ORIGINAL RESEARCH

A study of depression among patients with diabetes presenting to a tertiary care hospital in central India: A cross-sectional study

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ABSTRACT
Background: Depression among patients with diabetes is a significant concern as it can have a negative impact on their health outcomes. Studies have shown that patients with depression and diabetes are less likely to adhere to dietary restrictions and medication, resulting in uncontrolled hyperglycemia and increased complications. The factors associated with depression among diabetic patients vary in different populations and are not adequately studied in central India. The current study aims to analyze the factors associated with these conditions at a tertiary care center in central India. **Aim**: This cross-sectional study was conducted at a tertiary care hospital in central India aimed to estimate the prevalence of depression among diabetic patients and identify the determinants associated with it. **Subjects and Methods**: This study recruited 531 patients withdiabetes (more than 1 year) from both rural and urban areas. Demographic, clinical, and diabetes-related information was collected using a semi-structured questionnaire. Depression was assessed using Patient Health Questionnaire-9; a standardized questionnaire. **Results:** The prevalence of depression among patients with diabetes in the community was found to be 68.73%. Most frequently, depression was mild (257, 48.39%) in nature with moderate depression (108, 20.34%) seen the least. Several factors were found to be positively associated with depression including female gender,duration of diabetesmarital status, and annual health expenditure of more than 10 percent of family income. The presence of diabetic complications and other chronic diseases such ashypertension and obesity also were found to be associated with depression. **Conclusion**: Depression could be a barrier to the effective treatment of diabetes as it could lead to nonadherence to treatment by the patients. Patients with diabetes must be screened and treated wherever necessary for depression and other common mental disorders. This could improve treatment adherence and consequently better overall diabetes management.

INTRODUCTION

Diabetes is one of the leading causes of death and disability worldwide and affects people regardless of country, age groupor sex.(1) Diabetes affects an estimated 537 million people worldwide between the ages of 20 to 79 (10.5% of all adults in this age range). By 2030, 643 million people will have diabetes globally, increasing to 783 million by 2045.(2) According to the Indian Council of Medical Research–India Diabetes study between 2008 and 2020, the overall weighted prevalence of diabetes was 11.4% and prediabetes(HbA1C 5.6-6.4) 15.3%.(3)

The incidence of diabetes in the world, Southeast Asia, and India was 10.5%, 8.8%, and 9.6%, respectively, throughout 2021 and will rise to 12.5%, 11.5%, and 10.9%, respectively by 2045.(2)

However, the persistent demands of diabetes care, such as following a strict diet and exercising regularly to maintain good health, monitoring blood glucose levels, regular follow-up, managing symptoms, and constantly having to watch out for complications, can cause additional stress to diabetic patients. As a result, individuals suffer from depression, anxiety, and stress, all of which have a severe negative impact on their

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health and general quality of life.(4) During psychological stress, counter-regulatory hormones such as dopamine, a neurotransmitter; glucocorticoids, growth hormones; and glucagon are activated, which hinders insulin from functioning normally, causing blood glucose levels to increase. In patients with diabetes, poor glycemic control and functional impairment owing to developing diabetes complications may induce or exacerbate depression and anxiety.(5,6) Diabetes and depression co-existence leads to poor management of glycemic control, which increases the risk of diabetes complications and lowers the overall quality of life and life expectancy.(4)

Depression worsens the prognosis of diabetes, increases noncompliance to medical treatment, decreases the quality of life, prolongs the recovery from diabetes, and increases mortality.(7-10)Depression may increase the risk of developing T2DM by60%.(11).

AIMS & OBJECTIVES
1. To estimate the prevalence of depression in diabetic patients (more than 1year).
2. To find out the determinants associated with depression among patients with diabetes mellitus presenting to tertiary care hospitals in central India.

METHODS
- **Study design:** Hospital-basedcross-sectional study
- **Study participants:** All consenting patients with a confirmed diagnosis of diabetes (age >18yr) were interviewed and screened for depression
- **Study period:** December2022 to May 2024
- **Sample size:** 531
- **Study instrument:** Depression was assessed by using Patient Health Questionnaire-9; 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

Statistical analysis: The data were analyzed using Statistical Software for the Social Sciences version 29 (SPSS Inc., Chicago, IL, USA.

INCLUSION CRITERIA
1. Patients aged 18 years or more,
2. Patients of either sex,
3. Patients diagnosed with T1DM and T2DM at least 1 year back, on regular treatment

EXCLUSION CRITERIA
1. Pregnant women.
2. Patients with gestational diabetes,
3. Patients with known psychiatric disorders before the diagnosis of Diabetes
4. Patients with serious illness, and
5. Patient or relative not willing to participate in the study or sign an informed consent

RESULT
A total of 531 adult individuals with Diabetesparticipated in this study.Most patients were 41 – 50 years old (53.29%). The age of the study population ranged from 20 to 60 years with a mean of 48.23 ± 6.78 years.The study population had a slight male predominance (50.28%) with a male-to-female ratio of 1.01.In majority of the patients, the age at disease onset was 41 – 50 years (40.87%) and with a mean of 41.50 ± 7.18 years.(Table 1)

In most of the patients, the duration of the disease was 6 – 10 years (47.08%) with a mean of 9.13 ± 5.19 years.The majority of the patients resided in urban areas (68.55%). Most of the patients were married (77.59%). Majority of the patients belonged to class IV (35.40%).The most common comorbidities were hypertension (51.41%), dyslipidemia (14.88%), stroke (5.84%), and hypothyroidism (4.89%). While the least common comorbidities were rheumatoid arthritis (2.07%) and cataracts (2.64%).

The overall prevalence of depression was 68.73%(365 patients). The majority of the patients had a PHQ-9 score of 5 – 9 (mild depression, 48.39%) and 0 – 4 (no depression, 31.26%). While, the least number of patients had a PHQ-9 score of 10 – 14 (moderate depression, 20.34%).

Several factors were found to be positively associated with depression including female gender, duration of diabetes marital status, and annual health expenditure of more than 10 percent of family income. On the other hand, age, residence educational status, socioeconomic status, and were not found to be significantly associated with depression.

Table 1:Sociodemographic distribution of the study population (*n*=531)

Sr. No.	Characteristics	N	(%)
1	**Age**		
	≤ 20	2	0.38
	21 – 30	6	1.13
	31 – 40	47	8.85
	41 – 50	283	53.29
	51 – 60	193	36.35
2	**Gender**		
	Male	267	50.28

	Female	264	49.72
3	**Education status**		
	Illiterate	28	5.27
	Primary	99	18.64
	High school	129	24.29
	Secondary school	150	28.25
	Graduate and above	125	23.54
4	**BG-PrasadSocio–economicclass**		
	I	31	5.84
	II	38	7.16
	III	122	22.98
	IV	188	35.40
	V	152	28.63
5	**Residence**		
	Rural	167	31.45
	Urban	364	68.55
6	**Family type**		
	Nuclear	299	56.31
	Joint	165	31.07
	Third generation family	67	12.62
7	**Duration of Diabetes**		
	Less than10years	354	66.66
	More than10years	177	33.33
8	**Marital status**		
	Married	412	77.59
	Widow	68	12.81
	Unmarried	38	7.16
	Divorced	13	2.45
9	**Basal Metabolic Index**		
	>25	196	36.91
	<25	335	63.08
10	**Annual health expenditure**		
	<10 percent of annual family income	219	41.24
	>10 percent of annual family income	312	58.75

Table 2: Association of depression with sociodemographic variables (n=531)

Variables		Depression status		p-value
		Yes	no	
Age	less than 20 years	0	2	0.128
	21-30 years	5	1	
	31-40 years	30	17	
	41-50 years	190	93	
	51-60 years	140	53	
Education	Graduate and above	83	42	
	High school	91	38	
	Illiterate	17	11	
	Primary	75	24	
	Secondary school	99	51	0.387
Gender	male	170	97	0.01
	Female	195	69	
Marital status	Divorced	13	0	0.001
	Married	247	165	
	Unmarried	37	1	
	Widow	68	0	
Socioeconomic Class	I	25	6	0.178
	II	31	7	
	III	85	37	
	IV	124	64	

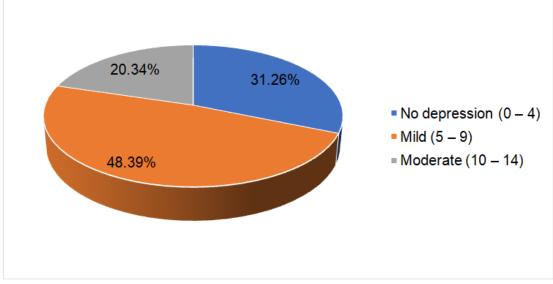|		V	100	52	
Residence		Rural	47	120	0.29
		Urban	119	245	
Annual health expenditure percentage of family income		less than 10%	54	162	0.01
		more than 10%	112	203	
Duration of disease		<10 years	200	104	0.04
		>10 years	165	62	

Figure 1:Distribution of study subjects according to PHQ-9 scores

DISCUSSION

This study aimed at estimating the prevalence of depressionamong patients with diabetes in tertiary care hospital-basedsettings and identifying its correlates.The overall prevalence of depression was 68.73%.(Figure 1) However, this figure is comparable but more than those reported in many hospital-based studies ranging from 8% to 83% with the majority having a prevalence of 41% and above.(16,18,20,21,22) This could be dueto selection bias as hospital settings attract patients with active symptomatology who are more likely to present at the health centers.Depression is common in diabetic patients due to the significant financial burden of chronic illness & its complication management. Depression was significantly more common among women than men. Similar findings were reported in many other studies.(24,25,26,27) A common explanation for this gender difference is the fact that women often have different social roles compared to men. This can lead to disadvantages such as dependence and unemployment. In the current study, the majority of the women were unemployed and homemakers.These findings could contribute to the relatively higher prevalence of depression among women.

Several studies have reported no significant associationbetween age and depression.(22,25,28) This is consistent with thefindings of the present study. (Table 2)

In the present study, the most common comorbidities were hypertension (51.41%), dyslipidemia (14.88%), stroke (5.84%), and hypothyroidism (4.89%). While the least common comorbidities were rheumatoid arthritis (2.07%) and cataracts (2.64%). The present study establisheda significantdifference in the prevalence of depression amongpatients with diabetes with one or more complicationscompared to the patients without diabetic complications. Thisis similarto the currentliterature.(25,29,30,31. This coincideswith many other study findings. Complicationssuch as nephropathy, neuropathy, and diabetic foot amongothers, and/or comorbid conditions may increase the cost ofmanagement or treatment of DM which may, in turn, lead tosome level of economic stress and consequently depression.Functional limitations resulting from complications such as retinopathy and amputation may as well contribute to the development of depression.

Although some studies established a significant association between educational status and depression (27,28)this is not the case in the present study as no significant associationwas observed between the two. Depression was seen to be more frequent in rural residentsas compared to their urban counterparts in otherstudies.(30,33) but in the present study no significant association was observed with residence.

In the present study, annual health expenditure in diabetic patients is more than 10 percent of annual

family income in 312(58.75%) study subjects &out of these 99 (18.64%) study subjects have more than 40 percent of annual family income. High level of annual health expenditure mainly because of surgery & complications of diabetes & wages loss due to diabetes. In the Nationally Representative Sample Survey Nanda & Sharma found that 37.9% of Indian households with diabetic members experienced Catastrophic health expenditure (at 10% threshold) (34)

In the present study, depression is more common in study subjects whose annual health expenditure is more than 10 percent of annual family income and the difference is statistically significant (p <0.05). depression was found more in study subjects (64.10%) whose annual health expenditure is more than 10 percent of their annual family income. Leonard E et al. reported that among people with diabetes, total healthcare costs for people with depression were 4.5times higher than for people without depression. (35) In another study, Wang et alfound that Nearly one-fifth of middle-aged and elderly people in China have catastrophic health expenditure and catastrophic health expenditure was associated with the risk of depression. (36)

The present study did not find a significant link between socioeconomic status and depression, which contradicts the findings of other studies.(29) One potential explanation for this inconsistency is that our study included participants from both rural and urban areas. Many of the rural participants accessed free primary health care through health centers. As a result, differences in socioeconomic status may not have led to significant differences in depression among the various social classes in our study population.

CONCLUSION
The present study Diabetes commonly presents with advancing age, with slight male predominance. The patients had low educational status, were skilled workers, and had a nuclear family. The patients were mainly married & mostly resided in urban areas and belonged to low socioeconomic classes. The majority of the patient's age at diabetes onset was 41 – 50 years and the duration of diabetes was 6 – 10 years. Hypertension was the most common comorbidity among diabetic patients. The present study highlights a high prevalence of depression (68.74%) in patients with diabetes, with mild severity being the most predominant.This is concerning given the substantial burden of diabetes in India. Several factors were found to be positively associated with depression including female gender, duration of diabetes marital status, and annual health expenditure of more than 10 percent of family incomeDepression could hinder effective diabetes treatment by causing patients to not follow their treatment plan. It's crucial to screen and treat diabetes patients for depression and other

common mental disorders to improve treatment adherence and overall diabetes management.

Conflict of Interest Declaration: The author(s) declare(s) that there is no conflict of interest.

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