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Original Research Article

Late-life depression: assessment of validity and performance of depression scales in patients attending outpatient clinic at the institute of mental health

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ABSTRACT

Background: Ageing and depression often coexist, with older individuals experiencing increased depressive symptoms. Factors include substance use, diabetes, cardiovascular disease, and rural elderly populations. This study aimed to assess the validity and performance of depression scales for late-life depression among patients attending the outpatient clinic at the Institute of Mental Health, Chennai.
Methods: This prospective study was conducted on 358 patients aged >50 years who reported to the OPD and were diagnosed with depression at the institute of mental health, Chennai. Baseline assessments were done at the time of recruitment into the study, and assessments were done (visit 1) for depression as in assessment tools. Scheduled visits were performed every six months for two years (visits 2-5). Adverse events were monitored and recorded periodically.
Results: The study found a significant positive correlation between CSDD, MADRS, and PHQ9 scores with HAMD, MADRS, and GDS. The HAMD had a higher correlation with all depression scales except the Geriatric Depression Scale (GDS). The GDS had a distinct dimensionality and varied items, while MADRS showed a good correlation with all depression scales except GDS. The PHQ9 and MADRS are more valid and accurate among the participants, with higher accuracy, sensitivity, and specificity values. After these two scales, the HAMD was better with higher values than all the other scales.
Conclusions: Various depression scales were found to have a strong correlation with each other in measuring late-life depression at a tertiary care psychiatric institution.

Keywords: Late-life depression, Depression scales, CSDD, MADRS, PHQ9, GDS

INTRODUCTION

The themes of ageing and depression often coalesce. Most of them are satisfied and undergo minor fluctuations in their effects. In Oriental culture, older people have much prestige. Depressive symptoms are increased in older persons; however, depressive illness is distinct from normal daily fluctuations in mood. It is a group of clinical conditions with unique clinical features. To understand the factors that precipitate significant and severe depression, common historical themes must be tempered by modern scientific expertise. Old age is a period of transition in which people are left to deal with physical ageing and challenges, such as loneliness, lack of family support, restricted personal autonomy, and financial dependency. Various studies have revealed that the median prevalence

rate of depression among the elderly population in India is 18.2%, which is higher than that in the world (5.4%).[1] In Clinic-based studies conducted in multidisciplinary wards, the incidence of depression was 42.4% to 72%. Substance use and diabetes are commonly associated. Cardiovascular disease, neoplasms, infections, and neurocognitive disorders have also been reported. The predictors were female sex, living status, mobility and nutritional status.[2] The associated factors were rapid industrialisation and technical developments, which have fragmented the joint family structures due to the rapid population shift from their homelands.[3] The older people are abandoned in their homes with reduced physical, psychological, emotional, financial, and social care. This has broken the rural elderly population in rural areas. The prevalence of MDD in the elderly population of India is 34.4% in the eastern rural areas of India.[4] This could be a major disease burden in the future. Advances in our capacity to diagnose and treat depression in late life are based on our increased understanding of the nature and cause of depression from the physical, psychological and social perspectives.

Psychological and psychosocial approaches to depression

Freud's psychodynamic theory suggests that the loss of loved ones leads to low self-esteem, which is influenced by negative childhood experiences. Beck's cognitive behaviour view suggests negative feelings are taken personally, leading to inferiority and suicidal thoughts. Late-life depression is similar to early-life depression, strongly associated with neuroticism and genetic functions, presenting a psychological threat and genetic risk.[5]

Symptoms and signs of late-life depression

Beck (1967) categorised emotional, cognitive, physical, and volitional symptoms. Emotional symptoms include depression, low self-esteem, and negative feelings towards the self. Cognitive symptoms included pessimism, self-blame, and low self-esteem. The physical symptoms include loss of appetite, sleep, and motivation. Volitional symptoms include appearance, psychomotor symptoms, and unusual behaviour.[6] Numerous surveys of community, clinical, and institutional populations for the frequency of depressive symptoms have appeared in the literature for the past 25 years. These were identified in various studies by Beck in 1967, Hamilton in 1960, Zung in 1965, and Blazer in 1980. The relationship between HAMD and MADRS was explained in the study.[7] The validation of GDS in the community reveals high sensitivity and specificity in late-life depression.[8]

Aim and objectives

This study aimed to assess the validity and performance of depression scales for late-life depression among patients attending the outpatient clinic at the Institute of Mental Health, Chennai.

METHODS

This study is a part of TN Dr. MGR Medical University, Chennai. This prospective study was conducted on 358 patients aged >50 years who reported to the OPD and were diagnosed with depression at the Institute of Mental Health, Chennai from October 2018 to July 2022.

Inclusion criteria

People above 50 years of age and diagnosed with major depressive disorder as the ICD 10/DSM 5 criteria were included.

Exclusion criteria

Patients not having a major depressive disorder as the primary diagnosis, depressive patients with severe medical illness, making it difficult to participate in the study, people from outside Chennai, and uncooperative patients were excluded.

A total of 360 consecutive patients satisfying all the inclusion criteria and none of the exclusion criteria were recruited for the study and followed up for two years. Baseline assessments were done at the time of recruitment into the study, and assessments were done (visit 1) for depression as in assessment tools. Scheduled visits were performed every six months for two years (visits 2-5). During routine visits to the institute, unscheduled visits were performed once a month to perform routine psychiatric review/medical examinations and obtain their medications. Adverse events were monitored and recorded periodically. Assessment tools included the Hamilton Rating Scale for Depression (HAMD) to assess the severity of depression and treatment response, the Montgomery Rating Scale for Depression (MADRS), the Cornell Rating Scale for Depression in Dementia (CSDD), the Geriatric Depression Scale (GDS), and PHQ9- to aid in the diagnosis, severity, and improvement of symptoms with treatment in various settings.

Statistical analysis

Data were checked for duplication and outliers, and logical validation was conducted before analysis. All statistical analyses were performed using STATA v 15.0 (Stata Corporation, College Station, TX, USA). Descriptive analysis summarised participant characteristics: frequency, percentage, median, and interquartile range. The Mann-Whitney U test was used for between-group comparisons of depression scores and other continuous variables. Internal consistency reliability was assessed by calculating Cronbach's alpha, item-total correlation, item-item correlation, and domain-domain correlation using Pearson's correlation analysis. Convergent and divergent validity were explored using Pearson's correlation matrix between the items and domains. Latent profile models were performed with varying latent classes ranging from two to five, utilising random start values and 20 iterations.

The fit of the four models was compared using Akaike's information criterion (AIC) and Schwarz's Bayesian information criterion (BIC). Based on these criteria, the model with the smallest AIC and BIC values was considered the best. Subsequently, we determined the expected classification for each individual in the dataset based on the predicted posterior class probabilities. Considering these predictors, the performance of each scale was evaluated using logistic regression to calculate predictive probability. The Youden index was used to determine the optimal cut-off of the scale score, which maximized the sum of the sensitivity and specificity minus 1. The data are presented as the sensitivity, specificity, and predictive value of a positive or negative depression scale. All statistical analyses were two-sided, with a type 1 error set at α=0.05.

RESULTS

A total of 358 participants were interviewed using structured and standardised questionnaires.

Table 1: Characteristics of study participants.

Parameters		N	%
Age classification	≤55	69	19.3
	56-60	138	38.5
	61-65	75	20.9
	66-70	45	12.6
	>70	31	8.7
Age (years), Median (Min, Max)		59 (50, 80)	
Gender	Male	168	46.9
	Female	190	53.1
Diabetes	Diabetes	115	32.2
	Non-diabetes	242	67.8
Functional assessment staging	No difficulty	18	5
	Subjective work difficulties	336	93.9
	Decreased organisational capacity	4	1.1
The Hamilton rating scale for depression	Depressed (≤35 and >15)	133	37.2
	Severely depressed (>35)	225	62.8
	Score-median (Min, Max)	36 (18, 49)	
Cornell scale for depression in dementia classification	Definite major (>13)	358	100
	Score-median (Min, Max)	28 (16, 35)	
Geriatric depression scale	Moderate (9-11)	2	0.6
	Severe (12-15)	13	3.6
	Very severe (>15)	343	95.8
	Score-median (Min, Max)	19 (10, 26)	
Montgomery-Asberg depression rating classification	Mild (7-19)	25	7
	Moderate (20-34)	323	90.2
	Severe (>34)	10	2.8
	Score-median (Min, Max)	28 (8, 40)	
Patient health questionnaire scale classification	Mild (5-9)	3	0.8
	Moderate (10-14)	17	4.7
	Moderately severe (15-19)	281	78.5
	Severe (>19)	57	15.9
	Score-median (Min, Max)	16 (8, 26)	

The mean age of the participants was 59 years (range: 50-80 years). Among these, 53.1% were females, 32.2% had diabetes, and 93.9% had subjective work difficulties. Hamilton Rating scale for depression (HAMD) indicated that all the participants were depressed, with 225 (62.5%) classified as severely depressed (scores >35). According to Cornell's Rating Scale for Depression, all 358 participants (100%) were classified as having severe depression. The

Geriatric Depression Scale classified 343 participants (95.8%) as having very severe depression (Table 1).

There was no significant difference in depression scores between genders, except for the PHQ9 scale, where males had lower scores than females.

Table 2: Correlation between the depression scales.

Variables	Age	HAMD	CGD	GD	MADR	PHQ
Age	1	-	-	-	-	-
	(NA)					
HAMD	-0.058	1	-	-	-	-
	-0.016	(NA)				
CGD	-0.036	0.510	1	-	-	-
	-0.132	(<0.001)	(NA)			
GD	0.120	0.032	0.172	1	-	-
	(<0.001)	-0.176	(<0.001)	(NA)		
MADR	-0.077	0.530	0.357	0.062	1	-
	-0.001	(<0.001)	(<0.001)	-0.009	(NA)	
PHQ	-0.057	0.360	0.311	-0.015	0.525	1
	-0.016	(<0.001)	(<0.001)	-0.535	(<0.001)	(NA)

Table 3: Internal consistency and validity of the depression scales.

Parameters	HAMD	CGD	GD	MADR	PHQ
N	358	358	358	358	358
Mean	35.72	27.9	19.11	27.49	17.09
SD	3.45	2.75	2.1	5.1	2.57
CV	0.1	0.1	0.11	0.19	0.15
Skewness	-1	-0.6	-0.48	-0.81	0.54
Kurtosis	6.42	5.71	5.4	3.79	4.16
p50	36	28	19	28	16
Min	18	16	10	8	8
Max	49	35	26	40	26
Inter-item Correlation	0.134	0.089	0.118	0.286	0.343
Cronbach's α	0.787	0.651	0.8	0.8	0.824
Convergent validity with a correlation coefficient >0.40					
Items	9	7	2	10	9
Total	24	19	30	10	9
%	37.50	36.80	6.70	100	100

Table 4: Sensitivity, Specificity and Predictive values at the recommended cut-off for the depression scales

Scale	Cut-Off (Score)	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)	Accuracy (95% CI)	ROC (95% CI)
HAMD	36	64.0 (57.8, 70.3)	67.7 (59.8, 75.5)	77.0 (70.9, 82.8)	52.6 (45.4, 60.3)	65.4 (60.5, 70.3)	65.8 (60.8, 70.9)
CGD	29	60.1 (54.6, 65.9)	79.2 (69.5, 87.8)	92.0 (87.8, 95.4)	33.3 (26.9, 40.9)	64.0 (59.0, 68.9)	69.7 (64.1, 75.2)
GD	19	57.8 (51.2, 64.6)	55.3 (47.6, 63.3)	63.6 (56.8, 70.5)	49.1 (42.0, 56.9)	56.7 (51.7, 61.9)	56.5 (51.3, 61.7)
MADR	26	64.5 (58.8, 70.3)	82.8 (74.8, 89.8)	91.4 (87.1, 95.0)	45.0 (38.0, 52.8)	69.3 (64.5, 74.0)	73.7 (68.8, 78.5)
PHQ	17	74.6 (68.9, 80.1)	86.9 (80.8, 92.2)	90.9 (86.5, 94.6)	66.1 (59.1, 73.1)	79.1 (74.8, 83.1)	80.7 (76.7, 84.8)

There were significant differences in depression scores between participants with and without diabetes in the HAMD ($p<0.001$) and MADRS ($p=0.037$), with lower depression scores among those without diabetes. Age was significantly related to depression scores, except for CSDD scores.

The results indicated that the CSDD scores (rho=0.510, $p<0.001$), MADRS scores (rho=0.530, $p<0.001$), and PHQ9 scores (rho=0.360, $p<0.001$) showed a highly significant positive correlation with HAMD. Similarly, MADRS was significantly associated with CSDD (rho=0.357, $p<0.001$), PHQ9 (rho=0.525, $p<0.001$), and GDS scores (rho=0.062, $p=0.009$). The HAMD exhibited a higher correlation with all depression scales except the Geriatric Depression Scale (GDS). The MADRS scale shows a good correlation with all depression scales except the Geriatric Depression Scale (GDS), which stands out as an exception. The Biplot shows the correlation between the depression scales (A) and scale items (B), indicating item-item and scale-scale correlations. The HAMD strongly correlates with the CSDD and almost all items on other scales. PHQ9 correlates with MADRS, and the items in MADRS are highly correlated with the PHQ9 items. The GDS is distinct from other scales. The items in the GDS had wide variability in their dimensionality and differed from the other scales (Table 2).

Cronbach's alpha shows higher reliability for PHQ9 (0.824), MADRS (0.800), and HAMD (0.787). The inter-term correlation replicates similar correlations between items. Convergent Validity states that 38/92 items (41.3%) have a correlation coefficient with a score of their dimension greater than 0.40. Divergent validity states that 75/92 items (81.5%) have a correlation coefficient with a score of their dimension greater than those computed with other scores, indicating that the scales consist of similarities. The convergent and divergent scores replicated Cronbach's findings.

The latent profile models show that the best criterion for the latent class is two. The binary predicted posterior class was determined and used as a reference standard to assess the performance of the depression scale. The PHQ9 and MADRS are more valid and accurate among the participants, with higher accuracy, sensitivity, and specificity values. After these two scales, the HAMD was better with higher values than all the other scales (Table 4).

DISCUSSION

In our study, 53.1% of the participants were females, and 32.2% were diabetic. The CSDD group showed the highest percentage of severe depression, whereas the HAMD group showed 62.5% severe depression. The MADRS and PHQ9 scales classified participants as having more than mild depression. This indicates that each depression scale measured certain domains of depression of their own and were good clinical measures of depression in older people.[9] Especially when late-life depression has symptoms that are categorized into many domains.[10] Late-life depression shows a significant difference in depression between Genders except for PHQ9 (0.017), females with higher scores in our study, which many studies have proved in the past.[11-13] Significant difference in depression scores, lower in nondiabetics in HAMD (0.001) and MADRS (0.037) in this study, which again is proven by earlier studies.[14,15] Age was significantly related to depression scores on all scales except CSDD in our study. Correlation is a statistical measure that expresses the extent to which two variables are linearly related (i.e. they change together at a constant rate). It is a common tool for describing simple relationships without stating cause and effect. CSDD (rho=0.510, $p<0.001$), PHQ9 (rho=0.525, $p<0.001$), and GDS scores (rho=0.062, $p=0.009$) were significantly and positively correlated with the HAMD in our study. MADRS was significantly related to CSDD, PHQ9, and GDS scores, which means that the results from data generated by testing with all these depression scales are likely attributable to a specific cause, and the observed relationship is unlikely to be due to chance. HAMD exhibits a higher correlation, and MADRS shows a good correlation with all the depression scales except for GDS, which stands out as an exception. This means that all the depression scales are appropriate to measure late-life depression, and the GDS scores show a high variability in dimensionality.[16]

In our study, HAMD was strongly correlated with CSDD, and almost all scales and PHQ9 correlated more with MADRS. The PHQ9 correlates more with the MADRS scale. In addition, the items in the MADRS and PHQ9 scales were highly correlated. Once again, the GDS remains distinct, with high variability in dimensionality, differing from other depression scales. The Geriatric Depression Scale (GDS) is a patient-reported outcome measure (subjective) that is multidimensional and multidisciplinary for identifying patients at risk of or with late-life depression. The variable dimensionality of the GDS makes this scale identify subjects with or at risk for depression and is distinct from other scales.[16] Hence, it is imperative to state that all the depression scales, HAMD, MADRS, PHQ9, and CSDD, measure late-life depression in a highly correlated manner, and the GDS measures late-life depression with variable dimensionality. As mentioned earlier, late-life depression is a syndrome presenting itself with fewer major symptoms, less emphasis on mood disturbance, greater preoccupation with somatic or psychotic symptoms and misleading cognitive deficits.[17]

In our study, Cronbach's alpha showed high reliability for the PHQ9, MADRS, GDS, and HAMD. The interterm correlation replicates similar correlations between items, ensuring good internal consistency. This means that the observed results represent the truth or true values in the population in which the assessments were performed (slate life depression in a tertiary care psychiatric institution) and are not due to methodological errors. In our study, the

convergent validity states that 41.3% (38/92 items) have a correlation coefficient of their own <0.4 (any score between 0.4 to 0.75 is good) and the divergent validity of 81.5% (75/92 items) with a correlation coefficient with a score of their dimension more than those computed with other scores. This means that 41.3% of items are closely related to other tests. Two measures are perfectly convergent and measure similar constructs; two similar questions reveal the same results. Similarly, divergent validity, which reveals opposite results to two opposite questions, i.e., two measures that are not supposed to be related, are, in fact, unrelated.[18,19] In our study, both types of validity showed good scores, and the convergent and divergent score values replicated the findings of Cronbach's alpha, satisfying the requirement for excellent construct validity. This provides a creative solution to this problem. It encourages people to think from multiple prospectives to open theoretically limitless options, which results in innovative solutions to address the challenges that late-life depression presents with.[20]

According to Eric Erikson's personality resilience and development, the 8th and final psychosocial crisis (ego integrity vs. despair) that takes place during old age lasts until the end.[21] This could be the real reason for the Geriatric Depression Scale (GDS) being distinct and highly variable in its dimensionality, which makes it distinct from the other depression scales in this study. Integrity in old age, which the older person recognises as having lived a fruitful life, helps them cope with their failures and successes. A failure to recognise this results in despair. When this despair increases, it results in late-life depression. Again, late-life depression shows its symptoms and signs in emotional, cognitive, physical and volitional domains.[10] PHQ9 and MADRS scales were more accurate in our study, with higher accuracy, sensitivity, and specificity. Subsequently, HAMD was found to be a better scale than the other scales, implying that this study has a greater positive predictive value.

Limitations

This study has been done at a tertiary care psychiatric institution, and the outcome of this study should be interpreted with caution.

CONCLUSION

In conclusion, various depression scales were found to have a strong correlation with each other in measuring late-life depression at a tertiary care psychiatric institution. Furthermore, this study has revealed that the Geriatric Depression Scale is a distinct, multidimensional, and multidisciplinary scale used to identify patients at risk for depression or those who suffer from late-life depression.

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