

# Severity and Factors Associated with Depressive Symptoms Among Type 2 Diabetic Patients in Vietnam

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## Abstract

**Background.** Diabetes and psychiatric disorders often co-occur. The prevalence of depression in a person with diabetes is two times higher than that of the general population. During the last decade, the prevalence of diabetes in Vietnam has nearly doubled. However, there is little data regarding depressive symptoms among people with diabetes. Therefore, this study aims to explore the level of depressive symptoms and its associated factors among patients with type 2 diabetes mellitus in Hanoi, Vietnam.

**Methodology.** A cross-sectional study was conducted among 519 patients diagnosed with type 2 diabetes at the Agricultural General Hospital, one of the largest primary care hospitals for diabetes in Hanoi, Vietnam. Patient Health Questionnaire-9 (PHQ-9) was used to assess the severity of depressive symptoms. Multivariate Tobit and logistic regression models were applied to examine factors associated with the severity of depressive symptoms and medication adherence

**Results.** Approximately 45.2% of participants were identified as having depressive symptoms at different levels. The proportion of patients with mild, moderate, moderately severe, and severe depressive symptoms is 36.0%, 7.6%, 1.4%, and 0.2% respectively. Regarding the treatment process, patients being treated for their diabetes for a longer time were more likely to have depressive symptoms. Depression was positively linked to currently drinking alcohol (Coef = 1.04; 95% CI = 0.30-1.78), having comorbidities (Coef = 1.08; 95% CI = 0.15; 2.01) and having irregular physical activities (Coef = -1.28; 95% CI = -2.18; -0.38). Patients with severe depressive symptoms (higher PHQ-9 score) were more likely to be non-adherent to their medications in the last month (AOR = 1.30; 95% CI = 1.17; 1.46).

**Conclusion.** Our study shows that a high percentage of patients with diabetes have depressive symptoms. There is a strong association between having depressive symptoms and non-adherence to medications in the last month. To reduce the risk of developing depressive symptoms, depression should be screened at the initial treatment process and patients should be advised to avoid alcohol and to engage in physical activities regularly.

**Key words:** diabetes, depression, depressive symptom, medication adherence, Vietnam

## INTRODUCTION

Diabetes is considered a major public health concern which is increasing dramatically in all countries. The estimated number of individuals with diabetes currently stands at 537 million, with projections indicating that this figure will rise to 643 million by 2030 and further increase to 783 million by 2045.<sup>1</sup> Nearly 80% of those with diabetes reside in low- and middle-income countries (LMICs), where the prevalence is rising rapidly. About 90% of those with diabetes have type 2 diabetes.<sup>2,3</sup> Between 2000 and 2019, there was a 3% increase in diabetes mortality rates by age.<sup>4</sup> During the year 2019, diabetes directly resulted in

1.5 million deaths, with nearly half (48%) of those deaths occurring before individuals reached the age of 70.<sup>5</sup>

Diabetes and psychiatric disorders often co-occur. The prevalence of depression in persons with diabetes is two times higher than that of the general population,<sup>6-8</sup> and share a bidirectional relationship. However, psychiatric disorders are commonly undiagnosed or underestimated among people with diabetes.<sup>9</sup> People with mental health problems are more likely to experience unhealthy lifestyles (overeating or physical inactivity) which adds to the development of diabetes.<sup>6</sup> Meanwhile, the necessity for persons with diabetes to strictly adhere to medication

and self-care regimens, and the costs associated with medical care, may lead to psychological impairments.<sup>10-12</sup> Both mental disorders and diabetes may negatively affect the quality of life of patients with diabetes.<sup>13</sup> Where comorbidity occurs, it presents significant clinical challenges and worsens the health outcomes of patients.<sup>14</sup>

The prevalence of psychological problems among patients with diabetes varies across settings. A study assessing depressive symptoms using the Geriatric Depression Scale in elderly patients with diabetes in the National Geriatric Hospital, Hanoi, Vietnam revealed that up to 80% of patients had depressive symptoms,<sup>15</sup> whereas only 30.6% of a Japanese sample of elderly patients with diabetes, screened with the Patient Health Questionnaire 9 (PHQ-9) reported depressive symptoms.<sup>16</sup> Furthermore, a cross-sectional study from India using the PHQ-9 found that 18% of the participants suffered from moderate (PHQ-9 range from 10 – 14) or severe depression (PHQ-9  $\geq 20$ ).<sup>17</sup>

During the last decade, the prevalence of diabetes in Vietnam has nearly doubled, to an alarming level. New diagnoses were most common in young people in urban areas.<sup>18</sup> In 2016, one in every 20 people was diagnosed with diabetes, and diabetes was more prevalent in urban than in rural areas.<sup>19</sup> However, there is little data regarding depressive symptoms among people with diabetes. Therefore, this study aims to explore the level of depressive symptoms and its associated factors among patients with type 2 diabetes mellitus in Hanoi, Vietnam. This is the first and critical step towards priority setting, implementation, and assessment of a psychological intervention program for patients with diabetes in the community.

## METHODOLOGY

### Subjects

A cross-sectional study was conducted involving outpatient diabetes patients that were under treatment at the Family Medicine Center (FMC) of the Agricultural General Hospital, Hanoi, Vietnam, one of the largest epicenters that offers health services for patients with diabetes.<sup>20</sup>

The inclusion criteria were (1) Age 18 years old or above; (2) Diagnosed with type 2 diabetes at least 6 months prior to the study, according to the “Guidelines for Diagnosis and Treatment of Type 2 Diabetes” issued by the Vietnamese Ministry of Health in 2017 (Decision No. 3319/QD-BYT);<sup>21</sup> (3) Registered as an outpatient receiving treatment for diabetes in the Department of Outpatient of Agricultural General Hospital; (4) Able to read, write and communicate with the interviewer. We excluded patients who had severe disease conditions or refused to take part in the study. Eligible patients were asked for written informed consent before participating in the study.

The sample size was based on the findings of Hermanns et al., with an estimated 14.1% of patients with diabetes

having depressive symptoms. With an  $\alpha = 0.05$  and  $\epsilon = 0.03$ , the required sample size was computed to be 517 patients. Anticipating refusal to participate in the study, we invited 519 patients. Convenience sampling was done from the lists of patients who were scheduled for a routine follow-up appointment.

### Materials and methods

Following their scheduled routine health appointments, patients were invited to fill out a 20-minute questionnaire, consisting of the following segments: Sociodemographic characteristics such as gender, age, occupation and educational level, and Diabetes treatment-related and health risk behavior characteristics.

Participants were asked about the duration of their diabetes, comorbidities including hypertension, dyslipidemia, heart diseases and lung diseases, alcohol consumption, smoking behaviors, and physical activity.

### Patient Health Questionnaire (PHQ-9)

To assess the severity of depressive symptoms among patients with diabetes, the Patient Health Questionnaire (PHQ-9) was used. This tool was formulated based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria and the Vietnamese version was shown to be highly valid and reliable.<sup>22</sup> The questionnaire has nine items, and each item may be scored from 0 to 3; therefore, the total score may range from 0 to 27.

The following cut-offs were used to classify depression severity: 0–4 points is normal, 5–9 points is mild, 10–14 points is moderate, 15–19 points is moderate-severe, and  $\geq 20$  points is severe. Patients with scores higher than 4 were considered as “having depressive symptoms.”<sup>23</sup>

The questionnaire was piloted on 20 volunteers (also outpatient diabetes), resulting in minor changes in the wording of diabetes treatment-related characteristics. During the study, the questionnaire was administered by a final-year nursing student, who had been well-trained regarding the study objectives, the questionnaire, and how to collect data.

### Statistical analysis

Multivariate Tobit and logistic regression models were applied to examine factors associated with the severity of depressive symptoms and medication adherence. To identify the reduced regression model, we added a forward stepwise selection strategy with a threshold of less than 0.2. A  $p$ -value less than 0.05 was considered statistically significant. Pearson’s chi-square test was used for categorical variables, and the Mann-Whitney U test was used for non-parametric continuous variables for comparing demographic characteristics, and health risk behaviors of participants between those who have and those who do not have depressive symptoms. All data analyses

were done using STATA software version 12 (Stata Corp. LP, College Station, United States of America).

### Ethics approval

Ethics approval was obtained from the Institutional Review Board of Hanoi University of Public Health number 316/2021/YTCC-HD3 on the 12<sup>th</sup> of July 2021.

### RESULTS

The socioeconomic characteristics of patients with diabetes are presented in Table 1. Of the 519 type 2 outpatients with diabetes invited to the study, 516 (99.4%) participated. Most participants finished secondary school (48.6%), retired (63.2%), and enrolled in a compulsory public health insurance scheme (78.7%). There were 231 patients (44.8%) with depression symptoms, ranging from mild to severe levels (PHQ-9  $\geq 5$ ).

While the study could not find a significant difference in the educational level and occupation of surveyed patients with diabetes, health insurance schemes of the two groups were significantly different.

Patients with diabetes with depressive symptoms were older and lived farther from health facilities than patients without depressive symptoms ( $p < .05$ ). The mean age of the whole sample size was 67 years old (SD = 9.0) and those who were depressed were statistically significantly older than those who did not have depression (68 and 66 years old respectively). The distance to health facilities between the two groups showed the same result, and the mean distance was 5.4 km (SD = 5.1).

Table 2 highlights the clinical-related symptoms and health risk behaviors of patients with diabetes. About 10% and more than 15% of participants currently smoked and

drank alcohol respectively. The majority of the participants (84.0%) engaged in daily physical activities. The prevalence of comorbidities was high (90.3%) and 16.7% of patients reported having side effects from their medications within the last 3 months. Regarding disease symptoms, 17.1% of patients reported headache, dizziness and about one-third had numbness of the limbs. Approximately 10% of the participants reported forgetting to take their medications within the last month. The mean duration of the disease was 8.0 years (SD = 6.5) and the mean BMI was 22.8 (SD = 2.8). Only alcohol drinking was found to be significantly different between groups.

Table 3 indicates the depressive symptom characteristics of patients with diabetes. About 36.0% of participants were classified as having mild depressive symptoms, while 10% scored worse (PHQ-9  $\geq 10$ ). The percentage of patients experiencing moderate, moderate-severe and severe depressive symptoms were 7.6%, 1.4% and 0.2%, respectively. The mean score of PHQ-9 was 5.0 (SD = 2.9), which is in the range of 'mild' symptoms.

Figure 1 depicts the mean score of PHQ-9 plotted against disease duration. The mean PHQ score was relatively constant (i.e., 5 points) among those having diabetes for 0-20 years but gradually increased thereafter.

The results of the multivariate regression models to identify factors associated with having depressive symptoms are shown in Table 4. Older people have more depressive symptoms (Coef = 0.05; 95% CI = 0.01-0.08). Patients who currently drink alcohol were more likely to have higher depressive symptoms compared to those who never use alcohol (Coef = 1.04; 95% CI = 0.30-1.78). In terms of physical activity, exercising several times a week or every day was also associated with a lower score of PHQ-9 (Coef = -0.96; 95% CI = -2.33; -0.42 and Coef = -1.28; 95% CI = -2.18; -0.38, respectively). By contrast, participants with

**Table 1.** Socio-economic characteristics

	Having depressive symptoms						p
	Yes		No		Total		
	n	%	n	%	n	%	
Total	231	44.8	285	55.2	516	100	
Gender							
Male	95	41.1	125	43.9	220	42.6	0.53
Female	136	58.9	160	56.1	296	57.4	
Educational level							
Under secondary school	44	19.1	49	17.2	93	18.0	0.42
Secondary school	117	50.7	134	47.0	251	48.6	
Higher than secondary school	70	30.3	102	35.8	172	33.3	
Occupation							
Employed	70	30.3	93	32.6	163	31.6	0.30
Unemployed	16	6.9	11	3.9	27	5.2	
Retired	145	62.8	181	63.5	326	63.2	
Health insurance							
Obligation	172	74.5	234	82.1	406	78.7	0.04 <sup>a</sup>
Volunteer	59	25.5	51	17.9	110	21.3	
	<b>Mean</b>	<b>SD</b>	<b>Mean</b>	<b>SD</b>	<b>Mean</b>	<b>SD</b>	<b>p</b>
Age	68	9.0	66	8.0	67	9.0	0.03 <sup>ab</sup>
Distance to health facility (km)	5.6	5.4	5.2	4.7	5.4	5.1	0.03 <sup>ab</sup>

Note: Italicized values are significant at \* $p < 0.05$ ; <sup>a</sup> from Pearson's chi-squared test p-value; <sup>b</sup> from Mann-Whitney U test p-value for non-parametric variables.

**Table 2.** Clinical-related symptoms and health risk behavior

	Having depressive symptoms						p
	Yes		No		Total		
	n	%	n	%	n	%	
Smoking							0.27
Never smoking	186	80.5	214	75.1	400	77.5	
Former smoking	23	10.0	41	14.4	64	12.4	
Currently smoking	22	9.5	30	10.5	52	10.1	
Drinking alcohol							0.04 <sup>aa</sup>
Never drinking	186	81.9	206	72.8	392	76.9	
Former drinking	13	5.7	21	7.4	34	6.7	
Currently drinking	28	12.3	56	19.8	84	16.5	
Physical activity							0.27
Several times per month	24	8.8	28	13.2	52	10.7	
Several times per week	16	5.8	10	4.7	26	5.3	
Everyday	234	85.4	175	82.2	409	84.0	
Other people in family having diabetes	63	22.7	53	23.4	116	23.0	0.86
Comorbidities	208	88.1	174	93.1	382	90.3	0.09
Disease symptoms							
Unexplained weight loss	14	4.9	18	7.8	32	6.2	0.18
Headache, dizzy	55	19.3	33	14.3	88	17.1	0.13
Numbness of the limbs	102	35.8	73	31.6	175	33.9	0.32
Forgot to take pills last month	22	8.2	24	11.2	46	9.5	0.28
Side effect of medicine within last 3 months	42	14.7	44	19.1	86	16.7	0.19
	<b>Mean</b>	<b>SD</b>	<b>Mean</b>	<b>SD</b>	<b>Mean</b>	<b>SD</b>	<b>p</b>
Duration of disease (year)	8.6	6.9	7.6	6.1	8.0	6.5	0.13
BMI	22.8	2.7	22.9	2.8	22.8	2.8	0.70

Note: Italicized values are significant at \*p<0.05; <sup>a</sup> from Pearson's chi-square test p-value

**Table 3.** Level of depressive symptoms among diabetic patients

	Frequency (n)	Percentage (%)
Normal	283	54.8
Mild	186	36.0
Moderate	39	7.6
Moderate severe	7	1.4
Severe	1	0.2
	<b>Mean</b>	<b>SD</b>
PHQ-9 score	5.0	2.9

**Table 4.** Factors associated with having depressive symptoms among diabetic patients

	PHQ9 score	
	Coef	95% CI
Age	0.05 <sup>**</sup>	0.01; 0.08
Drinking alcohol (vs never)		
Currently drinking	1.04 <sup>**</sup>	0.30; 1.78
Physical activity (vs several times a month)		
Several times a week	-0.96 <sup>*</sup>	-2.33; -0.42
Everyday	-1.28 <sup>**</sup>	-2.18; -0.38
Comorbidities	1.08 <sup>*</sup>	0.15; 2.01

Note: Italicized values are significant at \*p<0.05, \*\*p<0.01.

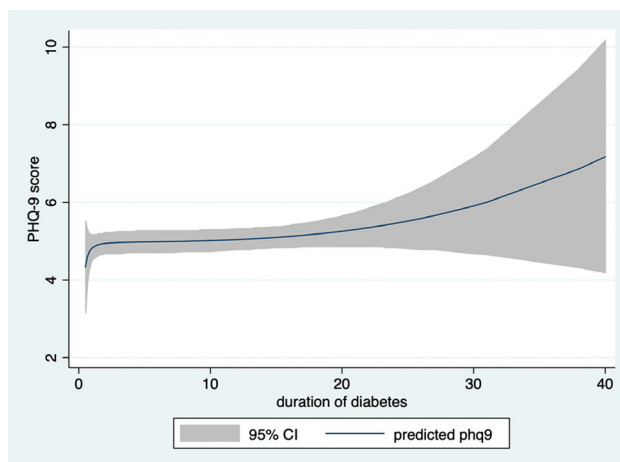
comorbidities had a higher likelihood of having depressive symptoms than those who did not (Coef = 1.08; 95% CI = 0.15; 2.01).

Table 5 shows the factors associated with medication adherence among patients with diabetes. Notably, patients having more severe depressive symptoms (higher PHQ-9 scores) were more likely to forget taking their medication in the last month (AOR=1.30; 95% CI = 1.17; 1.46). Being female and being older was associated with non-adherence to medication in the previous month (AOR=0.45; 95% CI =

**Table 5.** Factors associated with medication adherence among diabetic patients

	Missed medication last month (Yes vs No)	
	AOR	95%CI
Gender (female vs male)	0.45 <sup>*</sup>	0.20; 0.50
Age	0.95 <sup>*</sup>	0.91; 0.99
Health insurance (volunteer vs obligation)	0.35 <sup>*</sup>	0.12; 0.99
Drinking alcohol (vs never)		
Currently drinking	1.41 <sup>*</sup>	1.13; 1.51
Depressive symptom	1.30 <sup>**</sup>	1.17; 1.46
Numbness of the limbs (yes vs no)	1.48 <sup>*</sup>	1.17; 1.60
Side effect of medicine within last 3 months (yes vs no)	2.63 <sup>**</sup>	1.10; 6.30

Note: Italicized values are significant at \*p<0.05, \*\*p<0.01.



**Figure 1.** The mean of PHQ-9 score for the duration of diabetes.



0.20; 0.05 and AOR=0.95; 95% CI = 0.91-0.99, respectively). By contrast, those who currently drink alcohol, have numbness of the limbs, and experienced side effects from medicine within the last 3 months had a lower likelihood of sufficiently adhering to medication.

## DISCUSSION

Our study provided valuable evidence on the level of depression among diabetes patients in a primary setting in Vietnam. We found that nearly half of the patients suffered from mild to severe depressive symptoms. Moreover, depressive symptoms increased gradually from the early to the late stage of the treatment process. Currently drinking alcohol and having comorbidities were positively associated with more severe depression while doing physical activities related to lower PHQ-9 scores. Notably, patients with a higher level of depressive symptoms were more likely to forget to take their medicine in the last month.

The percentage of participants having depressive symptoms in our study was lower than that of other studies in Vietnam<sup>15</sup> and in other countries.<sup>16-24</sup> The difference can be explained by the variation of individual characteristics in our sample. We enrolled patients with diabetes aged 18 and above, while other studies collected data on elderly patients only. When compared to patients having chronic diseases such as cardiovascular disorders, results from our study are similar to previous studies.<sup>25,26</sup> Diabetes and cardiovascular disease are the most common chronic diseases,<sup>27</sup> for which patients have to undergo long treatment duration and strict compliance to a treatment regimen.

Regarding treatment duration, we found that patients who had long-standing diabetes were more likely to have depressive symptoms. At the start of the treatment process, they likely had to adapt to rigorous treatment procedures, which might have contributed to the development of depressive symptoms.<sup>28-29</sup> Moreover, patients with diabetes have to live with the condition for the rest of their lives,<sup>30</sup> therefore, they are more likely to have more severe depressive symptoms later in the treatment process.

Our study also emphasized aging in mental health problems. As prolonged diabetic treatment has been positively associated with an accelerated aging process, age-related comorbidities may reduce brain function and trigger several symptoms of depression.<sup>15</sup> Thus, an intervention that reduces depressive symptoms among patients with diabetes should focus on elderly patients or patients at the later stages of treatment.

The findings from our study are similar to several previous research in the association between persons with diabetes using alcohol and having depressive symptoms.<sup>31</sup> Heavy alcohol use is more common in those who are more depressed than among the general population.<sup>32</sup> On the other hand, there is evidence that chronic alcohol use causes high depressive symptoms.<sup>33</sup>

The study also revealed that having comorbidities were related to having depressive symptoms. Given that heavy alcohol use may increase the risk of having cardiovascular comorbidities, individuals who have both problems may have a higher risk of depression.<sup>34</sup>

In contrast, physical activity was associated with a lower level of depressive symptoms. Regular exercise is considered to have a positive effect in preventing the development of chronic diseases, as well as decreasing the likelihood of depression and alleviating mental stress.<sup>35</sup> Among patients with diabetes, physical activity also supports maintaining normal glucose uptake which contributes to better glucose control.<sup>36</sup>

Notably, a higher level of depressive symptoms was related to a higher likelihood of not taking medicine. This is in line with previous studies exploring the impact of depression on adherence to diabetic medication.<sup>10,37</sup> Compared with other patients, persons with diabetes were at a higher risk of experiencing depression and anxiety disorders.<sup>38</sup> Moreover, stressors and depressive symptoms are associated with medication nonadherence.<sup>39</sup> To reduce the long-term complications of diabetes, continuous medical care, self-management, and adherence to prescribed medication are required.<sup>40</sup> Therefore, earlier assessment of mental health problems among patients with diabetes will limit adverse effects and reduce the risk of long-term complications during the treatment process.

Several implications can be drawn from our study. As the level of depressive symptoms was found to be associated with non-adherence to medication, a comprehensive health-care program should integrate physical and psychological examination. Screening and intervention for depression should be initiated early in the treatment process to minimize the development of depressive symptoms later in the disease course, alongside limiting complications and providing psychological support. Avoiding alcohol and engaging in regular physical activities play an essential role in reducing the risk of developing depressive symptoms.

Nevertheless, our study has some limitations. First, self-reported information may lead to recall bias and social desirability bias. In order to minimize these, we excluded interviewers who were affiliated with the hospital. In addition, the instructions, as well as the purposes of the study, were explained clearly to the participants. Second, the cross-sectional study design may reduce the causal inferences between having depressive symptoms and non-adherence to medication. Finally, the generalizability of study results to other international populations can be limited due to the convenience sampling technique.

## CONCLUSION

Our study reveals that a great number of patients with diabetes have depressive symptoms. There is a strong association between having depressive symptoms and

non-adherence to medication in the last month. To reduce the risk of developing depressive symptoms, depression should be screened for during the initial treatment process and patients should be advised to avoid alcohol and engage in regular physical activities.

#### Statement of Authorship

The authors certified fulfillment of ICMJE authorship criteria.

#### CRedit Author Statement

**KTN:** Conceptualization, Methodology, Software, Formal analysis; **Writing** – original draft preparation; **HPN:** Conceptualization, Methodology, Writing – original draft preparation; **KVB:** Writing – review and editing; **JW:** Conceptualization, Methodology, Writing – original draft preparation.

#### Author Disclosure

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