence.<sup>[14,15]</sup> In addition, this study report followed the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) reporting guidelines (<https://www.strobe-statement.org/>).

### 2.2. Data collection and variables

Data were collected by means of 21-item Depression, Anxiety, and Stress Scale (DASS-21), where the 21 items are distributed into three subscales to assess symptoms related to depression, anxiety, and stress in the last week. The scores for each item ranged from 0 (absent) to 3 (highly frequent) to assess the intensity of symptoms. The total score for each subscale was obtained by summing the item scores and multiplying the result by 2. For depression, a score <9 was normal, 10–13 mild, 14–20 moderate, 21–27 severe, and >27 extremely severe. For anxiety, a score <7 was normal, 8–9 mild, 10–14 moderate, 15–19 severe, and >19 extremely severe. Regarding stress, a score of <14 was normal, 15–18 mild, 19–25 moderate, 26–33 severe, and >33 extremely severe.<sup>[7]</sup> The DASS-21 approach was validated on a pilot set of patients to verify the clarity and complete understanding of the questionnaire and to ensure the accuracy of the information collected. Information about the socioeconomic, demographic, and clinical status of the disease, as well as comorbidities, was also recorded for each patient. All the participants were informed about the study objectives and voluntarily signed an informed consent form. In addition, a letter of permission was also obtained from both tertiary hospitals. All procedures followed were in accordance with the ethical standards and approved by the Pontifical Catholic University of Ecuador ethics committee and with the Helsinki Declaration.

### 2.3. Statistical analysis

Quantitative data were summarized by mean and standard deviation (SD), while frequency tables (number, percentage) were used for categorical variables. Each prevalent was estimated with a 95% confidence interval (95% CI). The association between disorders and risk factors was assessed by logistic regression analysis and quantified by the odds ratio (OR) with a 95% CI. All results were considered statistically significant at the 5% critical level ( $P < .05$ ). Statistical analyses were performed with the Statistical Package for the Social Sciences (SPSS, version 22, IBM, NY).

## 3. Results

### 3.1. Baseline characteristics

According to the power calculation, a total of 208 patients were enrolled in the study. There were 120 (57.7%) women and 88 (42.3%) men with a mean age of  $69.8 \pm 9.6$  years. Among study patients, 197 (94.7%) were Hispanics, 160 (76.9%) were married, 88 (42.3%) had a primary school degree, and 92 (44.2%) had a secondary school education level. A total of 135 (64.9%) participants were unemployed and 114 (54.8%) had a monthly income below the minimum salary. Comorbidities were present in 130 (62.5%) participants (Table 1).

### 3.2. Participant diabetes assessment

Most of the participants ( $N = 157$ , 75.5%) had more than 5 years of DM2 duration. Of them, 78 patients (37.5%) had a duration from 5 to 10 years, and 79 patients (38.0%) had more than 10 years. The participants had an adequate glucose control with mean of glycosylated hemoglobin (HbA1c) of  $6.03 \pm 0.82\%$  and a mean fasting glucose of  $126.4 \pm 23.5$  mg/dL. Overall, 168 patients (80.8%) had no complications associated with DM2. Additionally, in 186 patients (89.4%) the most common DM2 treatment was lifestyle modifications accompanied by oral drugs. However, 170 patients (81.7%) did not achieve glucose control at least once per week (Table 2).

### 3.3. Prevalence of depression, anxiety, and stress

Anxiety was present in 70 patients (33.7%, 95% CI 27.3–40.5), followed by 66 patients (31.7%, 95% CI 25.4–38.5%) with depression, and 52 patients (25.0%, 95% CI 19.3–31.5%) with stress. In addition, 34 patients suffered moderate depression (16.4%) and 31 patients suffered moderate anxiety (14.9%). In contrast, 18 patients (8.7%) presented mild stress as indicated in Table 3.

### 3.4. Risk factors of depression, anxiety, and stress

Table 4 displays the results of logistic regression to assess the association between risk factors and respectively depression, anxiety, and stress. Overall, men were at lower risk of depression (OR 0.39 [95% CI, 0.18–0.81];  $P = .01$ ), anxiety (OR 0.31 [95% CI, 0.16–0.65];  $P = .002$ ), and stress (OR 0.35 [95% CI, 0.15–0.77];  $P = .009$ ) than women. Similarly, patients with a secondary school educational level had lower chances to develop depression (OR 0.23 [95% CI, 0.11–0.46];  $P < .001$ ), anxiety (OR 0.47 [95% CI, 0.25–0.90];  $P = .02$ ), and stress (OR 0.24 [95% CI, 0.12–0.49];  $P < .001$ ) compared to the others. Lastly, participants with DM2-related complications were more likely to have depression (OR 2.96 [95% CI, 1.32–6.63];  $P = .008$ ), and anxiety (OR 2.56 [95% CI, 1.20–5.48];  $P = .01$ ). When considering depression alone, an income superior to the minimum salary decreased the risk of depression (OR 0.39 [95% CI, 0.16–0.91];  $P = .03$ ).

**Table 1**  
**Sociodemographic characteristics of the participants (N = 208).**

Variable	Category	Mean ± SD or number (%)
Age (y)		69.8 ± 9.6
Gender	Female	120 (57.7)
	Male	88 (42.3)
Race	White	7 (3.4)
	Hispanic	197 (94.7)
	Indigene	1 (0.48)
	African American	2 (0.96)
	Other	1 (0.48)
Body mass index (kg/m <sup>2</sup> )	<18.5	0 (0.0)
	18.5–24.9	28 (13.5)
	25–29.9	123 (59.1)
	30–34.9	44 (21.2)
	35–39.9	6 (2.9)
	>40	7 (3.4)
Marital status	Single	12 (5.8)
	Married	160 (76.9)
	Free union	6 (2.9)
	Divorced/separate	1 (0.48)
	Widow/widower	29 (13.9)
Offspring	Yes	199 (95.7)
	No	9 (4.3)
Current alcohol consumption	Yes	3 (1.4)
	No	205 (98.6)
Frequency of alcohol consumption	Never	205 (98.6)
	At least once a month	3 (1.4)
	Once a week	0 (0.0)
	More than once a week	0 (0.0)
	Daily or almost daily	0 (0.0)
Type of alcoholic drink	Not apply	205 (98.6)
	Beer	2 (0.96)
	Wine	1 (0.48)
	Combined	0 (0.0)
	Other	0 (0.0)
Amount of alcohol (1 glass = 100 mL)	Not apply	205 (98.6)
	Less than a glass	0 (0.0)
	A glass	1 (0.48)
	Two glasses	1 (0.48)
	Three Glasses or more	1 (0.48)
Income*	Less than basic salary	114 (54.8)
	The basic salary	22 (10.6)
	More than basic salary	72 (34.6)
Level of education	No formal education	0 (0.0)
	Primary school	88 (42.3)
	Secondary school	92 (44.2)
	College	28 (13.5)
Working status	Employed	12 (5.8)
	Unemployed	135 (64.9)
	Retired	61 (29.3)
Smoking status	Smoker	16 (7.7)
	Non-smoker	192 (92.3)
Physical activity	Yes	173 (83.2)
	No	35 (16.8)
Hours of physical activity per week	None	35 (16.8)
	An hour or less	51 (24.5)
	Two to three hours	77 (37.0)
	More than three hours	45 (21.6)
Comorbidities	None	13 (6.3)
	Arterial hypertension	142 (68.3)
	Hypothyroidism	63 (30.3)
	Hyperthyroidism	6 (2.9)
	Dyslipidemia	83 (39.9)
	Non-advanced cancer	10 (4.81)
	Other	130 (62.5)
Prior family history	Yes	153 (73.6)
	No	55 (26.4)
Family history of diabetes	Yes	110 (52.9)
	No	98 (47.1)

\*Minimum vital income in Ecuador is 400 USD.

#### 4. Discussion

This study in ambulatory patients with DM2 of 2 public third-level hospitals in Quito (Ecuador) revealed a high prevalence of anxiety, depression, and stress associated with major risk factors, such as female gender and low-level education. However, other risk factors like income and complications of diabetes were associated with depression, and complications of diabetes alone were associated with anxiety.

Several studies have found similar values as ours, with the highest prevalence for anxiety, followed by depression and stress.<sup>[10,11]</sup> With respect to anxiety, one study showed a comparable prevalence among patients with DM2 of around 30%, while in other studies the prevalence ranged around 40%.<sup>[16–19]</sup> As for depression, a meta-analysis found a prevalence varying from 1.8% to 88% with a mean of 28% among patients with DM2.<sup>[20–23]</sup> Lastly, regarding stress, a study found a prevalence of 25.3% in patients with DM2.<sup>[10]</sup> Comparing our study to the studies mentioned above, we found a similar prevalence for anxiety and stress, but a much higher prevalence for depression. In addition, some studies have indicated a bidirectional relationship between depression, anxiety, and stress in patients with DM2.<sup>[24,25]</sup>

**Table 2**  
**Diabetes characteristics of the study participants (N = 208).**

Variable	Category	Mean ± SD or number (%)
Duration of DM2	1–5 years	51 (24.5)
	5–10 years	78 (37.5)
	>10 years	79 (38.0)
Most recent HbA1c level (%)		6.03 ± 0.82
Complications of diabetes	None	168 (80.8)
	Diabetic retinopathy	26 (12.5)
	Diabetic nephropathy	10 (4.8)
	Cardiovascular complications	0 (0.0)
	Diabetic foot ulcers	3 (1.4)
	Other	1 (0.48)
Current diabetes management	Lifestyle modifications	208 (100)
	Oral medications	186 (89.4)
	Insulin	51 (24.5)
	All	31 (14.9)
	Other	0 (0.0)
Glucose control (once a week)	Yes	38 (18.3)
	No	170 (81.7)

DM2 = Type 2 diabetes mellitus.

**Table 3**  
**Prevalence and severity of depression, anxiety and stress among the study participants (N = 208).**

Variable	Category	Number (%)
Depression	Normal	142 (68.3)
	Mild	15 (7.2)
	Moderate	34 (16.4)
	Severe	8 (3.9)
	Extremely severe	9 (4.3)
Anxiety	Normal	138 (66.4)
	Mild	19 (9.1)
	Moderate	31 (14.9)
	Severe	8 (3.9)
	Extremely severe	12 (5.8)
Stress	Normal	156 (75.0)
	Mild	18 (8.7)
	Moderate	16 (7.7)
	Severe	15 (7.2)
	Extremely severe	3 (1.5)

**Table 4****Association between risk factors and depression, anxiety, and stress by logistic regression analysis (N = 208).**

Disorder	Risk factor	Category	Number (%)	OR	95% CI		P value
					Lower	Upper	
Depression	Gender	Female	51 (77.3)	0.39	0.18	0.81	.01
		Male	15 (22.7)				
	Age	<65 years	19 (28.8)	0.74	0.33	1.62	.44
		>65 years	47 (71.2)				
	Level of education	Primary school	45 (68.2)	0.23	0.11	0.46	<.001
		≥Secondary school	21 (31.8)				
	Working status	Employed	4 (6.1)	0.91	0.22	3.82	.89
Unemployed/ Retired		62 (93.9)					
Income	≤ Basic salary	57 (86.4)	0.39	0.16	0.91	.03	
	>Basic salary	9 (13.6)					
Complications of diabetes	Yes	22 (33.3)	2.96	1.32	6.63	.008	
	No	44 (66.7)					
Anxiety	Gender	Female	54 (77.1)	0.32	0.16	0.65	.002
		Male	16 (22.9)				
	Marital Status	Single	4 (5.7)	0.73	0.36	1.50	.39
		With couple	66 (94.3)				
	Level of education	Primary school	40 (57.1)	0.47	0.25	0.90	.02
		≥Secondary school	30 (42.9)				
	Working status	Employed	4 (5.7)	0.73	0.19	2.82	.64
Unemployed/ Retired		66 (94.3)					
Income	≤ Basic salary	54 (77.1)	0.82	0.39	1.70	.58	
	>Basic salary	16 (22.9)					
Complications of diabetes	Yes	22 (31.4)	2.56	1.20	5.48	.01	
	No	48 (68.6)					
Stress	Gender	Female	41 (78.8)	0.35	0.15	0.77	.009
		Male	11 (21.2)				
	Level of education	Primary school	37 (71.2)	0.24	0.12	0.49	<.001
		≥Secondary school	15 (28.8)				
	Working status	Employed	3 (5.8)	0.91	0.20	4.07	.90
		Unemployed/ Retired	49 (94.2)				
	Income	≤ Basic salary	44 (84.6)	0.48	0.20	1.16	.10
>Basic salary		8 (15.4)					

CI = confidence interval, OR = odds ratio.

The variability in the prevalence of the three disorders may be attributed to sociodemographic factors (gender, age, level of education, socioeconomic status, complications, comorbidities, among others) depending on the context of each country.<sup>[26]</sup> However, we need more studies focused on the impact of sociodemographic characteristics to confirm this relationship. Some studies showed that female gender constituted a major risk factor for depression, anxiety and stress with a percentage of approximately 50%–60% in comparison with our study, in which we found a greater predominance.<sup>[16,18,27]</sup> Likewise, primary level of education was considered a significant risk factor for the three pathologies. A meta-analysis of Asian countries reported the same risk factors for depression and a study in Africa reported 7 times higher risk of anxiety in patients with a low educational level.<sup>[28,29]</sup> Regarding complications in patients with DM2, our findings are consistent with some studies that show a prevalence of around 33% for depression, in contrast with a higher prevalence for anxiety reported from a European study (45%).<sup>[30–32]</sup> Furthermore, an African study showed that low economic status was significantly associated with an increased risk of anxiety and depression in patients with DM2, in contrast to our study where low income was associated only with depression.<sup>[17]</sup>

This study had several limitations. First, the study used a non-individualized rapid screening scale (DASS-21) rather than several scales, as is usually done to establish an adequate diagnosis. Second, the study was inadequate to evaluate the bi-directionality of the association between disorders and risk factors; more randomized studies with larger samples are required to determine why the factors found in this study were strongly associated with depression, anxiety, and stress. Third,

the observed prevalence of depression (31.7%) was notably higher than the value expected in the power calculation (17%). Thus, the prevalence of each disorder was estimated with less precision than anticipated (7% rather than 5%). This study confirms the high variability of depression prevalence previously reported in DM2 outpatients; therefore, more studies are needed for a more prevalence precision. Finally, the study did not account for the impact of the current Covid-19 pandemic which may have affected the biological, social, and economic environment and in turn the patient's psychological sphere. The generalizability of our results needs to be validated by new studies in Latin American countries, we recommend performing a periodic screening in patients with DM2 to detect early symptoms of depression, anxiety, and stress with the DASS-21 questionnaire to provide integral care to the patient. In addition, more studies in larger populations of patients with DM2 in Latin American countries are needed to validate these results.

## 5. Conclusion

DM2 was associated with mild and moderate anxiety, depression, and stress and the main factors significantly associated were female gender and a low level of education.

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## Author contributions

LC and AM: study design, conducting the survey, revising the questionnaire, and manuscript writing; JLP and MC: contributed to the data analysis and manuscript edition; MC, CM, and NA: provided administrative support and supervision. All authors have read and approved the manuscript.

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