

# Prevalence of psychiatric morbidity and cognitive impairment among non-communicable disease patients in Southern Chennai, Tamil Nadu

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## ABSTRACT

**Introduction:** According to the WHO, non-communicable diseases cause 71% of all deaths globally. Despite many studies showing a significant association between non-communicable diseases (NCDs) and cognitive decline, it is not researched in Tamil Nadu. Hence, this study was conducted to screen for psychiatric morbidity and cognitive impairment (CI) among NCD patients in Southern Chennai. **Aims:** The aim of this study was to estimate the prevalence of psychiatric morbidity and CI and their associated factors among NCD patients attending NCD clinics of tertiary care hospitals. **Methods and Material:** A cross-sectional study was carried out in NCD patients (n = 343) attending an NCD clinic in a tertiary care hospital. Basic sociodemographic and clinical details were obtained by a semi-structured questionnaire. Cognition function and psychiatric morbidity were assessed using mini-mental state examination, patient health questionnaire 9 and generalised anxiety disorder 7 tools, respectively. **Results:** The mean age of the study participants was 58 years. Of 343 participants, 19.2% had severe CI, 26.8% had severe depression, and 29.7% had severe anxiety. Among 180 participants aged 59–86 years, 25.5% participants had osteoarthritis; of these, 41.3% had severe CI ( $P < 0.0001$ ), 82.6% had severe depression ( $P < 0.0001$ ) and 63% had severe anxiety ( $P < 0.027$ ), and their association was statistically significant. **Conclusions:** This study concludes that about one-fourth of the NCD patients suffered from CI and psychiatric morbidity, which are of rising concern. Musculoskeletal diseases are neglected to be assessed under NCDs, and in this study, osteoarthritis was found to be significantly associated with depression, anxiety and CI.

**Keywords:** Cognitive impairment, noncommunicable disease, psychiatric morbidity

## Introduction

Non-communicable diseases (NCDs) are a group of diseases that affects people for a longer time and have a detrimental socio-economic impact on the country. According to the WHO, NCDs cause 71% of all deaths globally.<sup>[1]</sup> From most deaths from NCDs, about 77% occur in low-income and

middle-income nations. The main types of NCD are diabetes, cancers, chronic respiratory diseases (such as COPD and asthma) and cardiovascular diseases (hypertension, ischemic heart disease and stroke). Unhealthy eating habits, physical inactivity and use of tobacco and alcohol are the top four behavioural risk factors for NCDs. Factors such as aging, rapid unplanned urbanisation and globalisation contribute to the rise of NCDs. Cardiovascular diseases, cancer, respiratory conditions and diabetes account for the majority of NCD mortality (17.9 million annually).<sup>[1]</sup>

An article titled “India: Health of the Nation’s States” was released by the Indian Council of Medical Research in 2017 that estimated the percentage of deaths in India attributable to NCDs

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has increased from 37.9% in 1990 to 61.8% in 2016.<sup>[2]</sup> By 2025, it is anticipated that Indian men and women's hypertension rates will increase to 22.9% and 23.6%, respectively.<sup>[3]</sup> It is anticipated that the number of diabetic patients in India will increase to 79.4 million by 2030.<sup>[4]</sup>

Many studies showed a significant association between NCDs and a decline in cognitive function that may result in mild cognitive impairment (CI) to dementia. Studies demonstrate that cognitive domains, including memory, attention, psychomotor ability, and executive skills, are impacted.<sup>[5]</sup> The prevalence of CI is estimated to be 4.6%, and there is a significant association between CI and NCDs, according to studies done in India.<sup>[6]</sup> According to research, there is a significant association between CI prevalence and NCD, which ranges from 4.6% to 10.8%.<sup>[7]</sup> Obesity, female, hyperglycaemia or inadequate glycaemic control, the extreme age groups and increased duration of illness are risk factors for CI in diabetes mellitus.<sup>[7,8]</sup>

The cohabitation of NCDs and mental disorders has an impact on a number of variables, including life expectancy, quality of life, prognosis, economic efficiency and general welfare.<sup>[9,10]</sup> When psychiatric illness prevails among NCD patients, they are more likely to have poor treatment adherence, unhealthy lifestyle, greater treatment costs, affected quality of life, deteriorating health, work absences, more hospital visits, inadequate self-care and higher mortality.<sup>[11]</sup> Thus, we studied the prevalence of psychiatric morbidity and CI, their associated factors and clinical characteristics among NCD patients attending NCD clinics of tertiary care hospitals.

## Methodology

This was a cross-sectional study carried out between 1<sup>st</sup> September 2022 and 31<sup>st</sup> December 2022 including the patients above age group of 18 years diagnosed with NCDs such as diabetes mellitus, cardiovascular disease, cerebrovascular disease, hypertension, thyroid disorder, COPD and cancer for a duration of >3 months<sup>[12]</sup> attending an NCD clinic in a tertiary care hospital. This study excluded participants with a history of mental illness, those who were taking psychotropic medications, those who had severe visual or auditory impairments and those who refused to give their consent.

### Sample size estimation and sampling technique

The Khullar *et al.*<sup>[13]</sup> study's prevalence of cognitive impairment in NCD patients, which was determined to be 33.7% with an absolute precision of 6% and 95% confidence interval (CI), was used to calculate the minimum sample size needed for this investigation, which came out to be 197. However, all the patients fulfilling the inclusion criteria were included in the study. The study participants were recruited through the judgmental sampling technique to achieve the sample size (n = 343).

The main outcome of this study was to determine the prevalence of cognitive impairment, psychiatric morbidity, and its associated factors among non-communicable disease patients.

### Data collection methods and tools

The patients were explained about the study using a patient information sheet. The consent form was obtained from study participants before enrolling them in the study. Socio-demographic, clinical characteristics, Anthropometric investigations, blood pressure, blood sugar level and treatment details were obtained along with psychiatry and cognitive function details. Validated instruments such as the Mini-Mental Status Examination (MMSE),<sup>[14]</sup> Generalised Anxiety Disorder-7 (GAD-7) scale<sup>[15]</sup> and Patient Health Questionnaire-9 (PHQ-9)<sup>[16]</sup> were used for the assessment of depression, anxiety and cognitive functions.

### Data analysis

Paper format was used to collect the data, which were entered into an Excel sheet, and the analysis was done using SPSS (version 21). Continuous variables were expressed in Mean  $\pm$  SD, and categorical variables were represented as proportions. Pearson Chi-square analysis was applied, and a *P* value < 0.05 was considered statistically significant. Using binary logistic regression, the unadjusted odds ratio (OR) and 95% CI were calculated. Adjusted odds ratio (AOR) and 95% CI were computed after adjusting for confounders using multivariable logistic regression to identify variables independently associated with cognitive impairment and psychiatric morbidity.

### Operational definition

1. **Cognitive impairment:** "Cognitive impairment is when a person has trouble remembering, learning new things, concentrating, or making decisions that affect their everyday life. It ranges from mild to severe. Perceptual, learning, linguistic, memory and thinking abilities get impaired in cognitive impairment".<sup>[17]</sup>
2. **Psychiatric morbidity:** "Psychiatric morbidity is a behavioural or intellectual sample that causes considerable distress or impairment of private functioning". Such features may be continuous, remitting, relapsing or occur as a single episode. In this study, we have assessed depression and anxiety.<sup>[17]</sup>  
"Depression is a mood disorder that can occur as mild, moderate, or severe depressive episodes, the patient suffers from lowering of mood, reducing of energy and decrease in activity".<sup>[18]</sup>  
"Generalized Anxiety disorder is an anxiety that is generalized and persistent but not restricted to, or even strongly predominating in any particular environmental circumstances".<sup>[18]</sup>
3. **NCD:** NCDs are chronic diseases that do not spread from person to person. The NCDs included in this study are diabetes mellitus (FBS >100 mg/dL, PPBS >140 mg/dL), hypertension (Systolic BP >140 mmHg and/or diastolic

BP >90 mmHg), coronary artery disease, stroke, COPD, osteoarthritis, thyroid disorder and cancer.<sup>[19,20]</sup>

4. **Body Mass Index (BMI):** Based on Asian WHO classification, “BMI of <18 kg/m<sup>2</sup> is underweight; 18–22.9 kg/m<sup>2</sup> is a normal BMI; 23–24.9 kg/m<sup>2</sup> is overweight; BMI >25 kg/m<sup>2</sup> is obesity”.<sup>[21]</sup>
5. **Waist Hip Ratio:** According to the WHO, “waist hip ratio of female >0.80 and male >0.90 has a higher risk of developing cardiovascular diseases and metabolic disorders”.<sup>[22]</sup>
6. **FBS and PPBS:** Based on ADA recommendations, “the glycaemic target is FBS = 80–130 mg/dL and PPBS <180 mg/dL”.<sup>[23]</sup>
7. **MMSE:** “Mini-Mental State Examination is a validated tool to assess the cognitive functions among the elderly, which include orientation, attention, memory, language and visual-spatial skills. The mini-mental state examination is scored on a scale of 0–30 with scores >23 interpreted as no cognitive impairment, 18–23 scores as mild cognitive impairment and 0–17 scores as severe cognitive impairment”.
8. **PHQ9:** “It is a validated screening tool for depression. It’s a continuous measure of depression symptom severity. The PHQ is scored on a scale of 0–27 with scores 1–4 interpreted as minimal depression, 5–9 as mild depression, 10–14 score as moderate depression, 15–19 as moderately severe depression and 20–27 score as severe depression”.
9. **GAD-7:** “It is a validated tool to assess anxiety disorder and it measures the symptom severity. It is scored on a scale of 0–21 with scores 0–4 interpreted as minimal anxiety, 5–9 as mild anxiety, 10–14 as moderate anxiety and >15 as severe anxiety”.

## Results

Among 343 study participants, the mean age of study participants was 58 ± 11.44 years. The sociodemographic details of the study participants are enlisted in Table 1. The majority were females (63.6%), and most of the participants were unemployed (49.6%) and unskilled workers (22.4%). The education status of most participants was illiterate (38.2%). Most of the study participants belong to the upper class (34.1%), followed by the upper middle class (25.4%).

In the clinical profile of the participants, predominant had obesity (49%), and 4.4% were underweight based on their BMI. The mean BMI of the participants was 25.1 Kg/m<sup>2</sup>. Among the study participants, 43.7% had uncontrolled hypertension, 34.7% had uncontrolled diabetes and 78.4% had a higher waist hip ratio. The mean blood pressure of the study participants was 127/80 mmHg. Participants in the study were found to have mean blood sugar levels of 141 mg/dL at fasting and 205 mg/dL in postprandial blood sugar, respectively. The mean waist hip ratio of males and females was 0.93 and 0.87, respectively.

The most prevalent non-communicable disease in this study was found to be diabetes mellitus (53.4%), followed by hypertension (48.7%) and osteoarthritis (23%), as shown in Figure 1. Among 343 participants, 19.2% had severe cognitive

impairment, 26.8% had severe depression, and 29.7% had severe anxiety.

Among the NCDs, osteoarthritic patients had a statistically significant association with CI ( $P = 0.0001$ ), depression ( $P = 0.003$ ) and anxiety ( $P = 0.004$ ). The cognitive profile, depression and

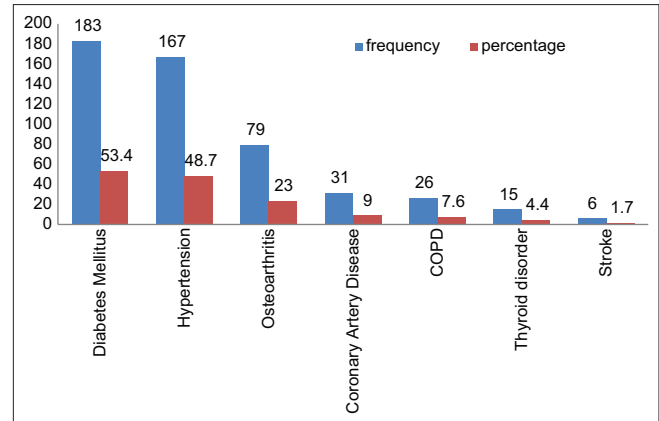


Figure 1: Primary diagnosis

Table 1: Socio-demographic characteristics and clinical profile of the study population (n=343)

Characteristics	Frequency, n (%)
Mean age (SD)	58±11.44 years
≤58 years	163 (47.5)
>58 years	180 (52.5)
Gender	
Male	125 (36.4)
Female	218 (63.6)
Occupation	
Unemployed	170 (49.6)
Unskilled worker	77 (22.4)
Semi-skilled worker	13 (3.8)
Skilled worker	20 (5.8)
Clerk/shop/farm	59 (17.2)
Semi-professional	2 (0.6)
Professional	2 (0.6)
Education	
Illiterate	131 (38.2)
Primary school	74 (21.6)
Middle school	57 (16.6)
High school	61 (17.8)
Intermediate/ Diploma	11 (3.2)
Graduate	8 (2.3)
Postgraduate	1 (0.3)
Marital status	
Married	340 (99.1)
Unmarried	3 (0.9)
Socioeconomic status	Modified BG Prasad scale (Fe 2022)
Upper class	117 (34.1)
Upper middle class	87 (25.4)
Lower middle class	61 (17.8)
Upper lower class	53 (15.5)
Lower class	25 (7.3)

anxiety of NCD patients were analysed using binary logistic regression, in which osteoarthritic participants had significant CI (OR: 3.14; CI: 0.17–0.55), depression (OR: 0.23; CI: 0.09–0.60) and anxiety (OR: 2.97; CI: 1.41–6.25) as shown in Table 2. In the multivariable analysis, we identified that osteoarthritis was independently associated with cognitive impairment (AOR: 3.52; CI: 1.95–6.37), depression (AOR: 5.66; CI: 2.13–15.04), and anxiety (AOR: 3.11; CI: 1.44–6.74) and hypertension was independently associated with depression (AOR: 2.12; CI: 1.19–3.77), which are listed in Table 3.

### Discussion

Most developing countries, including India, are facing major public health issues due to the increased burden of non-communicable diseases. In this study, 63.6% were female participants, 38.2% were illiterate and 49.6% were unemployed, which was almost similar to the previous study.<sup>[6]</sup> The prevalence of diabetes mellitus (53%), hypertension (48%) and COPD (7%) found in this study were comparatively lesser than Krishnamoorthy et al.<sup>[6]</sup> study, the reason being that our study had a larger sample size than the other study. This study's mean for BMI, systolic blood pressure, and diastolic blood pressure were 25 Kg/m<sup>2</sup>, 127 mmHg and 80 mmHg, respectively, which was similar to the findings of Mehra et al.'s<sup>[7]</sup> study.

Though few studies have found CI in NCD patients, it's being largely neglected to be evaluated. In this study, 19.2% had severe cognitive impairment, 26.8% had severe depression and 29.7% had severe anxiety, which is found to be consistent with the

results of recent studies done in India.<sup>[7]</sup> In many developing nations, especially India, the prevalence of NCDs and the elderly population are rising quickly. Despite this, cognitive impairment and psychiatric morbidity screenings are still rarely performed.<sup>[7]</sup> Indian studies suggest that the prevalence of cognitive impairment among hypertension patients was found to be 11.9–13%, whereas in a similar recent study conducted in Chandigarh, the prevalence was 35.5%, and in our study, it was 53.2%, the reason being that our sample size was larger than other studies.<sup>[7]</sup> Data from large population studies suggest that the risk for mild cognitive impairment in diabetes was due to chronic hyperglycaemia and among hypertensives, the significant predictor was hyperlipidaemia.<sup>[24]</sup>

The strength of this study is that we identified that the osteoarthritis patients have an independent and a significant association with CI, depression and anxiety disorders, which remains consistent with Kazim et al. study.<sup>[25]</sup> In our study, large study participants (n = 343) were recruited when compared to other studies, and among those, about one-fourth of our study participants had osteoarthritis, of which about 24% had cognitive impairment, 48% had depression and 36% had anxiety. Those who were screened and identified with cognitive impairment and psychiatric morbidity were referred to psychiatric OPD for further evaluation.

The limitation of this study was recall bias, as the patients had to self-report, which could be affected due to their cognitive impairment. The NCDs that are of major concern are cardiovascular diseases, diabetes mellitus and COPDs, while other types of NCDs, such as musculoskeletal diseases, are often

**Table 2: Cognitive profile, depression and anxiety in non-communicable disease patients (n=343)**

Non-communicable disease	n	Cognitive impairment			Depression			Anxiety		
		n (%)	Unadjusted Odds ratio (95% CI)	P	n (%)	Unadjusted Odds ratio (95% CI)	P	n (%)	Unadjusted Odds ratio (95% CI)	P
Osteoarthritis										
Not diseased	264	127 (48.1)	1.00 (ref)	-	205 (77.6)	1.00 (ref)	-	191 (72.3)	1.00 (ref)	-
Diseased	79	59 (74.6)	3.14 (0.17–0.55)	0.0001*	74 (93.6)	0.23 (0.09–0.60)	0.003*	70 (88.6)	2.97 (1.41–6.25)	0.004*
Hypertension										
Non-Hypertensive	176	97 (55.1)	1.00 (ref)	-	138 (78.4)	1.00 (ref)	-	136 (77.2)	1.00 (ref)	-
Hypertensive	167	89 (53.2)	0.92 (0.60–1.42)	0.251	141 (84.4)	0.67 (0.38–1.16)	0.15	125 (74.8)	1.14 (0.69–1.87)	0.59
Diabetes mellitus										
Non-diabetic	160	93 (58)	1.00 (ref)	-	135 (84)	1.00 (ref)	-	125 (78)	1.00 (ref)	-
Diabetic	183	93 (50.8)	1.34 (0.87–2.06)	0.176	144 (78.6)	1.46 (0.84–2.5)	0.17	136 (74.3)	1.23 (0.74–2.03)	0.410

\*n: frequency, percentage (%), CI: Confidence interval, \*significant P<0.05

**Table 3: Association of cognitive impairment, depression, and anxiety with non-communicable disease (n=343)**

Non-communicable disease	Cognitive impairment		Depression		Anxiety	
	AOR (95% CI)	P	AOR (95% CI)	P	AOR (95% CI)	P
Osteoarthritis						
Not diseased	1.00 (ref)	-	1.00 (ref)	-	1.00 (ref)	-
Diseased	3.52 (1.95–6.37)	0.0001*	5.66 (2.13–15.04)	0.0001*	3.11 (1.44–6.74)	0.004*
Hypertension						
Non-Hypertensive	1.00 (ref)	-	1.00 (ref)	-	1.00 (ref)	-
Hypertensive	1.29 (0.82–2.05)	0.276	2.12 (1.19–3.77)	0.011*	1.13 (0.67–1.90)	0.644

\*CI: Confidence interval, ref: reference variable, AOR: Adjusted Odds ratio, \*significant P<0.05

missed out on being assessed under NCDs. The results from this study can't be generalisable and the temporal association can't be made out in this study.

For patients with chronic disease to perform basic daily tasks, cognitive function must be intact; therefore, recognising the factors impacting cognitive functions is a first step in creating effective and targeted interventions that lessen their adverse effects. Hence, patients with NCDs should undergo routine cognitive testing and psychiatric morbidity screening, and patients should be informed about how cognitive impairment develops, its risk factors, and how to prevent it by engaging in cognitive exercises.

## Conclusion

This study concludes that about one-fourth of the NCD patients suffered from cognitive impairment and psychiatric morbidity, which are of rising concern. The osteoarthritis patients were significantly associated with cognitive impairment, depression, and anxiety. Hence, these patients need to be referred appropriately for further evaluation, which is essential for early diagnosis, treatment, and prevention of complications. Future research is required to fully comprehend the extremely complex network of CNS interactions with the musculoskeletal system and deliver benefits that may go far beyond.

## List of Abbreviations

CI - Confidence Interval  
 COPD - Chronic Obstructive Pulmonary Disease  
 GAD 7 - Generalized Anxiety Disorder Questionnaire 7  
 MMSE - Mini-Mental State Examination  
 NCD - Non-Communicable Disease  
 PHQ 9 - Patient Health Questionnaire 9

## Ethical policy and institutional review board statement

Approval from the institutional human ethical committee was obtained with reference number: IHEC-I/1193/22. All participants were informed regarding the purpose of the research study in their local language. An informed consent form was taken from the study participants who were willing to participate in the study.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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