



Depression among Patients with Diabetes: A Community-based Study in South India

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Background: Depression is one of the more common mental health conditions found among people suffering from chronic diseases. Its presence in patients with type 2 diabetes could hinder the adherence to and effectiveness of treatment. Most studies on depression among patients with diabetes are hospital-based suggesting the need for a community-based study to assess the correlates of depression among patients with diabetes. **Aim:** This study aimed to estimate the prevalence and to identify the factors influencing depression among patients with type 2 diabetes in Udupi taluk situated in southern India. **Subjects and Methods:** This study recruited 200 patients with type 2 diabetes from both rural and urban areas. Demographic, clinical, and diabetes-related information were collected using a semi-structured questionnaire. Depression was assessed using Patient Health Questionnaire-9; a standardized questionnaire developed in the United States of America and validated in the Indian population. **Results:** The prevalence of depression among patients with diabetes in the community was found to be 37.5%. Most frequently, depression was mild (42, 21%) in nature with severe depression (9, 4.5%) seen the least. Several factors were found to be positively associated with depression including female gender, rural residence, unemployment, and the status of being unmarried. The presence of diabetic complications and other chronic diseases such as hypertension and obesity also were found to be associated with depression. **Conclusion:** Depression was found to be particularly high among the study population. Since depression could significantly hinder patient's adherence to treatment, there is an urgent need for early diagnosis and treatment. This calls for the integration of mental health care into the management of diabetes.

Key words: Prevalence, patients with diabetes, depression, community, South India

INTRODUCTION

Diabetes mellitus (DM) is a chronic endocrine disease resulting due to either failure of the pancreas to produce enough insulin (type 1) or inability of the body to utilize the produced insulin (type 2).^{1,2} DM represents a tremendous issue of global concern.^{3,4} According to the International Federation of Diabetes,⁴ the prevalence of DM has already reached its epidemic level globally.⁴ About 9 million adults in 2014 from both developed and developing countries and across gender, as well as social class, were reported to be living with DM.² It accounted for about 1.5 million deaths globally in 2012 with more than 80% of the deaths believed to have occurred in low- and middle-income countries.² India has the highest number of patients with diabetes in the world.³

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DM is not only a public health threat as a disease by itself but also worrisome is concomitant comorbid conditions usually found in patients with diabetes.⁵⁻¹² One such is depression, defined by the World Health Organization as "a common mental disorder, characterized by sadness, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, feelings of tiredness, and poor concentration."¹³ Depression is among the most common mental disorders affecting around 350 million people in the world.¹³ Certainly, depression is paid due to attention both by researchers and clinical practitioners in developing and underdeveloped settings.

Depression has been documented in patients with DM.¹²⁻¹⁸ This has been reported in many studies across states, regions,

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and continents.^{5-12,18} Its presence in patients with diabetes had been pointed out to hinder the adherence to and effectiveness of treatment.¹⁹⁻²³ Although there are limited data with regards to depression among patients with diabetes, a few available studies indicated considerably high prevalence in this select group (patients with diabetes) with the common associated factors was gender, income, socioeconomic status, comorbid conditions, and complications.²⁴⁻²⁷ A proper knowledge about the extent and factors associated with depression in patients with diabetes might be of immense importance as it may pave the way for the clinicians toward an improved and effective management of the burdensome disease. It could as well as help researchers and guide policy makers in identifying the group at high risk of developing depression and accordingly implement a successful preventive program.

In this study, the aim and objectives were to estimate the prevalence of depression and identify its influencing factors in patients with type 2 diabetic in the communities of Udupi taluk in the South of India.

SUBJECTS AND METHODS

This community-based, cross-sectional study was carried out in Udupi taluk located in Udupi District, Karnataka State of southern India over 6 months between January and June 2016. Ethical clearance was obtained from a tertiary healthcare center. This study population comprised adult individuals suffering from type 2 DM willing to participate following consent. Following appropriate permissions, a total of 200 participants were enrolled from the community. This sample size was statistically calculated using an anticipated prevalence (Pp) of 45% as reported by in a similar study.¹ The total sample size required for this study was estimated to be 194 after considering a design effect of 1.5 and a nonresponse rate of about 10%. This was rounded up to 200 which gave the final number of participants enrolled in this study.

The list of all the villages (rural areas) and wards (urban areas) of Udupi taluk constituted the sampling frame. The sampling was done in three stages. First, stratified sampling technique was used where the sampling frame was stratified into two strata, urban and rural strata. The strata comprised wards and villages, respectively. In the second stage, ten units each of villages and wards were selected using simple random sampling technique. Finally, the selection of study participants was done by the house-to-house search in each of the selected villages and wards. In the household visit, the first house in each village or ward was selected at random and the search continued to the adjacent house until the desired number of participants in that particular area was achieved. Individuals who were 18 years and above and were confirmed

cases of type 2 DM of not less than a year were included in this study. Those diagnosed with type 2 DM but were unable to respond due to severe illness and/or diagnosed with mental illnesses (other than depression) were excluded from this study.

Study tools

Two questionnaires were employed in the data collection process. These includes a semi-structured questionnaire for the collection of sociodemographic information as well as information on clinical and diabetes-related variables. It was designed by the investigators and validated by one of the coinvestigators and a clinical psychologist, among other experts.

Patient Health Questionnaire-9, a free tool developed by Kroenke *et al.*²⁸ with an educational grant from Pfizer Inc., was used for the diagnosis of depression. Minimal (or no depression), mild, moderate, and severe depression are defined by the tool as total scores of 0–4, 5–9, 10–14, and 15 and above, respectively.²⁸ The instrument was previously validated in the Indian population.³

Study procedure

There was a rigorous house-to-house search for patients with type 2 diabetes in each of the twenty visited areas. The first house in each area was selected at random and the search continued to the next house. In each of the households visited, only one participant was found and interviewed, but one in which the couple are both patients with diabetes. Both participants were included and interviewed in total strictness to the protocol. In each visited house, the members would be asked if they had anyone diagnosed with DM after briefing them about this study. If there was an eligible participant in the family, they were asked whether they would like to participate or not. If interested, they were asked to sign the informed consent form after reading and thoroughly understanding the participant information sheet. In all cases, participation was purely voluntary.

Statistical analysis

The data were analyzed using Statistical Software for the Social Sciences version 16 (SPSS Inc., Chicago, IL, USA). Continuous variables were summarized by the mean and standard deviation for normally distributed and median and interquartile range for continuous skewed variables. Categorical variables were summarized by frequencies and percentages. Association between depression and categorical variables was computed using Chi-square test. Univariate and multivariate logistic regression analyses were performed for modeling and to find the crude and adjusted odds ratios.

RESULTS

A total of 200 adult individuals with type 2 DM participated in this study. The mean age of the participants was 63 (± 11.478). The median duration of diabetes was found to be 8 years (interquartile range = 11.5). Of the participants, 92 (46%) and 108 (54%) were males and females, respectively. This study included urban dwellers 140 (70%) roughly twice larger than rural dwellers. This was in an effort to reflect the estimated proportions of the target population residing in the two different settlements. Majority of the participants 122 (69.3%) were married, whereas 78 (30.7%) of them were either single or widowed. This study population included participants representing various social classes including 29.1% belonging to the upper class, 61.5% belonging to the middle class, and 9.5% belonging to the lower class. The sociodemographic distribution of the study population is summarized in Table 1.

More than half (118, 59%) of the participants were shown to bear extra burden of other chronic conditions with hypertension (92, 46%) being the most common comorbid condition. Other conditions included but were not limited to, asthma and obesity. Diabetic complications were also seen in some of the participants. The complications included coronary artery disease and retinopathy, which were found to be the most frequent complications among others. Almost a quarter (24.5%) of the participants had one form of complication or the other and in a few cases more than one.

The overall prevalence of depression was 37.5%. This, in the absolute figure, translates to 75 patients with depression. The most frequent level of depression was a mild depression 42 (21%), followed by moderate depression 24 (12%), and then severe depression 9 (4.5%). This is depicted in Table 2.

While assessing for depressive symptoms, multiple responses were allowed to be made as depression can present with varied symptoms. Depression or hopelessness (81.3%), tiredness (80%), lack of interest or pleasure (78.7%), and sleep disturbances (67.6%) were seen to be among the most common of all the depressive symptoms reported by the total of 75 patients with depression. The least was concentration problem and suicidal thoughts.

Depression was found to be significantly associated with a number of variables. The statistically significantly associated variables include female gender ($P < 0.01$), marital status ($P < 0.01$), rural residence ($P < 0.05$), and unemployment ($P < 0.01$). Others were clinical variables including the presence of comorbid condition ($P < 0.05$) and diabetic complication ($P < 0.05$). On the other hand, age, educational status, socioeconomic status, and type of treatment received were among the variables not found to be

Table 1: Sociodemographic distribution of the study population ($n=200$)

Variable	Frequency (%)
Age group (years)	
30-55	51 (25.5)
56-65	75 (37.5)
66-70	27 (13.5)
>70	47 (23.5)
Gender	
Male	92 (46)
Female	108 (54)
Marital status	
Single	4 (2.0)
Married	139 (69.5)
Widowed	57 (28.5)
Residence	
Rural	60 (30)
Urban	140 (70)
Educational status	
Illiterate	22 (11.0)
Primary school	67 (33.5)
Secondary school	61 (30.5)
College and above	50 (25.0)
Socioeconomic status	
Upper class	58 (29.0)
Middle class	123 (61.5)
Lower class	19 (9.5)
Occupation	
Professional	13 (6.5)
Skilled	35 (17.5)
Unskilled	13 (6.5)
Homemaker	88 (44.0)
Retired	49 (24.5)
Unemployed	2 (1.0)
Monthly income (INR)	
<2000	101 (50.5)
≥ 200	99 (49.5)

INR=Indian Rupee

significantly associated with depression. This is summarized in Tables 3 and 4.

DISCUSSION

This study aimed at estimating the prevalence of depression among patients with type 2 diabetes in a community-based setting and identifying its correlates.

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Table 2: Prevalence of depression in the study population (n=200)

Depression	Frequency (%)	Prevalence (%)
Yes	75 (37.5)	37.50
No	125 (62.5)	

Table 3: Depression levels among participants with depression (n=75)

Depression level	Frequency (%)
Mild	42 (56)
Moderate	24 (32)
Severe	9 (12)

The overall prevalence of depression was 37.5%. However, this figure is comparable but less than those reported in many hospital-based studies ranging from 21% to 83% with majority having a prevalence of 41% and above.²⁹⁻³⁵ This could be due to selection bias as hospital settings attract patients with active symptomatology who are more likely to present at the health centers.

Depression was significantly more common among women than men. Similar findings were reported in many other studies.^{27,29,31,32,36} A common explanation to this gender difference had been the fact that women play differing social roles as opposed to their male counterparts with attendant disadvantages including dependence and unemployment to mention but few.³⁶ In the current study, for instance, the majority of the women were unemployed and were homemakers. A significant association was found between depression and unemployment in this study. These findings could contribute to the relatively higher prevalence of depression among women.

Several studies have reported no significant association between age and depression.^{8,29,30} This is consistent with the findings of the present study. The present study established a significant difference in prevalence of depression among patients with diabetes with one or more complications compared to the patients without diabetic complication. This is in similarity with the current literature.^{1,3,29,33,37-43} Similarly, the presence of other chronic conditions such as hypertension, obesity, and/or asthma was seen to be associated with increased likelihood of depression in this population. This coincides with many other study findings.^{3,10,29,32} Complications such as nephropathy, neuropathy, and diabetic foot among others, and/or comorbid conditions may increase the cost of management or treatment of DM which may, in turn, leads to some level of economic stress and consequently depression. This is more likely to be applicable to those patients of lower socioeconomic status. Moreover, the presence of comorbidity and complications in the patients add to the morbid suffering

of the patients and thereby making them vulnerable to depression. Functional limitation resulting from complications such as retinopathy and amputation may as well contribute to the development of depression.⁴⁰

In this study, being unmarried, including singlehood and widowed status, was found to be significantly associated with depression. This is in line with the findings of Zhang *et al.*, Téllez-Zenteno and Cardiel, and Collins *et al.*^{11,32,42} It is widely believed that being married could confer individual with better mental health and hence, less psychiatric morbidity.^{25,26} However, Joseph *et al.* reported no association between the two.¹

Although a number of studies established a significant association between educational status and depression,^{3,34,44} it is not the case in the present study as no significant association was observed between the two. However, this finding is consistent with those of other studies.^{1,30,45-47}

Depression was seen to be more frequent in rural residents as compared to their urban counterparts in this study. Similar findings were also reported by Raval *et al.* and Ciechanowski *et al.*^{3,20}

Individual monthly income was seen to be associated with depression status. Patients with higher monthly earnings showed a lower prevalence of depression and vice versa. This was consistent as reported in other studies.^{14,15,17,19} This is likely due to relatively higher level of financial stress in lower earning class compared to their higher-earning counterparts as well as crippled access to better.

There was no significant association between socioeconomic status and depression demonstrated in the present study. This disagrees with the findings from other studies.¹ A possible explanation to this inconsistency may be the fact that, the present study tried to recruit patients from both rural and urban areas and a considerable number of the participants, especially in rural areas accessed primary health care provided through the health centers where health services are provided free of cost. Due to this reason, difference in socioeconomic status may not have contributed to significant differences in depression between the different social classes in this study population.

Depression was found to be significantly more frequent among unemployed participants than in employed ones. This is consistent with the findings of Joseph *et al.*, Rahman *et al.*, and Goldney *et al.* in similar studies conducted in India, Bangladesh, and Australia, respectively.^{1,24,30} Being unemployed may affect an individual's mental balance in several ways including forcing someone to stay at home with little or no company for most parts of the day and to depend on others for their day-to-day financial expenses including that of diabetes care. Similarly, unemployment may increase the burden of the cost of treatment as suggested by Joseph *et al.* [Tables 5 and 6].¹

Table 4: Association of depression with sociodemographic variables (*n*=200)

Variables	Depression status		<i>P</i>
	Yes (%)	No (%)	
Age			
30-55	16 (31.4)	35 (68.6)	0.452
56-65	27 (36.0)	48 (64.0)	
66-70	10 (37.0)	17 (63.0)	
>70	22 (46.8)	25 (53.2)	
Gender (<i>n</i> =199)			
Male	23 (25.2)	68 (74.7)	0.001*
Female	51 (47.7)	57 (52.3)	
Marital status			
Unmarried	28 (45.9)	33 (54.1)	0.104
Married	47 (33.8)	92 (66.2)	
Residence			
Rural	31 (51.7)	29 (48.3)	0.01*
Urban	44 (31.4)	96 (68.6)	
Educational status			
Illiterate	12 (54.5)	10 (45.5)	0.123
Primary	27 (40.3)	40 (59.7)	
Secondary	23 (37.7)	38 (62.3)	
Tertiary	13 (26.0)	37 (74.0)	
Monthly income (INR)			
<2000	49 (48.5)	52 (51.5)	0.002*
≥2000	26 (26.3)	73 (73.7)	
Socioeconomic status (<i>n</i> =199)			
Upper	19 (32.8)	39 (67.2)	0.299
Middle	46 (37.7)	76 (62.3)	
Lower	9 (47.4)	10 (52.6)	
Employment status (<i>n</i> =199)			
Employed	14 (22.9)	47 (77.0)	0.007*
Unemployed	60 (43.2)	78 (56.1)	
Decision-maker			
Myself	45 (34.6)	85 (65.4)	0.251
Others	30 (42.9)	40 (57.1)	

P<0.05 was considered significant. INR=Indian Rupee

CONCLUSION

The prevalence of depression among patients with diabetes was found to be high with approximately one out of every three patients with diabetes reported to suffer from one of three levels of depression. About 4.5% of the participants were suffering from severe depression which could translate into very large numbers given the huge burden of diabetes in India.

Table 5: Univariate logistic regression analyses of depression with sociodemographic and clinical variables

Variables	Crude OR (95% CI)	<i>P</i>
Age		
<65	Reference	0.152
≥65	1.54 (0.85-2.79)	
Gender		
Male	Reference	0.001*
Female	2.69 (1.47-4.94)	
Marital status		
Unmarried	Reference	0.088
Married	1.77 (0.918-3.40)	
Residence		
Urban	Reference	0.007*
Rural	2.33 (1.26-4.33)	
Monthly income (INR)		
≥2000	Reference	0.003*
<2000	2.66 (1.01-5.04)	
Employment status		
Employed	Reference	0.008*
Unemployed	2.53 (1.27-5.02)	
Duration of DM (years)		
<10	Reference	0.164
≥10	1.52 (.85-2.69)	
Comorbidity		
No	Reference	0.035*
Yes	1.92 (1.05-3.52)	
Complication		
No	Reference	0.012*
Yes	2.33 (1.21-4.49)	

P<0.05 was considered significant. OR=Odds ratio; CI=Confidence interval; DM=Diabetes mellitus; INR=Indian Rupee

Depression was found to be significantly associated with female gender, residing in rural areas, lower monthly income, the presence of complication and/or comorbidities, and unemployment among others.

Depression could be a barrier in the effective treatment of diabetes as it could lead to nonadherence to treatment by the patients. It is important that patients with diabetes be screened, treated where necessary, for depression and other common mental disorders. This could by far improve treatment adherence and consequently better overall diabetes management.

Limitations

The fact that the current study has a number of strengths does not make it free of limitations. One of the limitations of

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Table 6: Multivariate logistic regression analyses of depression with sociodemographic and clinical variables

Variables	Adjusted OR (95% CI)	P
Gender		
Male	Reference	0.10
Female	2.36 (0.84-6.62)	
Residence		
Urban	Reference	0.09
Rural	1.87 (0.905-3.88)	
Monthly income (INR)		
≥2000	Reference	0.71
<2000	1.21 (0.44-3.30)	
Employment status		
Employed	Reference	0.137
Unemployed	2.04 (0.80-5.25)	
Comorbidity		
No	Reference	0.46
Yes	1.32 (0.64-2.72)	
Complication		
No	Reference	0.015*
Yes	2.62 (1.21-5.67)	

P<0.05 was considered significant. OR=Odds ratio; CI=Confidence interval; INR=Indian Rupee

this study is its proneness to recall bias. This is because data depended solely on the responses of the participants. The study being cross-sectional or vertical cannot give any tangible insight into temporal association or cause-effect relationship. One cannot with full certainty know whether the reported associated factors preceded depression in the patients. In the same vein, this study lacks a comparison group with which to use as a reference in accurately estimating the difference in the prevalence of depression among diabetic and normal individuals.

Have you evaluated the severity of DM? No. Not really. However as per protocol, we excluded bedridden and physically/severely very ill patients who could not be able to respond. Fortunately, we did not encounter such cases in the field.

And did you evaluate anti-DM medication in the present study, as a type of antidiabetic treatment might have different impacts on depression? Yes. Majority of the participants used oral hypoglycemic drug (metformin). Type of treatment was not found to be significantly associated with depression in the present study.

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Conflicts of interest

There are no conflicts of interest.

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