ORIGINAL RESEARCH

The Relationship Between Depression and Multifactorial Control and Microvascular Complications in Vietnamese with Type 2 Diabetes Mellitus Aged 30–60 Years

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Background: Depression is a common mental disorder in people with type 2 diabetes mellitus (T2DM). Depression and T2DM have a reciprocal interaction through many factors, of which the most important is the multifactorial control and microvascular complications of T2DM.

Aim: This research aims to determine the rate of depression and the association between depression and multifactorial control and microvascular complications in patients with T2DM aged 30–60 years in Vietnam.

Methods: A cross-sectional and descriptive study was conducted on 231 outpatients with T2DM at Bach Mai hospital, Hanoi, Vietnam. Depression severity was measured with the Patient Health Questionnaire-9 (PHQ-9).

Results: The rate of depression in patients with T2DM aged 30–60 years was 16.9% (in which, the rate of mild depression was 15.2% and moderate depression was 1.7%; no serious depression). The prevalence of depression was higher in female patients than in male patients (p = 0.049). There is a statistically significant difference in the rate of depression by age, duration of diabetes, and treatment method for type 2 diabetes. Poor HbA1c control and microvascular complications increase the risk of depression (OR = 2.37; 95% CI 1.11–5.02, p = 0.033 and OR = 2.62; 95% CI 1.15–5.93, p = 0.027, respectively). When the multivariate analysis was performed, it was shown that sex, treatment for glycemic control, and microvascular complications had a statistically significant influence on PHQ-9 score.

Conclusion: In Vietnam, there are 16.9% of patients with T2DM aged 30–60 years suffer from depression. Poor HbA1c control, the presence of microvascular complications, and without antihyperglycemic treatment increase the risk of developing depression.

Keywords: type 2 diabetes mellitus aged 30–60 years, depression, multifactorial control, microvascular complications

Introduction

The association between depression and type 2 diabetes mellitus (T2DM) was first documented in the literature more than 300 years ago when Willis made the surprising conclusion that diabetes was caused by persistent depression.[1] Then, a series of studies around the world focused on the occurrence of depression in diabetic patients or the development of diabetes due to depression and most authors agree that the relationship between depression and diabetes is a reciprocal relationship.[2,3] Results

from the World Mental Health survey showed that the rate of depression is higher in people with diabetes than in people without diabetes.[4]

The cause and mechanism of depression in T2DM are not fully understood so far. There are two main hypotheses about whether depression occurs or recurrence in T2DM. Firstly, depression is the result of birth defects. Many studies have reported the general biological background between diabetes and depression.[5,6] Alteration of the hypothalamic–pituitary–adrenal axis, such as increased cortisol production in depressed patients, is also observed in diabetics.[7] Metabolic disorders of neurotransmitters, especially norepinephrine and serotonin in depressed patients, are also observed in diabetics.[8,9] Secondly, depression is a consequence of psychosocial factors related to diabetes. Some studies suggest that depression is associated with difficulty in liking with suspected complications in diabetics.[8,10,11] There was a relationship between pathological variables (such as inactivity) and indirect depression through the perception of the harmful effects of diabetes mellitus.[12]

Depression that occurs in a person with diabetes can have serious consequences both on the physical and mental side of the patient.[2,13] Depression makes people with diabetes less physically active, easily abuses alcohol and tobacco, has poor eating habits, and poor adherence to diabetes treatment regimens.[11,14] Studies have demonstrated that depression increases the risk of persistent hyperglycemia, increases vascular complications and mortality.[15,16] As a result, the patient's quality of life and the economic burden associated with diabetes become more severe.[17–19] Clinically, depression is commonly diagnosed based on diagnostic criteria, questions, or scales to assess depression, such as the International Classification of Diseases tenth revision (ICD-10) depression diagnostic standard, the Patient Health Questionnaire-9 (PHQ-9), Beck's depression detection scale, Hamilton Depression Rating Scale, and Montgomery Asberg Depression Rating Scale, in which PHQ-9 is considered a short and reliable questionnaire that has been studied and applied in many countries around the world to screen and evaluate depression.[20,21] The PHQ-9 is not only suitable for screening for major depressive stages in the community[22] but also reliable to diagnose depressive disorders in adults.[23]

In Vietnam, T2DM accounts for about 5.4–6.0% of the population and continues to increase. Patients face many health problems at the same time, both physical and psychological, the complications of the disease, and the increasing cost of treatment. Therefore, it has a significant effect on the mental health of the patient. To the best of our knowledge, there are very few studies on depression in patients with T2DM who are of working age, so we implemented this study with the aim: to determine the rate of depression and the association between depression and multifactorial control and microvascular complications in outpatient with T2DM aged 30–60 years old.

Materials and Methods
Study Population and Design
Study subjects include all outpatients diagnosed with T2DM according to the American Diabetes Association (ADA 2014) criteria aged from 30 to 60 years old at the Medical Examination Service, Bach Mai Hospital, Hanoi, Vietnam. Exclusion criteria included other types of diabetes (type 1 diabetes, gestational diabetes, specific types of diabetes based on ADA 2014 classification), T2DM with a combination of advanced cancer and other life-threatening conditions, patients are experiencing acute complications (such as ketoacidosis coma, hyperosmolar coma, acute hypoglycemic coma, septic shock, sepsis), abnormal thyroid function, and patients diagnosed with a psychiatric disorder prior to the onset of diabetes or being treated for mental illness. All patients were explained about the study procedure and were given two identical informed consents. One copy was kept by the patient and one was kept by the research team.

The sample size (n) of 231 patients with T2DM was calculated according to the "estimate a population proportion" formula used for qualitative analysis in descriptive and analytical research as follows: $n = [Z^2_{(1-\alpha/2)} \times p(1 - p)]/\Delta^2$, where $p = 0.183$ is the rate of depression in the population of patients with T2DM using the PHQ-9 questionnaire in Zhang's study in 2013, in Hong Kong,[24] $Z^2_{(1-\alpha/2)} = 1.96$ is the value corresponding to $\alpha = 0.05$ and Δ is the desired deviation between the rate obtained from our study sample and p of 0.183 of the previous study population. In our study, $\Delta = 0.05$.

Study Protocol

The following steps were carried out on the day of examination: administrative information (name, age, gender, address, and occupation), previous medical history and current diseases, examination for clinical signs and symptoms and diabetic complications, laboratory tests, and questionnaire PHQ-9.

We used PHQ-9 to detect symptoms and evaluate depression.[25] Briefly, patients sat in a quiet private room with an imposing seriousness, openness, and friendliness on the same day with the clinical and paraclinical examination. An experimenter explained carefully and thoroughly for patients to understand each question in PHQ-9. Patients were given enough time to think and answer each question. The experimenter gave points to each reply from patients and summed up all the points. According to PHQ-9: 0–4 points: no depression; 5–9 points: mild depression; 10–14 points: moderate depression; 15–19 points: moderate-severe depression; and 20–27 points: severe depression.

Blood tests were performed at the medical examination and treatment department at the Bach Mai Hospital: blood collection techniques and testing comply with Bach Mai hospital's procedures. Fasting venous blood samples were taken early in the morning and then were used to measure blood glucose, HbA1c, total cholesterol, triglyceride, HDL-C, and LDL-C by the Roche Cobas 6000 automated biochemistry machine. Twenty-four-hour urine samples were collected on the same day and were used to measure albuminuria by enzymatic turbidimeter autoanalyzer.

Patients were considered to have diabetic microvascular complications when one of the following abnormalities was present: kidney damage with microalbuminuria measurement >30 mg/24 hours;[26] ophthalmoscopy showing proliferative or pre-proliferative retinopathies diagnosed by an ophthalmologist; peripheral neuropathies based on the UK screening test (UKST) >2 points.[27]

Ethical Statement

All patients provided written informed consent and agreed to participate in this study. The protocol was approved by the Institutional Review Board of the Hanoi Medical University, Hanoi, Vietnam (No.3788/QĐ-ĐHYHN). The study was also conducted using good clinical practice following the Declaration of Helsinki.

Statistical Analysis

All results are presented as mean (SD) or, if skewed, as median (interquartile range) for the continuous variables, and as a percentage for categorical variables. Differences between groups were examined with Student's *t*-test or Mann–Whitney's test. The chi-square test or fisher's exact test of association is used to discover if there is a relationship between two categorical variables. The relationships between indicators of depression (or PHQ-9) and other factors were determined using univariable linear regression and multivariable linear regression. Pearson's r and standardized B were calculated for the correlation between PHQ-9 indices and variables (such as age, gender, treatment therapy, and HbA1c control). The Kruskal–Wallis H-test was used to determine if there are statistically significant differences between the three groups of treatment options on the PHQ9-score. A *p*-value <0.05 was considered statistically significant. Data were processed using SPSS software version 26 (64-bit) for Window (SPSS Inc., Chicago, IL).

Results

The median age of the study group was 52 years; the percentage of patients who achieved the target goal of the factors was as follows: 48.9% for BMI <23 kg/m^2, 77.5% for accepted control for blood pressure, 29.0% for glucose, 44.6% for HbA1c, 42.0% for triglycerides, 50.6% for total cholesterol, 79.2% for HDL-C, and 72.6% for LDL-C; the rate of accepted control of triglycerides and HDL-C were significantly higher in women than those in men (p < 0.05); the rate of newly diagnosed patients without treatment was 18.2%, the rate of patients with lifestyle modification in combination with oral antihyperglycemic agents was 71.9%, the rate of patients using insulin was 10.0%; the rate of patients with microvascular complications was 15.6% and there was no difference between men and women (p > 0.05) (Table 1).

The rate of depression in patients with type 2 diabetes was 16.9%. Of which, mild depression accounted for 15.2%, moderate depression made up 1.7%, and no serious depression. The prevalence of depression was higher in female patients than in male patients (p = 0.049). The percentage of depression among male patients was 12.3%, whilst it was

Table 1 The Demographic and Biomedical Characteristics of the Study Population

Variables, Unit		Men (n=122)	Women (n=109)	All (n=231)
Age, years		51.5 (45.3–57)	53.0 (44.8–57)	52 (45–57)
Duration of diabetes (%)	Newly diagnosed	27 (22.1)	15 (13.8)	42 (18.2)
	< 5 years	84 (68.9)	75 (68.8)	159 (68.8)
	≥ 5 years	11 (9.0)	19 (17.4)	30 (13.0)
Hypertension	Positive	25 (20.5)	27 (24.8)	52 (22.5)
	Negative	97 (79.5)	82 (75.2)	179 (77.5)
BMI, n(%)	< 23 kg/m^2	55 (45.1)	58 (53.2)	113 (48.9)
	≥ 23 kg/m^2	67 (54.9)	51 (46.8)	118 (51.1)
Treatment therapy, n(%)*	Naive	27 (22.1)	15 (13.8)	42 (18.2)
	Lifestyle modification, oral antihyperglycemic agents	79 (64.8)	87 (79.8)	166 (71.9)
	Insulin therapy	16 (13.1)	7 (6.4)	23 (10.0)
Glucose control, n(%)	Poor (≥ 7.0 mmol/L)	92 (75.4)	72 (66.1)	164 (71.0)
	Accept (< 7.0 mmol/L)	30 (24.6)	37 (33.9)	67 (29.0)
	Overall (mmol/L)	8.4 (6.9–11.3)	7.7 (6.7–9.5)	8.2 (6.7–10.7)
HbA1c control, %	Poor (≥ 7.5%)	74 (60.7)	54 (49.5)	128 (55.4)
	Accept (< 7.5%)	48 (39.3)	55 (50.5)	103 (44.6)
	Overall	7.8 (6.9–9.6)	7.3 (6.5–9.1)	7.6 (6.6–9.3)
Triglycerides control, n(%)	Accept (< 1.88 mmol/L)*	42 (34.4)	55 (50.5)	97 (42.0)
	Poor (≥ 1.88 mmol/L)*	80 (65.6)	54 (49.5)	134 (58.0)
	Overall (mmol/L)**	2.5 (1.5–3.3)	1.9 (1.4–2.9)	2.2 (1.4–3.2)
Total cholesterol control, n(%)	Accept (< 5.20 mmol/L)	57 (46.7)	60 (55.0)	117 (50.6)
	Poor (≥ 5.20 mmol/L)	65 (53.3)	49 (45.0)	114 (49.4)
	Overall (mmol/L)	5.35±1.33	5.04±1.11	5.2±0.1
HDL-C control, n(%)	Poor (< 0.90 mmol/L)*	33 (27.0)	15 (13.8)	48 (20.8)
	Accept (≥ 0.90 mmol/L)*	89 (73.0)	94 (86.2)	183 (79.2)
	Overall (mmol/L)	1.0 (0.9–1.2)	1.2±0.03	1.1 (1.0–1.3)
LDL-C control, n(%)	Poor (≥ 3.40 mmol/L)	33 (28.9)	28 (25.7)	61 (27.4)
	Accept (< 3.40 mmol/L)	81 (71.1)	81 (74.3)	162 (72.6)
	Overall (mmol/L)	2.9±0.1	2.8±0.1	2.9±0.1
Lipid disorders, n(%)**	Positive	114 (93.4)	86 (78.9)	200 (86.6)
	Negative	8 (6.6)	23 (21.1)	31 (13.4)
Alanine transferase, U/L*		29.8 (18.3–44.7)	24.3 (17.4–36.3)	27.2 (18–41.4)

(Continued)

Table 1 (Continued).

Variables, Unit		Men (n=122)	Women (n=109)	All (n=231)
Aspartate transferase, U/L*		22.85 (19.2–31.3)	22.1 (17–28.7)	22.7 (18.4–29.5)
Creatinine, μmol/L**		73.3 (65.0–80.8)	53.3 (46.3–59.6)	62.8 (50.5–75)
Microvascular complications	Positive	14 (11.5)	22 (20.2)	36 (15.6)
	Negative	108 (88.5)	87 (79.8)	195 (84.4)

Notes: Data were illustrated into Mean±SD or number (percentage) or Median (Q1–Q3); *p < 0.05; **p < 0.001 (between men and women group).
Abbreviations: BMI, body mass index; HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol.

22.0% among female patients. The degree of depression and PHQ-9 scores were not statistically different between men and women (p > 0.05) (Table 2).

There was a statistically significant difference in the rate of depression by age group (p = 0.026), duration of diabetes (p = 0.001) and treatment method for T2DM (p = 0.002). Poor control of HbA1c and present microvascular complications increased the risk of developing depression (OR = 2.37, 95% CI 1.11–5.02, p = 0.033 and OR = 2.62, 95% CI 1.15–5.93, p = 0.027); The rate of depression was not statistically significant compared with the control levels of blood pressure, BMI, blood lipids, and glucose (p > 0.05) (Table 3).

When the multivariate analysis was performed, it was shown that sex, treatment for glycemic control, and microvascular complications had a statistically significant influence on the PHQ-9 score. Regarding therapeutic options, patients without any antihyperglycemic intervention tended to have higher PHQ-9 scores than those treated with insulin (p = 0.01) (Table 4).

Discussion
The Prevalence of Depression in T2DM at Working Age
We screened and assessed depression using the PHQ-9 questionnaire on 231 patients with T2DM, showing that the number of patients with depression was 16.9%. In which mild depression made up 15.2%, moderate depression

Table 2 The Prevalence of Depression in Type 2 Diabetes Mellitus Aged 30–60 Years

Variables, Units		Men (n = 122)	Women (n = 109)	Overall (n = 231)
PHQ-9 scores	Median (Q1-Q3)	2.0 (2.0–3.0)	3.0 (2.0–4.0)	3.0 (2.0–4.0)
	Mean rank	108.67	124.20	
	p-value*		p = 0.068; Z = −1.826	
Depression	Positive	15 (12.3)	24 (22.0)	39 (16.9)
	Negative	107 (87.7)	85 (78.0)	192 (83.1)
	p-value**		p = 0.049	
			OR = 2.01; 95% CI (0.99–4.08)	
Grade depression	Mild	14 (11.5)	21 (19.3)	35 (15.2)
	Moderate	1 (0.8)	3 (2.8)	4 (1.7)
	Severe	0	0	0
	p-value***		p = 0.122	

Notes: *Mann–Whitney U-test; p-value (between men and women). **Chi-square test; p-value (between men and women). ***Fisher's Exact test; p-value (between men and women).
Abbreviation: PHQ-9, Patient Health Questionnaire-9.

Table 3 Relationship Between Depression and Multifactor and Microvascular Complications in Patients with Type 2 Diabetes

Variables, Units		Depression n(%)		p
		Positive	Negative	
Gender	Male	15 (38.5)	107 (55.7)	0.054
	Female	24 (61.5)	85 (44.3)	
Age (years)	30–40	4 (10.3)	24 (12.5)	0.026
	41–50	5 (12.8)	63 (32.8)	
	51–60	30 (76.9)	105 (54.7)	
Duration of diabetes	Newly diagnosed	15 (35.7)	27 (64.3)	0.001
	< 5 years	19 (11.9)	140 (88.1)	
	≥ 5 years	5 (16.7)	25 (83.3)	
Treatment therapy	Naive	15 (35.7)	27 (64.3)	0.002
	Lifestyle modification, oral antihyperglycemic agents	21 (12.7)	145 (87.3)	
	Insulin therapy	3 (13.0)	20 (87.0)	
BMI control	Accept	22 (56.4)	91 (47.4)	0.380
	Poor	17 (43.6)	101 (52.6)	
Hypertension control	Good	10 (26.5)	42 (21.9)	0.674
	None	29 (74.4)	150 (78.1)	
Glucose control	Poor	31 (79.5)	133 (69.3)	0.247
	Accept	8 (20.5)	59 (30.7)	
HbA1c control	Poor	28 (71.8)	100 (52.1)	OR=2.37 95% CI (1.11–5.02) p=0.033
	Accept	11 (28.2)	92 (47.9)	
Cholesterol control	Poor	22 (56.4)	92 (47.9)	0.382
	Accept	17 (43.6)	100 (52.1)	
Triglyceride control	Poor	21 (53.8)	113 (58.9)	0.596
	Accept	18 (46.2)	79 (41.1)	
HDL-C control	Poor	5 (12.8)	43 (22.4)	0.202
	Accept	34 (87.2)	149 (77.6)	
LDL-C control	Poor	13 (33.3)	48 (26.1)	0.429
	Accept	26 (66.7)	136 (73.9)	
Lipid disorders control	Positive	36 (92.3)	164 (85.4)	0.312
	Negative	3 (7.7)	28 (14.6)	

(*Continued*)

Table 3 (Continued).

Variables, Units		Depression n(%)		*p*
		Positive	**Negative**	
Microvascular complications	Positive	11 (28.2)	25 (13.0)	OR=2.62 95% CI (1.15–5.93) p=0.027
	Negative	28 (71.8)	167 (87.0)	

Abbreviations: BMI, body mass index; HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol.

Table 4 Multivariate Linear Regression Between PHQ-9 Scores and Age, Gender, Treatment Therapy, HbA1c Control and Microvascular Complications

Determinant	Standardized B	*p*-value
Age (years)	0.084	0.205
Gender (1 = male; 2 = female)	0.135	0.039

Treatment therapy:
   Naive (1 = positive, 0 = negative)
   Lifestyle modification, oral antihyperglycemic agents (1 = positive, 0 = negative)
   Insulin therapy (control)
	
	0.258
	0.049
	1
		
		0.010
		0.620

HbA1c control (1 = poor, 2 = acceptable)	−0.088	0.173
Microvascular complications (1 = positive, 2 = negative)	−0.151	0.026

Abbreviation: PHQ-9, Patient Health Questionnaire-9.

accounted for 1.7%, and no patient had a serious level. A World Health Survey, which estimated the prevalence of depression (based on ICD-10 diagnostic criteria) in 245,404 people in 60 countries from various regions of the world, results showed that in one year, the rate of a single depressive episode was 3.2% and the rate of depression in people with diabetes was 9.3%.[28] Another study, which combined 10 controlled studies with a total of 51,331 people, found that the rate of depression in subjects with T2DM was 17.6% and this rate in subjects without diabetes was 9.8%, the rate of depression in women was higher than in men with diabetes.[29] A study in a rural community in Pakistan showed that the rate of depression in diabetes patients was 14.7% and 4.9% of people without diabetes.[30] In Hong Kong, China in 2013, the rate of depression in T2DM outpatients surveyed by the PHQ-9 questionnaire was 18.3%.[24] The rate of patients with depression was in T2DM patients in this study tended to be lower in Vietnam than in many other studies, this may be due to the difference in age of the patients participating in the survey and the unique characteristics of the conditions of society. Currently, in Vietnam, the situation of diabetes control has been receiving more and more attention from the Government with large-scale action programs nationwide, such as that diabetic patients are provided with anti-diabetic drugs, educated of basic understandings of diabetes, counseled on nutrition issues and treatment methods and shared from family and community.

The results of this study also showed that the prevalence of T2DM at working age was lower than that compared with other age groups. The study of patients with T2DM showed that patients who were over 60 years old had a higher rate of depression (higher than other age groups).[31] In Vietnam, a study showed that the rate of depression in T2DM patients aged 18 years and older in Hue city was 23.2%,[32] while the proportion of patients with signs of depression susceptibility in elderly patients with T2DM was 79.4%.[33] The more they are aging, the more adverse factors they will have to face such as difficulty in controlling blood glucose, increasing chronic complications, increasing treatment costs, other pressures from social families.[8,29]

In our study, the rate of depression in the patients with newly diagnosed T2DM was the highest (35.7%). The effect of the duration of diabetes on depression varies by a study.[34,35] Patients with newly diagnosed T2DM have not been consulted for treatment, but they are often confused, worried, and scared about the disease, considering it was a dangerous and uncured disease they had to adopt and adapt for the rest of their lives, leaving economical and psychological consequences.

The Relationship Between Depression and Multifactorial Control and Microvascular Complications Patients with T2DM

The results of our study showed that the percentage of depression was different among patients stratified by diabetes treatments, in which the depression rate was the highest in the group of patients who had not been treated for diabetes. Previous studies showed that patients with diabetes treated with oral drugs had lower depression scores than patients using insulin.[31,36] However, in our study, we studied subjects aged from 30 to 60 years old. The majority of patients were controlled blood glucose by lifestyle modifies, adjusting their diet, and using oral drugs (71.9%), the proportion of patients using insulin was very low (10.0%) so the effect of insulin usage on depression could not be assessed. Besides, for the youngest subjects, especially working-age people with diabetes, in addition to worrying about the disease, having to regularly take medicine and visit medical facilities was also a big challenge, which even made them drop out of diabetes treatment. As a result, the rate of depression in this group was quite high.

When considering the association between multifactorial control (glucose, BMI, lipid profiles, and blood pressure) and depression, we found that the percentage of patients whose control level reached the goal of glucose was quite low (29.0%), that of HbA1c was 44.6% and the poor control of HbA1c increased the risk of depression significantly (OR = 2.37, p = 0.033), while the rate of control reached the goal of other factors, such as blood pressure, blood lipids achieved higher goals. In fact, the relationship between poor blood glucose control and depression has a reciprocal nature: people with depression often experience behaviors of fatigue, depression, eating, living in moderation, even they do not adhere to treatment easily lead to difficulty in controlling blood glucose.[37] In contrast, diabetic patients with poor blood glucose control had a higher risk of depression due to the presence of more metabolic stress as well as anxiety about their medical status.[38–40] T2DM is characterized by concomitant insulin resistance and hyperglycemia, and both have the potential to induce systemic inflammation, which in turn releases cytokines including tumor necrosis factor (TNF)-α, interferon (INF)-γ, interleukin (IL)-2, IL-4, IL-8, IL-10, and IL-12. These cytokines may induce depressive symptoms through effects on monoamines and other neurotransmitters, effects on neuroplasticity, effects on the hypothalamic–pituitary–adrenal system.[41,42]

Both univariate and multivariate analyses showed that patients with T2DM with microvascular complications were at increased risk for depression. And patients without any antihyperglycemic intervention had higher PHQ-9 scores than those treated with insulin. Previous studies have shown that the presence of microvascular complications increases the risk of depression.[29,43,44] Psychological stress increases sharply in the first two years after patients have concomitant retinopathy, and retinopathy is an important risk factor for increased rates of depression in patients with T2DM.[45] There is an association between diabetic neuropathy and anxiety and depression degree through perceptions of diabetic neuropathy symptom unpredictability and the lack of treatment control and restrictions in activities of daily living and changes in social self-perception.[46] Renal disease progression may be associated with increased risk and severity of depression, albuminuria being more strongly associated with depression than glomerular filtration rate.[47]

There were some limitations of our study. This study was implemented on a relatively small sample size. Besides, we had not been able to associate between the social factors and depression of the participants.

Conclusion

The prevalence of depression in patients aged 30–60 years with T2DM in Vietnam is 16.9%. Regarding the severity of depression, mild depression accounts for 15.2%, moderate depression makes up 1.7%. Diabetes management, HbA1c control, and microvascular complications have a statistically significant effect on the rate of depression.

Abbreviations

T2DM, type 2 diabetes mellitus; PHQ-9, Patient Health Questionnaire-9; ICD-10, international classification of diseases tenth revision; BMI, body mass index; SD, standard deviation; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; OR, odds ratio; CI, confidence interval.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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