






# Factors Associated with Untreated Depression Among Type 2 Diabetic Patients at Halaba Kulito Hospital, South Ethiopia: A Cross-Sectional Study

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**Background:** Depressed type 2 diabetes mellitus patients (T2DM) show poorer compliance with treatment and self-care recommendations than non-depressed T2DM patients. This contributes to poor prognosis and accelerates diabetic-related complications including poor glucose regulation, diabetic retinopathy, neuropathy, nephropathy, and escalated healthcare expenditure.

**Objective:** This study aimed to determine the magnitude of untreated depression and associated factors among people living with T2DM at outpatient diabetic clinic in Halaba Kulito General Hospital, Southern Ethiopia.

**Methods:** Institution-based cross-sectional study was conducted from November 1 to December 15, 2019 at Halaba Kulito Hospital, Southern Ethiopia. We collected data by face-to-face interview with patient record review. A total of 418 type 2 diabetic patients were systematically selected and interviewed using a pretested structured questionnaire. We used a composite score of nine-items Patient Health Questionnaire (PHQ-9) to assess depression status. Descriptive statistics was used to summarize respondents' background characteristics. Logistic regression analysis was done to identify associated factors with the outcome variable. Levels of significance were set at 5% ( $P < 0.05$ ).

**Results:** The finding depicted that 120 (29.3% with 95% Confidence interval (CI) = 25.0%, 34.0%) study participants satisfied diagnostic criteria for depression disorder. After controlling for confounding effect, we identified being hypertensive (Adjusted Odds Ratio (AOR) = 5.66; 95% CI: 3.24, 9.86), having no child (AOR = 3.32; 95% CI: 1.88, 5.86), and poor glycemic control (AOR = 6.23; 95% CI: 3.65, 10.54) as risk factors for untreated depression among people with type 2 diabetes.

**Conclusion:** Findings of this study indicate that untreated depression among type 2 diabetic patients is high. Poor glycemic control, not having a child and having hypertension were among significantly associated factors with depression. These results suggest much need for interventions, including strong medication adherence and self-care activities such as exercise or healthful diet for optimal glycemic control.

**Keywords:** anxiety, depression, diabetes, Ethiopia

## Background

Diabetes mellitus (DM), a leading endocrine disorder with growing public health concern globally, is characterized by elevated blood glucose level when the pancreas produces little or no insulin or variable degrees of cells' resistance to insulin or both.<sup>1</sup> The burden of diabetes is rising and has been becoming among the few major public health challenges to the health services and economic development

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(Medical and treatment cost), particularly in developing countries including Ethiopia.<sup>2,3</sup> Studies in Ethiopia showed visual disturbance, hypertension, neuropathy and nephropathy were the top four chronic complications diagnosed in DM patients.<sup>4</sup> Despite this, a systematic review on prevalence and related acute and chronic complications shows insufficient priority given to diabetes and interventions to prevent acute and long-term complications are lacking in Ethiopia at a national level with the major focus of the country on combating infectious disease.<sup>5,6</sup>

Depression is a state of depressed mood, low energy and poor concentration, feelings of guilt or low self-worth, loss of interest or pleasure, disturbed sleep or appetite, and aversion to activity affecting a person's behavior and feelings, thoughts, and sense of wellbeing.<sup>7,8</sup> It is the second leading cause of burden of disease, with around 340 million people of all ages suffering from depression globally.<sup>9-11</sup>

Though the two are separate entities and are by themselves major health problems in the world, the association between diabetes mellitus and depression is well established from a growing body of literature. Most notably, evidence shows that the relationship between depression and T2DM has been found to be bi-directional;<sup>9,12,13</sup> the likelihood of depression in (T2DM) patients is approximately double that found in the overall population<sup>13</sup> whereas depressed patients have 60% increased risk of developing type 2 diabetes.<sup>1,14</sup>

Depressed type 2 diabetic patients show poorer compliance with treatment and self-care recommendations than non-depressed T2DM patients. This contributes to poor prognosis and accelerates diabetic-related complications including poor glucose regulation, diabetic retinopathy, neuropathy, nephropathy, and escalated healthcare expenditure.<sup>12,14-16</sup> Despite this, depression in diabetes is recognized and treated in only about one-third of cases.<sup>17</sup>

According to the International Diabetes Federation (IDF-2014), an estimated 4.9 million people in Ethiopia aged 20 to 79 years are suffering from diabetes.<sup>18</sup> Although there are not many, studies from some parts of Ethiopia assessed the prevalence and risk factors associated with depression among people with diabetes. An institution-based cross-sectional study conducted in Gondar town, Northwest Ethiopia, for instance, discovered 15.4% prevalence of depression among diabetic patients.<sup>9</sup> While from a study conducted in Oromia region, Western Ethiopia, disproportionately high (47%) prevalence of depression among T2DM patients was documented with risk factors for

increased prevalence being female, lack of school education, current use of alcohol, having chronic complication of DM, more than five years of being diabetic patient and having other additional chronic illness.<sup>19</sup> Although depression is common, it is often ignored, undiagnosed and untreated in DM patients.<sup>20</sup> In general, a number of studies showed that the presence of untreated depression in patients with DM is associated with the burden of complications, financial stress, poor overall health status, poor glycemic control, decreased the quality of life and increases mortality.<sup>6</sup>

Given one of the top five countries with the highest number of people affected by DM in sub-Saharan Africa (SSA) and depression, contributing the highest share of burden compared to other forms of mental disorders,<sup>9</sup> there is limited information regarding the status of depression specifically among T2DM patients in Ethiopia. Hence, the purpose of this study was to determine the magnitude of untreated depression and associated factors among people living with T2DM at an outpatient diabetic clinic in Halaba Kulito General Hospital, Southern Ethiopia. Identifying the factors may help in developing intervention strategies explicitly targeting the prevention of depression among T2DM patients.

## Methods and Materials

### Study Design and Period

We conducted an institution-based cross-sectional study at Halaba Kulito primary hospital. The study was conducted from November 1 to December 15, 2019.

### Study Setting

Ethiopia is located in the Horn of Africa and is the second most populated country in sub-Saharan Africa, with almost 105 million inhabitants.<sup>21</sup> Halaba Kulito town, the administrative center of Halaba special district, is found in Hadiya zone, Southern Nations, Nationalities and Peoples' Region (SNNPR), Ethiopia. The town is located 245 km south from Addis Ababa, the capital of Ethiopia, and 90 km from Hawassa, the capital city of SNNPR. Estimated total population residing in the town is 39,507 people (49% (19,358) males and 51% (20,149) females). There is one health center and one primary hospital in the town. The hospital provides service for more than 100,000 people in the catchment area. It has one emergency, three outpatient departments, antiretroviral treatment care, maternal and child health care, ophthalmology and

dentistry departments and four wards; gynecology and obstetrics, pediatrics, medical and surgical wards.

## Source and Study Participants

The source population was all diabetic patients who have a medical follow-up at Halaba Kulito primary hospital, and diabetic patients who had follow-up at this hospital during the study period were the study population. Those patients aged 18 years and above with the diagnosis of diabetes, obtained from patient's medical records, for at least six months were included in the study while patients with a history of mental illness and head injury were excluded. Further, we excluded patients already on antidepressants because pharmacological treatment with antidepressants for psychiatric disorders can help patients achieve better glycemic control and have been shown to prevent depression in patients with diabetes<sup>12</sup> and could have therefore underestimated its prevalence.

## Sample Size Determination and Sampling Technique

We calculated sample size using a single population proportion formula by using assumptions of 95% confidence level and 5% margins of error. Also, we used 44.7% prevalence of diabetic depression among type 2 diabetic outpatients in Black Lion General Specialized Hospital, Addis Ababa, Ethiopia.<sup>22</sup> Considering 10% non-response rate, the total sample size became 418.

By taking three months of average client flow, monthly patient flow registered in the diabetic clinic was 458. We used systematic random sampling technique to recruit every  $k^{\text{th}}$  eligible respondent which gives sampling interval of two over two months data collection period and sequence of client flow at the diabetic outpatient clinic was used as a sampling frame. Lottery method was used to select the first participant then every subsequent participant was selected by skipping two clients until the required sample size was reached.

## Study Instrument

Clinical information includes diagnosis of diabetes, fasting plasma glucose and medication history; complications and comorbidities including hypertension, retinopathy, nephropathy and neuropathy were obtained from medical records of patients. Patients with established type 2 diabetes mellitus were evaluated for depression by interviewer administered nine-item Patient Health Questionnaire (PHQ-9). The PHQ-9 diagnosis has a high agreement with major

depression diagnosis based on structured interviews with 78% sensitivity and 98% specificity.<sup>23</sup> It was an easy depression screening tool which was a brief questionnaire that scores each of 9 DSM-IV criteria for depression as "0" (not at all) to "3" (nearly every day). PHQ-9 scores of 5, 10, 15, and 20 represent mild, moderate, moderately severe and severe depression, respectively.

## Operational Definition

A cutoff score of 12 and above on the 9-item Patient Health Questionnaire (PHQ-9) was considered having depression and otherwise, no depression. A cut of a summed score of 12 on the PHQ-9 screening instrument was recommended because of its higher specificity (80.0%).<sup>24</sup> The likelihood that a patient is falsely screened as depressed is then at an acceptable rate. Level of depression as mild, moderate, moderately severe, and severe depression was defined with a PHQ-9 score of 5–9, 10–14, 15–19, and 20–27, respectively. The same cutoff point was identified from studies conducted elsewhere.<sup>17</sup>

Good glycemic control: Average fasting blood glucose level from three recent visits of  $\leq 130$  mg/dL was considered good glycemic control. Poor glycemic control: an average of three recent visits fasting blood glucose level of  $> 130$  mg/dL was deemed to be poor glycemic control.<sup>7</sup>

Presence of hypertension: defined in the study as systolic BP level of  $\geq 140$  mmHg and diastolic BP of  $\geq 90$  mmHg, or current treatment for hypertension with prescription medication.<sup>13,16</sup>

## Data Collection Method and Quality Control

We collected data through face-to-face interviews and medical record review by four diploma holder data collectors who had previous experience in data collection in health surveys and knew the language and culture of surveyed people. Data collectors were closely supervised by two Health officers who were recruited for this purpose. The questionnaire was pretested before the actual data collection using 5% (21) of the sample on a similar setting outside the study area. Findings and experiences from the pre-test were utilized to modify the tool.

## Analysis and Statistics

Completeness of questionnaires was checked daily during the data collection period. Data were coded and entered into EpiData Entry software (version 3.1, EpiData Association,

Odense, Denmark) and analyzed by using SPSS statistical software version 25 (SPSS Inc., Chicago, IL, USA). Descriptive statistics of the data, including frequencies, proportions, mean, standard deviation and cross-tabulations were used to summarize respondents' background characteristics. Bivariate and multivariable logistic regression were employed; any variable in bivariate analysis with a *p*-value <0.25 was put into a multivariate model to adjust for confounders. Significant associations with the outcome variable during multivariable analysis were identified on the basis of adjusted odds ratio (AOR) with 95% confidence interval (CI). Levels of significance were set at 5% (*p*-value <0.05).

## Ethical Consideration

This study was approved by Wolaita Sodo University, College of Health Science and Medicine Ethical Review Committee (CHSM/ERC/107) and ethical clearance was obtained from the same office. The study was conducted in accordance with the Declaration of Helsinki. Support letter was written to the respective district health bureau explaining the objectives of the research and its significance so that medical director Halaba Kulito Hospital was contacted and requested for permission to conduct the survey. Participants were informed about the purpose, benefit, risk, confidentiality of the information and the voluntary nature of participation in the study. We obtained informed written consent. Participants were informed that they had the right to withdraw from the study at any time.

## Result

### Socio-Demographic Characteristics

Out of 418 sampled type-2 diabetic patients, a total of 410 were interviewed making a response rate of 98.1%. The mean age of the respondents was 47.4 years, with a standard deviation of ±9.6 years. The majority of participants were married 264 (64.4%) followed by widowed 73 (17.8%). Little more than one fourth (28.5%) of study participants had no formal education, while 71 (17.3%) have attended at least elementary (grade 1–8) education (Table 1).

### Clinical and Self-Care Characteristics

Among 410 study participants, it was found that majority 335 (81.7%) and 233 (56.8%) never had smoking and alcohol consumption history, respectively. Further, more than half (53.2%) of participant reported regular physical activity. About two hundred sixty-one (63.7%) and little more than two in three (67.8) study participants reported less than or equal to eight years of duration of diagnosis and treatment of

**Table 1** Sociodemographic Characteristics of Type 2 Diabetic Patients at Halaba Kulito Hospital, South Ethiopia; 2019 (n=410)

Characteristics	Depression	
	No Frequency (%)	Yes Frequency (%)
<b>Total</b>	290 (70.7)	120 (29.3)
<b>Age</b>		
<30	5 (50.0)	5 (50.0)
30–39	65 (77.4)	19 (22.6)
40–49	102 (69.9)	44 (30.1)
50–59	75 (72.5)	28 (27.2)
≥60	43 (64.2)	24 (35.8)
<b>Sex</b>		
Male	142 (71.0)	58 (29.0)
Female	148 (70.5)	62 (29.5)
<b>Residence</b>		
Urban	165 (69.6)	72 (30.4)
Rural	125 (72.3)	48 (27.7)
<b>Marital status</b>		
Married	195 (73.9)	69 (36.1)
Widowed	47 (64.4)	26 (35.6)
Divorced	27 (65.9)	14 (34.1)
Single	21 (65.9)	11 (34.4)
<b>Educational status</b>		
No formal education	74 (63.2)	43 (36.8)
Read and write	72 (76.6)	22 (23.4)
Elementary (Grade 1–8)	57 (80.3)	14 (19.7)
High school (Grade 9–12)	29 (61.7)	18 (38.3)
College and above	58 (71.6)	23 (28.4)
<b>Occupational status</b>		
Farmer	113 (67.7)	54 (32.3)
Employed	92 (77.3)	27 (22.7)
Self-employed	27 (71.1)	11 (28.9)
Merchant	58 (67.4)	28 (32.6)
<b>Had a child</b>		
Yes	233 (77.4)	68 (22.6)
No	57 (52.3)	52 (47.7)
<b>Monthly income (Ethiopian birr)</b>		
<500	65 (75.6)	21 (24.4)
501–1200	108 (72.5)	41 (27.5)
1201–2151	69 (62.7)	41 (37.3)
>2151	48 (73.8)	17 (26.2)

DM, respectively. Little less than one quarter (30.2%) of study participants were hypertensive with the median systolic blood pressure 140 (120–150) mmHg and diastolic blood pressure 84 (78–89) mmHg (Table 2).

**Table 2** Clinical and Self-Care Characteristics of Type 2 Diabetic Patients at Halaba Kulito General Hospital, Halaba Kulito Town, Southern Ethiopia; 2019 (n=410)

Characteristics	Depression	
	No Frequency (%)	Yes Frequency (%)
<b>Total</b>	290 (70.7)	120 (29.3)
<b>Smoking status</b>		
Never	245 (73.1)	90 (26.9)
Current	10 (52.6)	9 (47.4)
Previous	35 (62.5)	21 (37.5)
<b>Alcohol consumption</b>		
Does not drink	175 (75.1)	58 (24.9)
Occasional	96 (64.4)	53 (35.6)
Always	19 (67.9)	9 (32.1)
<b>Family history of DM</b>		
No	97 (65.5)	51 (34.5)
Yes	193 (73.7)	69 (26.3)
<b>Personal history of depression</b>		
No	231 (71.3)	93 (28.7)
Yes	59 (68.6)	27 (31.4)
<b>Hypertension</b>		
No	232 (81.1)	54 (18.9)
Yes	58 (46.8)	66 (53.2)
<b>Systolic blood pressure (mmHg)</b>		
<120	131 (74.4)	45 (25.6)
120–139	87 (74.4)	30 (25.6)
140–159	53 (61.6)	33 (38.4)
≥160	19 (61.3)	12 (38.7)
<b>Diastolic blood pressure (mmHg)</b>		
<80	139 (75.1)	46 (24.9)
80–89	83 (81.4)	19 (18.6)
90–99	47 (63.5)	27 (36.5)
≥100	21 (42.9)	28 (57.1)
<b>Neuropathy</b>		
No	279 (70.5)	117 (29.5)
Yes	11 (78.6)	3 (21.4)
<b>Nephropathy</b>		
No	283 (70.9)	116 (29.1)
Yes	7 (63.6)	4 (36.4)
<b>Retinopathy</b>		
No	274 (71.9)	107 (28.1)
Yes	16 (55.2)	13 (44.8)

(Continued)

**Table 2** (Continued).

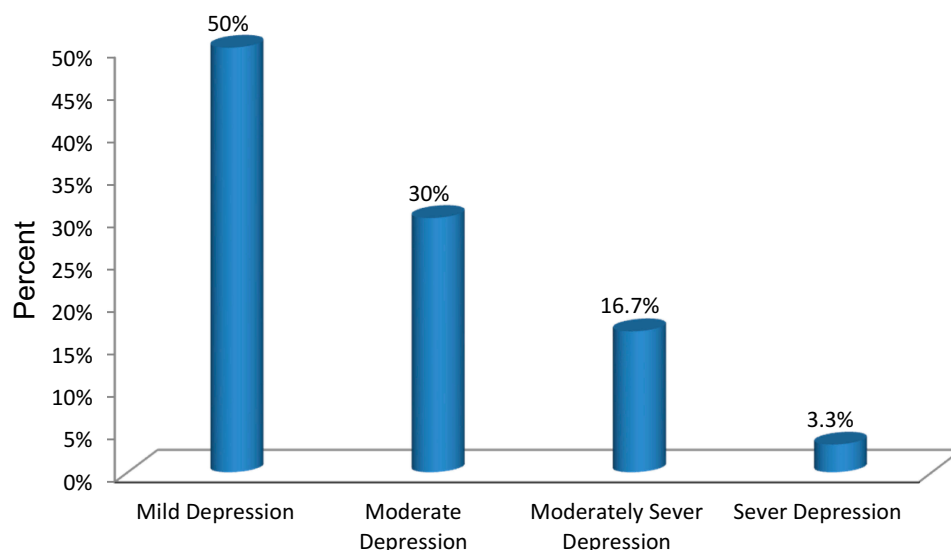
Characteristics	Depression	
	No Frequency (%)	Yes Frequency (%)
<b>Disability</b>		
No	283 (70.8)	117 (29.3)
Yes	7 (70.0)	3 (30.0)
<b>Duration of DM diagnosis (Years)</b>		
≤8	193 (73.9)	68 (26.1)
9–16	70 (64.8)	38 (35.2)
≥17	27 (65.9)	14 (34.1)
<b>Duration of DM treatment (Years)</b>		
≤8	207 (74.5)	71 (25.5)
9–16	64 (64.6)	35 (35.4)
≥17	19 (57.6)	14 (42.4)
<b>Glycemic control</b>		
Good (≤126 mg/dL)	216 (84.0)	41 (16.0)
Poor (≥127 mg/dL)	74 (48.4)	79 (51.6)
<b>Diabetes treatment regime</b>		
Insulin only	119 (70.0)	51 (30.0)
Oral hypoglycemic and insulin	70 (72.9)	26 (27.1)
Oral hypoglycemic agent only	101 (70.1)	43 (29.9)

## Prevalence of Untreated Depression

As stated elsewhere in this document, the prevalence of depression among T2DM patients was computed using a 9-item PHQ questionnaire. Accordingly, one hundred twenty (29.3% with 95% CI: 25.0, 34.0) study participants were identified as having depressive episode in the two weeks preceding the survey. The largest percentage of participants manifested the symptoms of mild depression (PHQ = 5–9) (50.0%) (Figure 1).

## Factors Associated with Untreated Depression

In bivariate analysis, nine variables including marital status, smoking status, glycemic control, having hypertension, duration of DM diagnosis, duration of DM treatment, having a child, developing retinopathy and family history of DM were significant and fitted for multivariable regression with p-value <0.25 (Table 3). The multivariate model showed that three explanatory variables significantly associated with untreated depression



**Figure 1** Severity of untreated depression among type 2 diabetic patients attending Halaba Kulito general hospital diabetic clinic, Southern Ethiopia, 2019.

among type 2 diabetic patients. Being hypertensive was 5.6 times (AOR = 5.66; 95% CI: 3.24, 9.86) more likely to be depressed than their counterparts. Participants who had no child were 3.3 times (AOR = 3.32; 95% CI: 1.88, 5.86) more likely to develop depression than those who responded no child. Moreover, glycemic control among type 2 diabetic patients had a significant association with depression by which; the odds of untreated depression among T2DM who had poor glycemic control were more than 6 times (AOR = 6.23; 95% CI: 3.65, 10.54) higher than those who had good glycemic control (Table 3).

## Discussion

### Magnitude of Depression

This cross-sectional study provides systematically collected data to assess the magnitude and associated factor of diabetic depression among type 2 diabetic patients. Accordingly, the magnitude of depression among T2DM patients was 29.3%. Comparable findings in the magnitude of depression were reported from similar studies conducted in Ghana (31.3%)<sup>14</sup> and Kedah, Malaysia (32.1%).<sup>25</sup>

Again, the magnitude of depression in our study is higher than similar reports from Addis Ababa and Mekele town, Ethiopia (13% and 17, respectively),<sup>26,27</sup> Malaysia (15.7%)<sup>28</sup> and community-based cross-sectional studies using the Beck Depression Inventory scale conducted in Nepal (22.7%)<sup>1</sup> and Brazil (18.6%).<sup>29</sup> The difference might be attributed to the difference in socio-economic background, study period and using a different assessment tool with varying specificity and sensitivity scale to detect the outcome variable.<sup>1,27,29</sup> For

instance, a study conducted in Brazil uses psychiatrist to interview a relatively small sample (70) of aged 30–65 years type 2 diabetic outpatients. Likewise, a prospective cohort study conducted in Madrid, Spain shows a depression prevalence of 20%. The possible reason for the observed difference in finding might be due to the assumption that in the study conducted in Madrid, Spain, the authors used age-appropriate depression screening measures collected by the general practitioners under routine clinical practice and this might possibly lower the prevalence. Our study finding is smaller than study reports conducted at Addis Ababa, Ethiopia (44.7%),<sup>22</sup> Saudi Arabia (49.6%),<sup>30</sup> Karachi, Pakistan (43.5%),<sup>10</sup> Malaysia (40.3%),<sup>15</sup> Nepal (40.3%)<sup>31</sup> and Montenegro (62.9%).<sup>17</sup> This may partly be due to the difference in socio-demographic characteristics,<sup>30</sup> small sample size,<sup>2,14</sup> study period and outcome variable measurement methods<sup>10,15,30,31</sup> of study subjects.

### Factors Significantly Associated with Depression

After controlling the effect of confounding variable, poor glycemic control, having a child and having hypertension were significantly associated with the outcome variable.

From this study, it was found that poor glycemic control is one of the variables significantly associated with depression. Participants who have poor glycemic control were about 6 times more likely to develop depression than those who have good glycemic control. Several studies admitted that diabetic patients with poor glycemic control

**Table 3** Bivariate and Multivariable Analysis of Factors Associated with Untreated Depression Among Type 2 Diabetic Patients Attending Halaba Kulito General Hospital Diabetic Clinic, Southern Ethiopia, 2019 (n=410)

Characteristics	Depression		COR <sup>a</sup> (95% CI)	AOR (95% CI)
	No (%)	Yes (%)		
<b>Marital status</b>				
Married	195 (73.9)	69 (26.1)	1	1
Widowed	47 (64.4)	26 (35.6)	1.56 (0.90, 2.71)	0.87 (0.05, 14.80)
Divorced	27 (65.9)	14 (34.1)	1.46 (0.72, 2.95)	0.32 (0.10, 5.78)
Single	21 (65.6)	11 (34.4)	1.48 (0.67, 3.22)	0.51 (0.02, 9.53)
<b>Had child</b>				
Yes	233 (77.4)	68 (22.6)	1	1
No	57 (52.3)	52 (47.7)	3.12 (1.96, 4.96)	3.32 (1.88, 5.86)*
<b>Smoking</b>				
Never	245 (73.1)	90 (26.9)	1	1
Current	10 (52.6)	9 (47.4)	2.45 (0.96, 6.22)	2.39 (0.69, 8.19)
Previous	35 (62.5)	21 (37.5)	1.63 (0.90, 2.95)	1.64 (0.81, 3.32)
<b>Glycemic control</b>				
Good	216 (84.0)	41 (16.0)	1	1
Poor	74 (48.4)	79 (51.6)	5.62 (3.54, 8.91)	6.23 (3.65, 10.54)*
<b>Having hypertension</b>				
No	232 (81.1)	54 (18.9)	1	1
Yes	58 (46.8)	66 (53.2)	4.88 (3.08, 7.74)	5.66 (3.24, 9.86)*
<b>Retinopathy</b>				
No	274 (71.9)	107 (28.1)	1	1
Yes	16 (55.2)	13 (44.8)	2.08 (0.96, 4.47)	2.13 (0.81, 5.59)
<b>Duration of DM</b>				
≤8	193 (73.9)	68 (26.1)	1	1
9–16	70 (64.8)	38 (35.2)	1.54 (0.95, 2.49)	0.83 (0.03, 18.34)
≥17	27 (65.9)	14 (34.1)	1.47 (0.72, 2.97)	0.41 (0.07, 2.28)
<b>Duration of DM treatment (Years)</b>				
≤8	207 (74.5)	71 (25.5)	1	1
9–16	64 (64.6)	35 (35.4)	1.59 (0.97, 2.60)	2.50 (0.65, 9.60)
≥17	19 (57.6)	14 (42.4)	2.14 (1.02, 4.50)	4.46 (0.75, 26.32)
<b>Family history of DM</b>				
No	97 (65.5)	51 (34.5)	1.47 (0.95, 2.27)	1.34 (0.78, 2.30)
Yes	193 (73.7)	69 (26.3)	1	1

Notes: \*Significant association at p-value <0.05. <sup>a</sup> Crude odds ratio.

have a significant association with depression.<sup>7,30,32</sup> As explained elsewhere,<sup>12,16</sup> poor glycemic control can be associated with poor medication adherence and poor quality of life including the absence of dietary plans and physical activity which may increase the risk of developing more significant stress, worsening of mood and less life satisfaction.

In our study, having hypertension was shown to be associated with depression. Having hypertension increased

5.5 times the likelihood of depression among T2DM patients. Similarly, having hypertension has been identified as a significant factor for depression in studies conducted in Pakistan<sup>33</sup> and India.<sup>13</sup> Moreover, a community-based cross-sectional study conducted in Duhabi-Bhaluwa, Nepal revealed that having an additional illness increases the likelihood of developing major depressive disorder among people with T2DM.<sup>1</sup> These findings reflect the fact that having hypertension is seen to be an obvious

burden to the existing illness. Further, depression among type 2 diabetic patients was found to be strongly associated among those who had no child. This result was supported by the study conducted in Kedah, Malaysia<sup>25</sup> in which type 2 diabetic patients who live with their children were significantly less depressed when compared with those who live alone. A plausible explanation could be the social stigma associated with being childless which may lead to some social and psychological problems.

## Study Limitation and Strength

Although the current study provided much useful information, it has some limitations to be noted that can be subsequently addressed by other studies. Our study was limited to a single but significant healthcare center in Halaba town, and therefore, the result of this study may not necessarily be generalizable to other populations. Since we did not conduct sensitivity analysis, the choice we made on analysis modeling might have potential bias and the results across different models may or may not be consistent. In addition, the cross-sectional design of the study limits our ability to make causal inferences, and therefore, the findings of this study must be interpreted with caution.

## Conclusion

The findings of this study indicate depression is a common mental health problem among type 2 diabetic patients which is related to being hypertensive, having no child and poor glycemic control. This emphasizes for much need interventions, including strong medication adherence and self-care activities such as exercise or healthful diet for optimal glycemic control. Furthermore, tools such as the Patient Health Questionnaire-9 and the Beck Depression Inventory may be incorporated into the beginning of a clinic visit so that responses indicating severe levels of depressive symptoms can be further assessed and addressed promptly and directly with the patient.

## Abbreviations

DM, diabetes mellitus; PHQ-9, Patient Health Questionnaire-9; T2DM, type 2 diabetes mellitus.

## Data Sharing Statement

All data are already described and included in the manuscript.

## Ethics Approval and Informed Consent

College of Health Science and Medicine Ethical Review Committee (CHSM/ERC/107) of Wolaita Sodo University provided ethical clearance. Official letter of permission was obtained from the same office. The study was conducted in accordance with the Declaration of Helsinki. Support letter was written to the respective district health bureau. Participants were informed about the purpose, benefit, risk, confidentiality of the information and the voluntary nature of participation in the study. Informed written consent was obtained.

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## Author Contributions

All authors made substantial contributions to conception and design, data analysis, drafting or revising the article; took part in drafting the article, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

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## Disclosure

The authors declare that they have no competing interest.

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