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Agreement between CES-D and CIDI-SF scales of depression among older adults: a cross-sectional comparative study based on the longitudinal aging study in India, 2017-19

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Abstract

Background Understanding the differences between various instruments for assessing depression will help researchers and health practitioners to choose a more appropriate tool and develop a framework to enhance resilience to mental health problems in the older population. The current study aimed to compare the 10-item Center for Epidemiological Studies-Depression (CES-D) scale with the Composite International Diagnostic Interview-Short Form (CIDI-SF) for measuring depressive symptoms in older Indians.

Methods Data came from the first wave of the Longitudinal Aging Study in India (LASI) which was conducted during 2017-19. The final sample included 30,368 older individuals aged 60 years and above (15,824 women and 14,544 men). The level of agreement between the CES-D and CIIDI-SF instruments for depression classification was assessed using Kappa coefficients at various cut-off values. Multivariable logistic regression models were used to examine the associations between background characteristics and depressive symptoms assessed by both instruments.

Results The prevalence of depressive symptoms based on the CES-D instrument was higher than that of CIDI-SF (30.2% vs. 8.3%). The level of agreement between the CES-D and CIDI-SF for depression classification was 'none' to 'minimal' ($\kappa = 0.04–0.24$). Assuming the CIDI-SF scale as the "gold standard", with rising threshold values, sensitivity of the CES-D scale decreased while specificity increased. The CES-D scale yielded a sensitivity of 29–82% and specificity of 39–92% across cut-off values of 3 to 6. The Pearson correlation between the CIDI-SF and CES-D total scores was significant but weak ($r = .20$). Multivariable analysis showed that depressive symptoms were more prevalent among women, those with higher education, individuals living alone, those with diagnosed psychiatric disorders, and individuals with two or more chronic conditions, compared to men, those who were uneducated, those not living alone and healthier peers, when assessed using both CES-D and CIDI-SF scales. The associations of marital status, religion and wealth quintiles were significant only for depressive symptoms assessed using the CES-D scale.

Conclusions Depression cases identified by the CES-D showed poor agreement with those identified by the CIDI-SF. Therefore, the prevalence of depressive symptoms measured by the CESD is not interchangeable with that measured

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by the CIDI-SF. These findings suggest the importance of using both the CES-D and CIDI-SF in large population-based cohorts and surveillance surveys to obtain more accurate and nuanced understanding of depressive disorders across various subgroups of the older population.

Keywords CES-D, CIDI-SF, Depressive symptoms, Older adults, India

Background

Depression is a major public health concern that leads to increased disability, suicidal ideation and mortality [1, 2]. Internationally validated instruments are largely used to efficiently identify individuals in need of treatment for depression and other mental illnesses, particularly among underserved populations in resource-poor settings [3–6]. Subjective assessments of depressive disorders have been conducted in many of the large scale population-based surveys globally, despite the variety of diagnostic instruments employed in primary care settings [7–9].

Considering the cross-cultural differences in the associated factors of depression, studies have utilized different measures to better capture the actual cases of depressive disorders in specific populations. Such self-report questionnaires or structured interviews administered by lay persons are often used to assess common mental disorders, including depression, in population-based research, as they are less burdensome and more cost-effective than clinical psychiatric interviews [10]. The Center for Epidemiologic Studies Depression Scale (CES-D) [11], is one of these key measurement instruments, originally designed for use in research settings, mainly focusing on emotional and cognitive symptoms of depression. It was developed in 1976 for use in the general adult population (aged 18 or older) [11], the optimal cutoff score for CES-D scale remains unclear [12–14]. An earlier study conducted in five Asian countries —Indonesia, Korea, Myanmar, Sri Lanka, and Thailand— evaluated the validity of the CES-D as a tool for cross-cultural comparisons and found results comparable to those obtained in other European and North American cultures [15].

On the other hand, the Composite International Diagnostic Interview-Short-Form (CIDI-SF), a fully structured set of scales developed from the larger CIDI, originally developed for use in the redesigned US National Health Interview Survey [16, 17] has thus far not been validated in Asian countries' context. This scale is a fully structured diagnostic interview designed to be used by trained non-clinician interviewers [17]. Since diagnostic criteria for depression and the understanding of symptom presentation were developed in high income, Western Industrialized countries, it has been challenging to establish reliable estimates of depression prevalence in Asian countries including India. Despite the lack of evidence for culturally specific symptomatology, common tools such as the Geriatric Depression Scale (GDS), the CES-D and the Public Health Questionnaire (PHQ) have been used to study the prevalence of depression in India. A meta-analysis of such studies between 1997 and 2016 showed varying levels of prevalence of depression (29.3-39.7%) due to their varied methodological approach and screening tools as well as their focus on particular regions of the country [18]. Such inconsistencies in depression prevalence suggest the problematic nature of measurement of depression in specific contexts.

Diagnosis and treatment of depression are more challenging for older adults than for younger adults, and managing late-life depression based on binary diagnoses by mental health specialists presents an additional barrier [19, 20]. Besides, depression is often under-recognised and under-treated in older adults because of lack of perceived need for treatment and the tendency to attribute related symptoms to age-related physical illnesses or other difficulties. Thus, identification of depressive symptoms in older adults using appropriate valid scales becomes increasingly important, especially as older adults may have different presentations and needs than younger individuals. Data from a multicentric study and the National Mental Health Survey (2015–2016) showed variability in the presentation of mental disorders within Indian populations including considerable irritability or being restless [21] and neurotic and stress-related disorders [22], beyond just depressed mood among older adults. Therefore, it is important to examine the ecological and construct validity of existing assessment tools and to move toward a more nuanced understanding of depressive symptomatology within the Indian population.

Understanding the differences between the CES-D and CIDI-SF, two of the most widely used instruments, will help researchers and health practitioners select a more appropriate tool for assessing depressive symptoms and developing resilience to mental health problems in the older Indian population. This analysis compares the CES-D and CIDI-SF scales for measuring late-life depressive symptoms, using data from a large, country-representative, population-based sample of older men and women in India. First, we aim to compare the prevalence and associated factors of depressive symptoms assessed using both scales. Second, we will explore the loading of scale items on multiple factors to determine the overlap and distinctiveness of the scales. Third, we will examine the agreement between the two scales and compare the cut-off scores indicating the presence of depressive symptoms.

Methods

Data

Data from the first wave of the Longitudinal Aging Study in India (LASI) conducted during 2017-19 was used in the present study. LASI is a nationally representative survey that provides vital information on the mental and social well-being of older Indian adults. It collects data of over 72,000 individuals aged over 45 years and their spouses across all states and union territories of India (excluding Sikkim). LASI adopted a multistage stratified cluster sampling design to collect unit-level data, including three stages in rural areas and four stages in urban areas. The detailed information about sample design, survey questionnaires, fieldwork, data collection, and procedure were published elsewhere [23, 24]. LASI provides internationally harmonized data enabling cross-country analysis. International Institute for Population Science (IIPS), University of Southern California (USC), and Harvard T.H. Chan School of Public Health (HSPH) were the major contributors in conducting the LASI survey. The ethical approval and necessary guidelines for conducting the LASI survey were suggested by the Indian Council of Medical Research (ICMR). In the fieldwork, all participants were provided with information brochures explaining the purpose of the survey and the safety of health assessments. Moreover, the consent forms were also administered to each participant.

Study population

LASI included a total of 31,464 individuals aged 60 years and over. In the present study, we excluded the individuals with missing data for the items on both depression scales ($n = 1{,}096$). Therefore, the final analytic sample included 30,368 older individuals aged 60 years and above, and among them 15,824 were women and 14,544 were men. This sample did not show any significant differences in sociodemographic characteristics compared to the full sample. A flow chart of the sample selection criteria is provided in Fig. 1.

Measures

Depression scales

All participants were interviewed face-to-face and administered the CES-D and CIDI-SF during the same interview, and the CES-D was not measured independently of CIDI-SF (not blinded). Data were collected by trained field workers who administered a comprehensive household survey and individual questionnaire in the local language and recorded information specifying whether questions were answered by the individual or their proxy. CIDI-SF was used to screen for probable major depression in the past year whereas the CES-D was used as a short self-report screening measure for depressive symptoms present in the past week.

CES-D scale

An internationally validated 10-item CES-D scale was used to screen for the prevalence of depressive symptoms in older adults [11, 25]. The CES-D consists of seven negative symptoms (feeling depressed, low energy, feeling alone, trouble concentrating, bothered by things, fear of something, and everything is an effort) and three positive symptoms (feeling happy, satisfied, and hopeful) which were present in the week prior to the interview (Cronbach's alpha- 0.79). There were four possible responses to these symptoms: rarely or never (< 1 day), sometimes (1 or 2 days), often (3 or 4 days), and most or all of the time (5–7 days) in a week prior to the interview. In the present

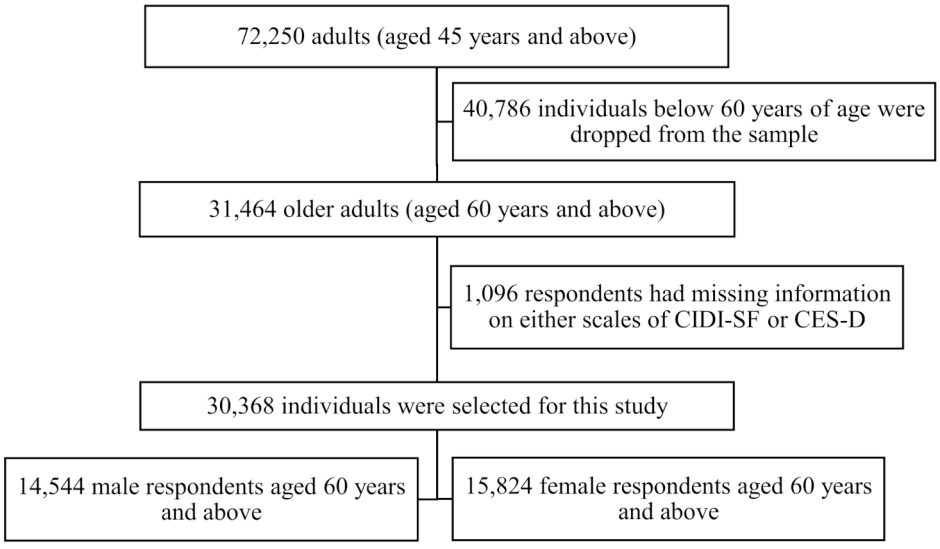

Fig. 1 Sample selection criteria for this study

study, for the negative symptoms, rarely or never (< 1 day) and sometimes (1 or 2 days) were scored zero, and often (3 or 4 days) and most or all of the time (5–7 days) categories were scored one. We reversed the scoring for the positive symptoms. The scores on these binary items of depressive symptoms were added to obtain the overall composite score, which ranged from 0 to 10. A person with a score of four or higher was positively screened for depressive symptoms among community-dwelling older Indians [26]. This is a departure from the original scoring of the CES-D scale, i.e., from 0 to 30 considering the Likert scale of 0–3 for each item [27]. This was done so in this study to make the comparison between both the CES-D and CIDI-SF scales easier. For the sensitivity analysis, CES-D depression was assessed using the standard scoring method of 0–30, with each item scored from 0 to 3. A score of 15 or above was used as the cut-off to indicate the presence of depression.

CIDI-SF scale

LASI used the CIDI-SF scale to assess the symptoms-based prevalence of major depression among study participants. This scale is a structured diagnostic instrument used by trained lay interviewers to assess major depressive disorder based on the Diagnostic and Statistical Manual of Mental Disorders (DSM) criteria, and is widely used in population-based health surveys [23] and has been validated in cross-cultural settings [28–30]. A total of 10 dimensions were captured in the CIDI-SF scale. The CIDI-SF module begins with a stem question, whether participants ever had feeling of being sad, blue, or depressed for at least two weeks during the past 12 months. If they responded yes, they were further asked about the frequency of such feeling with possible responses: (a) all day long, (b) most of the day, (c) about half the day, and (d) less than half the day. We recoded (a) and (b) as 1, and 0 otherwise. The respondents with feeling of being sad, blue, or depressed that lasted all day long or most of the day were then "screened in" and were asked to complete the full CIDI-SF module. Subsequently, seven yes-or-no type questions were asked about the symptoms during those two weeks (i.e., loss of interest in most things like work, hobbies or activities, loss of appetite, feeling tired or low in energy, feeling of worthlessness, trouble concentrating, thinking a lot about death, and trouble falling asleep) (Cronbach's alpha- 0.71). For the sleep item, the participants were asked if they faced problems (a) every night, (b) nearly every night, or (c) less often, and we recoded (a) and (b) as 1, and (c) as 0. For the item on loss of interest, participants were asked if they lost interest in most things (a) all day long, (b) most of the day, (c) about half the day, or (d) less than half the day. We recoded (a) and (b) as 1, and 0 otherwise. We added these responses, and the overall score of the CIDI-SF scale ranged from 0 to 10. In this study, those with a score of four or more are identified as having probable major depression [31].

Other variables

Multiple variables associated with depressive symptoms, such as socio-demographic characteristics, memory, chronic conditions, and psychiatric disorders, were included as covariates in this study. The socio-demographic characteristics included age groups (categorized as 60–69 years, 70–79, 80 + years), gender (female, male), education (no education, primary, secondary, higher), marital status (currently married, widowed, divorced/ separated/ deserted/ others), working status (never worked, currently working, not currently working), religion (Hindu, Muslim, Christian, others), wealth index (poorest, poorer, middle, richer, richest), living arrangements (living alone, living with spouse and living with others) and caste (scheduled caste, scheduled tribe, other backward classes and 'others' which mainly include those in the forward class category).

The memory of older individuals was assessed with immediate and 15 to 20 min delayed recall of ten words—ability to recall a greater number of words was considered as a better memory. Participants were asked about the diagnosis of eight chronic health conditions by asking: "Has any health professional ever diagnosed you with the following chronic conditions or diseases?" with a possible binary response of yes or no. These eight conditions were: hypertension, diabetes, cancer, chronic lung disease, chronic heart disease, stroke, arthritis, and high cholesterol. The morbidity score was categorized as: 0, "no chronic disease"; 1, "single morbidity"; 2 or more, "multimorbidity". Also, a variable of psychiatric disorders was created with possible responses of no and yes and denotes to self-reported physician diagnosis of depression, Alzheimer's disease, dementia, psychiatric problems such as unipolar/bipolar disorder, schizophrenia etc., and neurological problems such as neuropathy, convulsions, migraine, Parkinson's etc.

Statistical approach

Descriptive and bivariate analyses were conducted to present the preliminary results. To assess the prevalence of depression case status using the CES-D and CIDI-SF scales, we categorized participants into four mutually exclusive categories: (a) not a case on both scales; (b) a case on CES-D scale; (c) a case on CIDI-SF scale; and (e) a case on both scales. The prevalence estimates were weighted to account for the complex survey design and to provide nationally representative estimates. Chi-square test for categorical variables and t-test for the continuous variables was used to identify the association of the sample characteristics with these four categories.

The socio-demographic and health-related correlates of depressive symptoms by both scales were examined using adjusted logistic regression models.

Further, internal consistency of the two scales of depressive symptoms was evaluated using Cronbach's alpha. We then conducted an exploratory principal component factor analysis to determine a meaningful number of factors from the items of both the scales. We combined items from both scales and performed a factor analysis to see how items from each scale load on the factors and to explore the overlap and distinctiveness of the scales.

To assess the level of agreement on depression case status between the CES-D and CIDI-SF scales, we calculated the weighted and unweighted Kappa coefficients (κ). The weighted Kappa coefficients represent the estimates accounted for the stratified sampling design, and thus reported in this study to describe the agreement between the two depression scales by background characteristics such as age, gender, and education. The value of Cohen's kappa coefficient (κ) is interpreted as: 'none' (0 to 0.20), 'minimal' (0.21 to 0.39), 'weak' (0.40 to 0.59), 'moderate' (0.60 to 0.79), 'strong' (0.80 to 0.90), and 'almost perfect' (>0.90) [32]. Finally, we used "*roctab*" function in Stata software to determine the sensitivity and specificity of the CES-D compared with the CIDI-SF (treated as temporary "gold standard") for four different cut-offs (≥3, ≥4, ≥5, and ≥6). All analyses were conducted using Stata software, version 15.1, accounting for the LASI survey design.

Results

Depression classification and associated factors of depressive symptoms using CIDI-SF and CES-D scales

Table 1 presents the sample characteristics by depression classification based on the CIDI-SF and the CES-D instruments. Out of a total of 30,368 older adults selected in the final sample, around 5.2% ($n=1,204$) were identified as having depression on both CES-D (threshold ≥4 symptoms) and CIDI-SF (threshold ≥4 symptoms) scales; 25.0% ($n=7,290$) on CES-D scale only; 3.1% ($n=848$) on CIDI-SF scale only; and 66.7% ($n=21,026$) were identified as non-cases by both instruments. As compared to the cases of depression identified on both CES-D and CIDI-SF instruments, those identified on only CIDI-SF scale were younger, had a higher level of education and higher wealth, more likely to be male, married, and working, with better memory, and less likely to be ever diagnosed with a psychiatric problem and with no disease. Compared to cases of depression identified on both CIDI-SF and CES-D, those identified on only CES-D scale were more likely to be married, male, employed, had higher wealth and better memory, and less likely to have a history of psychiatric problems.

Bivariate and multivariable logistic regression analyses using both CES-D and CIDI-SF scales showed that the prevalence of depressive symptoms was higher in older women, those who had secondary or higher education, who had psychiatric disorders, had two or more chronic conditions and those who lived alone compared to the counterparts (Table 2). The associations of marital status, belonging to a specific religion and wealth quintiles were only significant with depressive symptoms assessed using only CES-D scale. We conducted sensitivity analyses and included supplementary tables for both bivariate and multivariable estimates (Table S1) by adopting the suggested scoring approach for CESD (0–3 for each item and a total score of 0–30, considering 10 as a cut-point for dichotomization). The estimates remained consistent with those from the previous scoring approach, except for gender, which was found to be non-significant for the CES-D only.

Factor structure of CIDI-SF and CES-D scales

Pearson correlation between the CIDI-SF and CES-D total scores was significant but weak ($r=.20$). The results of an exploratory factor analysis of the structure of a set of items of CES-D and CIDI-SF by analyzing intercorrelations among them are provided in Table 3. The depressive symptoms assessed using CES-D and CIDI-SF instruments were not related, and the items in the CES-D and CIDI-SF instruments that are loaded on three factors explained 62% of the variation. The first factor (severe depression indicators) had the loadings of all 10 items of the CIDI-SF instrument; therefore, it appeared to tap the major depressive disorder and explained the maximum variation (41%). The second factor (negative emotional state) had the loadings of 7 items with depressive affect and somatic retardation from the CES-D scale and the third factor had the loadings of 3 items with positive affect from the CES-D scale.

Agreement on number of depressive symptoms and comparison of cut-off scores for CIDI-SF and CES-D scales

Table 4 presents the agreement between CIDI-SF and CES-D on the number of depressive symptoms. The results suggest that 1,515 (5%) participants had no symptoms on both instruments. Nearly 23% of the older adults ($n=6,786$) with at least four depressive symptoms on the CES-D instrument had zero depressive symptoms on the CIDI-SF instrument. On the other hand, only 2.8% ($n=848$) cases of depression based on the CIDI-SF instrument (at least four depressive symptoms) had less than three depressive symptoms on the CES-D instrument.

Figure 2 shows the strength of agreement on the number of depressive symptoms between CES-D and CIDI-SF instruments across age, sex, and education-level

Table 1 Sample characteristics by depression classification based on the CES-D and CIDI-SF, LASI, 2017-19

Characteristics	Total sample (30,368)	CIDI-SF			
		Depression (*N* = 2,052, 8.3%)		No depression (*N* = 28,316, 91.7%)	
		a. CES-D depression (*N* = 1,204, 5.2%)	b. CES-D No depression (*N* = 848, 3.1%)	c. CES-D depression (*N* = 7,290, 25%)	d. CES-D No depression (*N* = 21,026, 66.7%)
Age-groups (in years)					
60–69	18,523	679 (55.1)	542 (62.7)	4,177 (57.2)	13,125 (60.6)
70–79	8,758	375 (31.4)	223 (24.3)	2,226 (30.7)	5,934 (29.6)
80+	3,087	150 (13.5)	83 (13.1)	887 (12.1)	1,967 (9.8)
	p <.001	-	$^{b}p_{a}$= *0.003*	$^{c}p_{b}$= *0.842*	$^{d}p_{c}$< *0.001*
Gender					
Men	14,544	479 (38.3)	407 (46.3)	3,238 (44.0)	10,420 (49.1)
Women	15,824	725 (61.7)	441 (53.7)	4,052 (56.0)	10,606 (50.9)
	p <.001	-	$^{b}p_{a}$< *0.001*	$^{c}p_{b}$= *0.003*	$^{d}p_{c}$< *0.001*
Education					
No education	16,245	758 (65.3)	472 (58.2)	4,337 (63.4)	10,678 (53.1)
Primary	7,324	264 (21.7)	205 (25.0)	1,642 (20.6)	5,213 (23.6)
Secondary	4,475	125 (8.3)	117 (12.1)	947 (11.0)	3,286 (15.2)
Higher	2,324	57 (4.6)	54 (4.8)	364 (5.0)	1,849 (8.1)
	p <.001	-	$^{b}p_{a}$= *0.005*	$^{c}p_{b}$= *0.047*	$^{d}p_{c}$< *0.001*
Marital Status					
Currently married	19,356	623 (52.3)	525 (61.3)	4,232 (56.5)	13,976 (64.5)
Widowed	10,230	550 (45.6)	308 (37.6)	2,838 (40.8)	6,534 (33.5)
Others[†]	782	31 (2.1)	15 (1.1)	220 (2.7)	516 (2.0)
	p <.001	-	$^{b}p_{a}$< *0.001*	$^{c}p_{b}$< *0.001*	$^{d}p_{c}$< *0.001*
Working status					
Never worked	8,476	315 (21.5)	236 (25.4)	2,191 (27.9)	5,734 (26.4)
Currently working	9,106	286 (26.3)	252 (32.3)	1,906 (28.5)	6,662 (32.9)
Not currently working	12,783	603 (52.3)	360 (42.3)	3,192 (43.6)	8,628 (40.7)
	p <.001	-	$^{b}p_{a}$< *0.001*	$^{c}p_{b}$< *0.001*	$^{d}p_{c}$< *0.001*
Religion					
Hindu	22,264	963 (84.1)	632 (80.0)	5,542 (83.3)	15,127 (82.5)
Muslim	3,583	152 (11.2)	109 (12.6)	882 (11.1)	2,440 (10.5)
Christian	3,028	42 (1.4)	50 (3.4)	628 (3.2)	2,308 (2.9)
Others	1,492	47 (3.3)	57 (4.1)	238 (2.4)	1,150 (4.1)
	p <.001	-	$^{b}p_{a}$< *0.001*	$^{c}p_{b}$< *0.001*	$^{d}p_{c}$< *0.001*
Wealth index					
Poorest	5,939	384 (41.5)	209 (30.9)	1,758 (31.4)	3,588 (22.7)
Poorer	5,331	219 (19.1)	162 (21.6)	1,424 (20.6)	3,526 (18.0)
Middle	5,653	218 (16.1)	160 (19.6)	1,396 (18.5)	3,879 (18.7)
Richer	6,023	202 (12.8)	163 (17.7)	1,312 (15.1)	4,346 (19.5)
Richest	6,910	169 (10.4)	149 (10.2)	1,306 (14.4)	5,286 (21.1)
	p <.001	-	$^{b}p_{a}$= *0.005*	$^{c}p_{b}$< *0.001*	$^{d}p_{c}$< *0.001*
Cognitive measures, mean (SE)					
Word recall- immediate	4.64	4.18 (1.82)	4.76 (1.82)	4.4 (1.89)	4.75 (1.88)
	p <.001	-	$^{b}p_{a}$< *0.001*	$^{c}p_{b}$< *0.001*	$^{d}p_{c}$< *0.001*
Word recall- delayed	3.35	2.91 (1.95)	3.38 (1.96)	3.12 (1.98)	3.46 (2.03)
	p <.001	-	$^{b}p_{a}$< *0.001*	$^{c}p_{b}$< *0.001*	$^{d}p_{c}$< *0.001*
Psychiatric disorders[‡]					
No	29,612	1114 (93.7)	809 (95.5)	7036 (96.0)	20,653 (98.3)
Yes	746	89 (6.3)	39 (4.5)	249 (4.0)	369 (1.7)
	p <.001	-	$^{b}p_{a}$= *0.010*	$^{c}p_{b}$< *0.001*	$^{d}p_{c}$< *0.001*
Morbidity[§]					
No disease	13,940	437(40.5)	305(36.6)	3115(44.7)	10,083(48.9)

Table 1 (continued)

Characteristics	Total sample (30,368)	CIDI-SF			
		Depression (*N* = 2,052, 8.3%)		No depression (*N* = 28,316, 91.7%)	
		a. CES-D depression (*N* = 1,204, 5.2%)	b. CES-D No depression (*N* = 848, 3.1%)	c. CES-D depression (*N* = 7,290, 25%)	d. CES-D No depression (*N* = 21,026, 66.7%)
1	8,944	350(27.7)	276(31.7)	2215(29.3)	6103(29.0)
2+	7,484	417(31.8)	267(31.7)	1960(26.0)	4840(22.1)
	$p < .001$		$^{b}p_a = 0.177$	$^{c}p_b < 0.001$	$^{d}p_c < 0.001$
Living arrangements					
Living alone	1,566	113 (9.6)	48 (7.3)	548 (8.5)	857 (4.3)
Living with spouse	5,917	208 (18.6)	163 (20.8)	1,417 (19.5)	4129 (19.9)
Living with others	22,885	883 (71.8)	637 (72.0)	5,325 (72.0)	16,040 (75.8)
	$p < .001$	-	$^{b}p_a = 0.007$	$^{c}p_b = 0.028$	$^{d}p_c < 0.001$
Caste					
Schedule Caste	4,964	246 (25.2)	165 (19.4)	1,317 (22.2)	3,236 (18.1)
Schedule Tribe	4,992	98 (4.9)	67 (4.5)	1,049 (8.2)	3,778 (8.8)
Other Backward Classes	11,486	541 (49.7)	348 (47.4)	2,861 (45.7)	7,736 (46.3)
Others[#]	7,918	283 (20.2)	249 (28.8)	1,797 (23.9)	5,589 (26.8)
	$p < .001$	-	$^{b}p_a = 0.036$	$^{c}p_b < 0.001$	$^{d}p_c < 0.001$

Notes: CES-D = 10-item Center for Epidemiologic Studies Depression Scale (threshold ≥ 4 symptoms); CIDI-SF = 10-item Composite International Diagnostic Interview—short form (threshold ≥ 4 symptoms); The values presented in parentheses are percentages that are weighted to account for the complex survey design and to provide nationally representative estimates

[†]Includes divorced, separated, deserted, and never married

[‡]Self-reported physician diagnosis of depression, Alzheimer's disease, dementia, unipolar/bipolar disorder, schizophrenia etc., and neurological problems such as neuropathy, convulsions, migraine, Parkinson's etc

[§]Self-reported physician diagnosis of chronic diseases that include hypertension, diabetes, cancer, chronic lung disease, chronic heart disease, stroke, arthritis, and high cholesterol

[#]Others include those who are not from scheduled caste/tribe or other backward classes but from general category, mainly from forward classes

Chi-squared tests were used to examine differences by each variable between the four depression groups

The *p* values in the total sample column indicate overall difference across the four depression groups

$^{b}p_a$ indicates difference between the depression group identified by CIDI-SF only (b) vs. the depression group identified by both CIDI-F and CES-D (a)

$^{c}p_a$ indicates difference between the depression group identified by CES-D only (c) vs. the depression group identified by both CIDI-F and CES-D (a)

$^{d}p_a$ indicates difference between no depression group (d) vs. the depression group identified by both CIDI-F and CES-D (a)

sub-groups. We observed that the Kappa coefficient value increases with an increase in the number of symptoms and starts declining after reaching the maximum value at the threshold of six (κ: 0.18–0.23). While looking at the strength of agreement between CES-D and different thresholds of the CIDI-SF Scale (≥ 4, ≥ 5, ≥ 6, ≥ 7), the values of the Kappa coefficient for different cut-offs of the CES-D Scale remains consistent and shows the 'none' to 'minimal' strength of agreement.

Figure 3 shows the sensitivity and specificity for different cut-off scores of the CES-D by assuming classification of depression cases on the CIDI-SF scale as a "gold standard." We observed that with increasing threshold values of the CES-D instrument, sensitivity decreased, and specificity increased in detecting depression cases. For instance, at threshold ≥ 3, the sensitivity of depression cases was 40%, and specificity was 82%, while at threshold ≥ 6, sensitivity was 29%, and specificity was 92%.

Discussion

Prevalence of depression in older adults varies largely across studies, likely reflecting methodological differences rather than true disparities. The current study explored the agreement between two depression scales (CIDI-SF and CES-D) in the largest country-representative aging survey in India. We found that the overall level of agreement between the CES-D and CIDI-SF was 'none' to 'minimal', irrespective of various demographic and socioeconomic covariates. This suggests that the populations in the LASI survey with symptoms of depression are mostly different according to both scales. Consistent with our findings, a study of older adults in the US reported a weak agreement in depression classification based on the CES-D and CIDI-SF scales (κ = 0.32–0.44); however, the level of disagreement was greater in our study focused on the older Indian population (κ = 0.04–0.24) [30].

Considering the CIDI-SF as a temporary "gold standard", the CES-D scale showed a high rate of false positives; therefore, at a cut-off of 4, the CES-D instrument

Table 2 Associations between socio-demographic characteristics and depressive symptoms (percentage distribution and adjusted odds ratios) according to CES-D (≥ 4) or/and CIDI-SF (≥ 4) scales among older adults aged 60 years and over, LASI, 2017-19

Characteristics	CES-D (weighted %)	Adjusted odds ratio (95% confidence interval)	CIDI-SF (weighted %)	Adjusted odds ratio (95% confidence interval)	Both CES-D & CIDI-SF (weighted %)	Adjusted odds ratio (95% confidence interval)
Age-groups (in years)						
60–69	28.8	Ref.	8.1	Ref.	5	Ref.
70–79	31.3	0.97 (0.86–1.09)	8.1	0.91 (0.77–1.07)	5.8	1.03 (0.83–1.27)
80+	34.7	1.10 (0.94–1.29)	10.3	1.14 (0.88–1.46)	7.2	1.20 (0.87–1.66)
Gender						
Men	27.5	Ref.	7.3	Ref.	4.4	Ref.
Women	32.6	1.13* (1.01–1.26)	9.3	1.30** (1.09–1.56)	6.5	1.52*** (1.19–1.94)
Education level						
No education	34.1	Ref.	9.3	Ref.	6.3	Ref.
Primary	27.6	0.82*** (0.73–0.92)	8.4	1.04 (0.85–1.27)	5.7	1.02 (0.77–1.35)
Secondary	23.2	0.73** (0.61–0.89)	5.9	0.66*** (0.54–0.81)	3.6	0.66** (0.51–0.85)
Higher	21	0.59*** (0.48–0.73)	5.5	0.55*** (0.41–0.72)	3.5	0.60** (0.42–0.85)
Marital Status						
Currently married	27.3	Ref.	7.5	Ref.	4.6	Ref.
Widowed	34.8	1.25** (1.09–1.44)	9.8	1.16 (0.96–1.40)	7	1.18 (0.91–1.53)
Others[†]	36.6	1.45** (1.13–1.87)	6.8	0.84 (0.54–1.29)	5.6	1.07 (0.64–1.81)
Working status						
Never worked	30.5	Ref.	7.2	Ref.	4.5	Ref.
Not currently working	32.4	1.17* (1.02–1.35)	9.6	1.64*** (1.36–1.99)	6.8	1.96*** (1.54–2.48)
Currently working	27	0.95 (0.82–1.09)	7.6	1.47*** (1.19–1.81)	4.5	1.52** (1.15–2.00)
Religion						
Hindu	30.5	Ref.	8.3	Ref.	5.5	Ref.
Muslim	31.2	0.99 (0.87–1.13)	9.1	1.12 (0.91–1.39)	5.9	1.12 (0.86–1.45)
Christian	30	0.85 (0.68–1.06)	6.3	0.88 (0.58–1.34)	3.7	0.69 (0.42–1.13)
Others	21.3	0.72** (0.59–0.88)	8.2	0.99 (0.73–1.35)	5.3	0.95 (0.64–1.41)
Wealth index						
Poorest	38.5	Ref.	12.1	Ref.	6.2	Ref.
Poorer	32.8	0.84** (0.74–0.95)	9	0.89 (0.75–1.07)	4.3	0.70** (0.56–0.88)
Middle	29.6	0.83** (0.72–0.95)	7.9	0.92 (0.73–1.16)	5	0.82 (0.59–1.12)
Richer	24.8	0.92 (0.78–1.08)	6.9	0.98 (0.79–1.21)	5.7	0.94 (0.72–1.21)
Richest	22.5	0.89 (0.75–1.05)	4.7	1.16 (0.93–1.43)	6.4	1.13 (0.86–1.48)
Psychiatric disorders[‡]						
No	29.6	Ref.	8.1	Ref.	5	Ref.
Yes	50.9	1.69*** (1.31–2.18)	18	1.85*** (1.38–2.49)	12.1	2.30*** (1.67–3.17)
Morbidity[§]						
No disease	28.2	Ref.	6.9	Ref.	4.6	Ref.
Single	30.1	1.11 (0.99–1.23)	8.4	1.20* (1.00–1.45)	5.2	1.10 (0.87–1.40)
Two	34.2	1.37*** (1.22–1.55)	11.1	1.54*** (1.31–1.81)	7	1.46*** (1.18–1.81)
Living arrangements						
Living alone	46	Ref.	12.7	Ref.	10.2	Ref.
Living with spouse	29.5	0.72** (0.58–0.89)	8.2	0.80 (0.59–1.10)	5	0.69 (0.47–1.02)
Living with others	29.2	0.65*** (0.54–0.79)	8	0.73* (0.56–0.95)	5.3	0.67** (0.50–0.89)
Caste						
Scheduled caste	34.9	Ref.	9.8	Ref.	6.9	Ref.
Scheduled tribe	27.5	0.76*** (0.64–0.89)	4.7	0.49*** (0.37–0.65)	3.1	0.46*** (0.33–0.65)
Other backward class	30	0.82** (0.72–0.92)	8.8	0.94 (0.78–1.13)	5.7	0.83 (0.65–1.06)

Table 2 (continued)

Characteristics	CES-D (weighted %)	Adjusted odds ratio (95% confidence interval)	CIDI-SF (weighted %)	Adjusted odds ratio (95% confidence interval)	Both CES-D & CIDI-SF (weighted %)	Adjusted odds ratio (95% confidence interval)
Others[#]	27	0.90 (0.79–1.04)	7.6	0.85 (0.69–1.05)	4.9	0.77 (0.60–1.00)
Overall	**30.2**		**8.3**		**5.2**	

Notes: The cut-off for CES-D and CIDI-SF scales was greater than or equal to 4

Percentages are weighted to account for the complex survey design and to provide nationally representative estimates

[†]Includes divorced, separated, deserted, and never married

[‡]Self-reported physician diagnosis of depression, Alzheimer's disease, dementia, unipolar/bipolar disorder, schizophrenia etc., and neurological problems such as neuropathy, convulsions, migraine, Parkinson's etc

[§]Self-reported physician diagnosis of chronic diseases that include hypertension, diabetes, cancer, chronic lung disease, chronic heart disease, stroke, arthritis, and high cholesterol

[#]Others include those who are not from scheduled caste/tribe or other backward classes but from general category, mainly from forward classes

Table 3 Factor item loadings, communalities, and percentage variance explained by the exploratory factor analysis

	Factor 1 (Major depression indicators)	Factor 2 (Negative emotional state)	Factor 3 (Positive emotional wellbeing)	Communalities
Factor 1: Major depression indicators				
Felt sad, blue, or depressed	0.882	0.084	0.022	0.78
Loss of interest	0.939	0.056	0.010	0.89
Feeling tired	0.945	0.059	0.012	0.90
Loss of appetite	0.926	0.050	0.007	0.86
Trouble concentrating	0.938	0.053	0.008	0.88
Feeling of worthlessness	0.896	0.055	0.003	0.81
Thinking about death	0.806	0.065	0.001	0.65
Trouble falling asleep	0.937	0.045	0.005	0.88
Problem with falling asleep	0.892	0.037	0.004	0.80
Lost interest in most things	0.653	0.113	0.027	0.44
Factor 2: ***Negative emotional state***				
Trouble concentrating	0.110	0.646	-0.017	0.43
Feel depressed	0.204	0.676	0.015	0.50
Feel tired or low in energy	0.099	0.556	-0.024	0.32
Feel afraid of something	0.037	0.659	-0.070	0.44
Feel alone?	0.076	0.661	-0.019	0.44
Bothered by things	0.081	0.630	-0.146	0.42
Everything you did was an effort	0.048	0.457	-0.417	0.39
Factor 3: ***Positive emotional wellbeing***				
Feel you were overall satisfied	0.016	-0.082	0.732	0.54
Hopeful about the future	0.007	-0.201	0.670	0.49
Feel happy	0.056	0.086	0.771	0.61
Percentage variance explained	40.5	14.1	7.8	62.3

becomes less appropriate. Multiple studies have reported a high rate of false positives with the CES-D scale [12, 33]. In contrast, increasing the cut-off values for the CES-D scale reduced the number of false positives but also increased the risk of missing the potential depression cases. Besides, it is possible that subjects screened for four symptoms on the CIDI-SF currently have depression or experienced in the past year. For example, 5.2% of those who tested positive on both scales had depression, while 3.1% who were positive only on the CIDI-SF may have had depression in the past year but did not meet the CES-D criteria in the last week (i.e. 8.3% may have had depression in the past year). Hence, the optimal best cut off for achieving a good balance between specificity and sensitivity may be 4 to 5 (12 to 15 on the usual scoring of 0–30) for the CES-D, as per this study. Moreover, previous review studies suggest that the CES-D has a diagnostic accuracy and recommend applying a cutoff score that provides an adequate tradeoff between sensitivity and specificity when used in epidemiological studies [14, 34].

There are several potential explanations for the observed lack of concordance between depression

Table 4 Agreement on number of symptoms identified by CES-D and CIDI-SF scales, LASI, 2017-19

Number of depressive symptoms using CES-D	Number of depressive symptoms using CIDI-SF											
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
0	1,515	14	3	2	1	1	2	3	6	7	3	**1,557**
1	3,919	52	9	3	9	12	9	14	24	20	24	**4,095**
2	5,492	126	13	5	15	12	19	24	34	75	48	**5,863**
3	9,572	234	48	19	39	35	45	73	81	115	98	**10,359**
4	3,218	113	32	12	15	21	40	61	62	64	78	**3,716**
5	1,678	117	13	8	19	10	26	29	56	58	73	**2,087**
6	959	73	11	4	6	14	23	24	44	63	68	**1,289**
7	681	72	10	5	7	12	21	30	30	51	61	**980**
8	199	18	2	3	2	3	8	9	10	18	35	**307**
9	42	8	0	0	2	0	3	4	8	7	19	**93**
10	9	3	0	0	1	0	1	0	1	5	2	**22**
Total	**27,284**	**830**	**141**	**61**	**116**	**120**	**197**	**271**	**356**	**483**	**509**	**30,368**

prevalence assessed by the CES-D and CIDI-SF scales in the LASI survey. First, symptoms reported on the CES-D pertained to current depression at the time of the interview whereas the symptoms reported on the CIDI-SF related to depression experienced in the previous year. Therefore, CIDI-SF positive indicates past depression, and CES-D positive indicates current depressive symptoms. Although positive on both scales can indicate various situations such as chronic depression, depression partly in remission, recurrent depression, they may not necessarily relate to the same depressive episode. Relatedly, the questions in the CIDI-SF scale were comparatively of higher intensity and assumed to identify major depressive episodes occurring in the past 12 months [17]. This scale captured characteristics of the illness, which include trouble falling asleep and loss of appetite that were not addressed in the CES-D.

Secondly, older patients with depression may avoid recalling their symptoms when asked to report on an additional scale, particularly soon after being asked about similar symptoms in another scale. However, this potential bias was minimized in LASI by administering the CES-D questionnaire in a separate section after the CIDI-SF. Moreover, the CIDI-SF scale is subject to higher chances of recall bias because it assesses major depressive disorder over the past year. Finally, selection bias due to non-participation may have affected the current results. For example, those with major depression might have been unable to participate in the study, resulting in a higher proportion of participants with minor depression. Since the CIDI-SF scale is more sensitive in detecting major depression cases, this could have contributed to the weak agreement between the CIDI-SF and CES-D in the study sample.

The present study also revealed that the prevalence of depressive symptoms in the oldest old adults (aged 80+) was substantially greater than younger adults (aged 60–69 years), which may be attributed to the fact that in older age, people face predominant physical health problems and experience a greater loss of social functioning, making them increasingly prone to depressive disorders [35]. Previous studies in India have shown similar findings [36, 37]. Importantly, both the prevalence of diagnosed depression (CIDI-SF) as well as screening for depressive symptoms (CES-D) increased with physical comorbidity among older adults in this study. In a previous study, however, the CIDI-SF appeared to be less informative about the relationship between chronic illnesses and comorbid depression compared to the CES-D [38]. This needs to be further investigated in future studies.

The findings have several implications for future research using either scale as a case-identification tool or screening assessment to capture patterns of mental

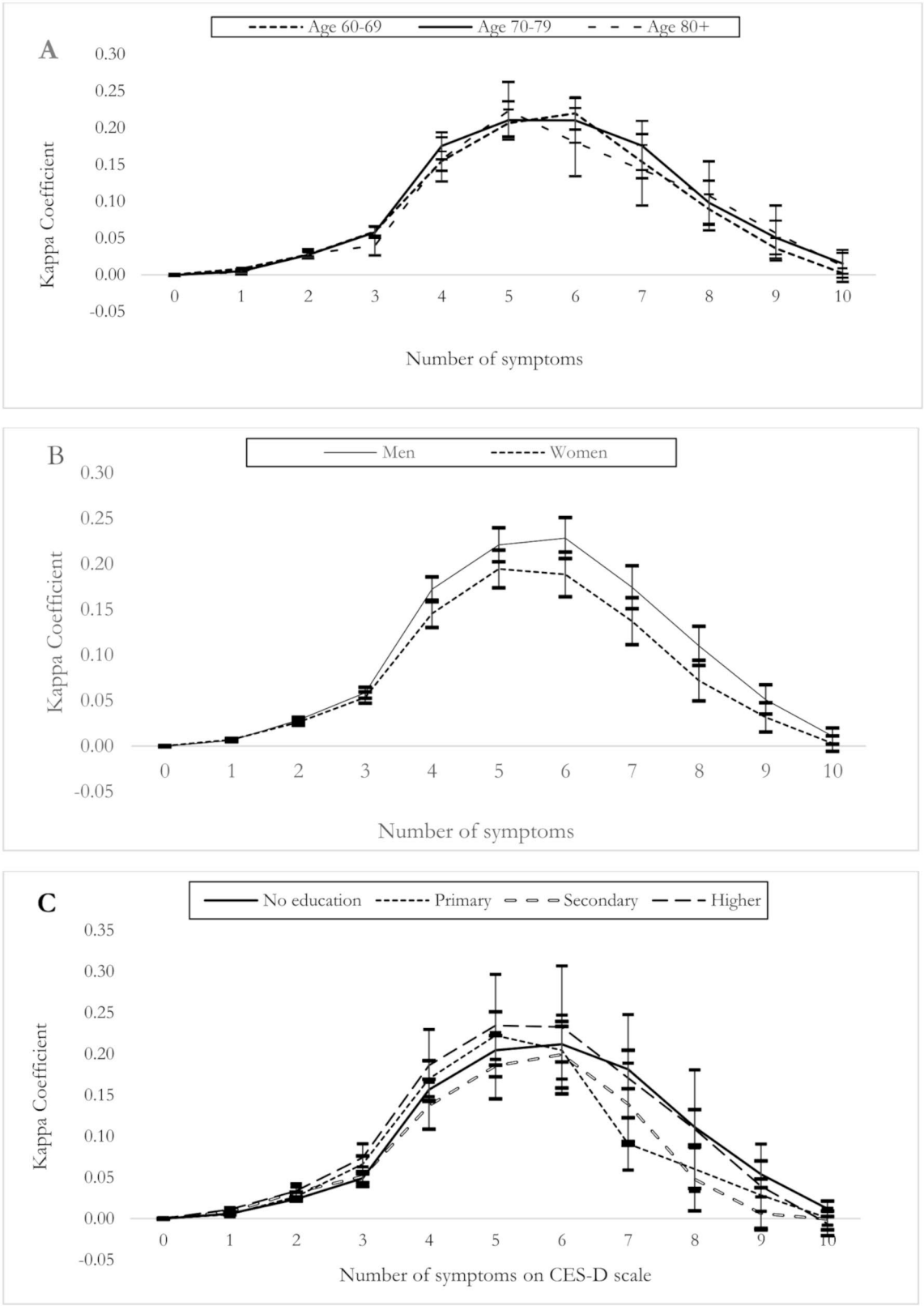

Fig. 2 Cohen's kappa coefficient comparing agreement in number of depressive symptoms across the CES-D and CIDI-SF by (**A**) age, (**B**) gender, (**C**) education

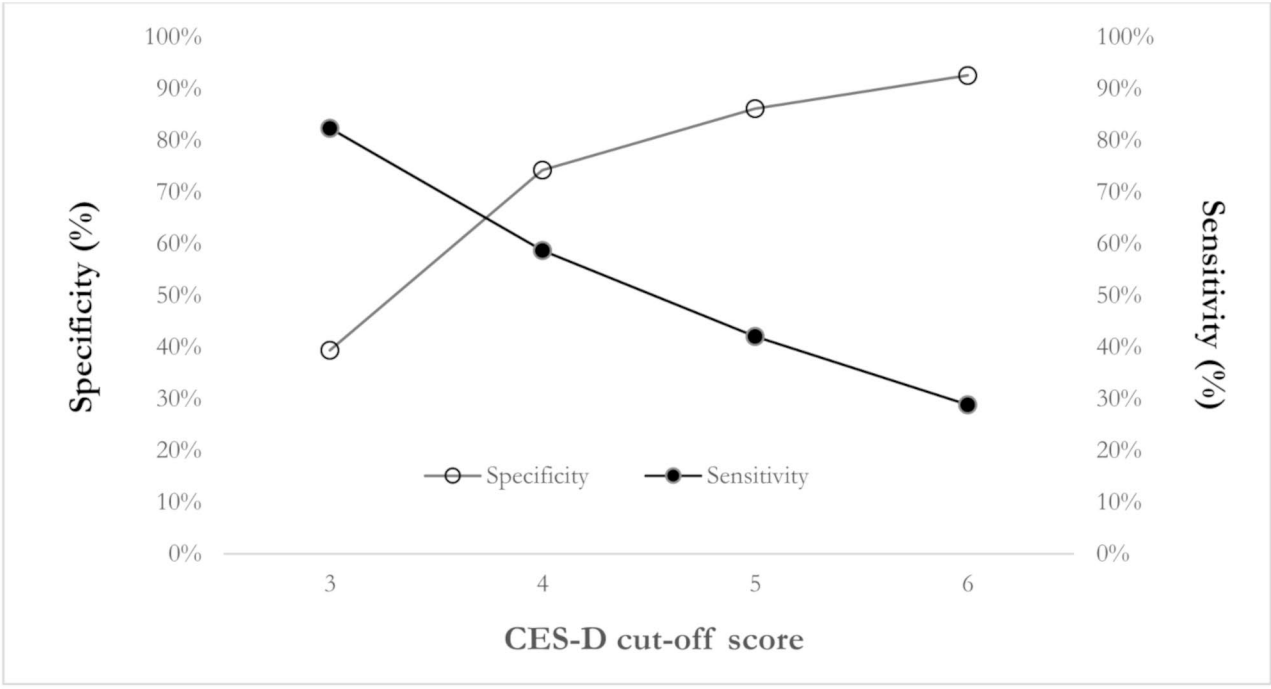

Fig. 3 Sensitivity and specificity for different cut-off scores of the CES-D by assuming the CIDI-SF scale as a "gold standard". Sensitivity and specificity of the CES-D across four thresholds of symptom counts (≥ 3, ≥ 4, ≥5, and ≥ 6) to define depression case status relative to depression cases defined by the CIDI-SF scale

illness across different populations. Although studies that examined depression as a predictor of other illnesses have reported similar findings regardless of the scale used (CES-D or CIDI-SF), care needs to be taken while interpreting results from both instruments. For example, some of the constructs in CES-D such as disengagement and perceived stress are more related to age-related health outcomes, which may have different implications compared to symptoms assessed through the CIDI-SF. Similarly, the positive elements of affect, which are reverse-coded, differentiate between the CES-D and the CIDI-SF might also have different implications among various population subgroups. Since both scales of depression capture different domains of mental illness, they can be effectively utilized in community-based surveys similar to how multiple measurement scales are used in the assessment of physical illnesses.

Limitations of the current study include the use of self-report instruments for assessing depression which are subject to external biases. Given that we observed lower sensitivity among participants with increasing cut-off scores, it is plausible that participants are concerned with social desirability and thus more likely to under-report the symptoms of depression on both scales. Even though the overall response rate in the LASI survey was 87%, we cannot rule out the possibility of participation bias since individuals with depression are less likely to participate in population-based studies. Notwithstanding these limitations, the major strength of the study is its large sample size and the use of an age-stratified, gender-balanced, nationally representative, and well characterized population sample.

Conclusions

The current study found that depression cases identified by the CES-D have poor agreement with those identified by the CIDI-SF in a national sample of older Indians. Therefore, the prevalence of depressive symptoms measured by the CESD is not interchangeable with that measured by the CIDI-SF. However, independent of the scale used, prevalence varied greatly by socio-demographic factors, including age, gender, education, marital status, living arrangements, religion, caste, and household wealth quintile. These findings suggest the importance of using both the CES-D and CIDI-SF in large population-based cohorts and surveillance surveys to obtain more accurate and nuanced understanding of depressive disorders in various subgroups of older population. Therefore, the current findings may be useful when conducting future rounds of the LASI survey, as well as for epidemiologists while assessing depression in older Indian adults, and for researchers while exploring and comparing depression prevalence across different scales.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12888-025-06671-0.

Supplementary Material 1

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Author contributions
Conceived and designed the research paper: TM, TVS and MK; Analysed the data: TM and MK; Contributed to the study design and concept: SL, and MV; Wrote the manuscript: TM, SL, MV, MK and TVS; Refined the manuscript: TM, SL, MV and MK. All authors read, reviewed and approved the manuscript.

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Data availability
The study used secondary data which is available in the public repository of International Institute for Population Sciences, Mumbai, accessible through https://www.iipsindia.ac.in/content/lasi-wave-i. The data are also available at the Gateway to Global Aging Data repository (https://g2aging.org/).

Declarations

Ethics approval and consent to participate
The survey agencies that conducted the field survey for the data collection have collected prior informed consent (written and verbal) from all the participants. The Indian Council of Medical Research (ICMR) extended the necessary guidance and ethical approval for conducting the LASI survey. All methods related to the current analysis were carried out in accordance with relevant guidelines and regulations by the Indian Council of Medical Research (ICMR).

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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