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Original Article

Hospital-Based Combined Screening for Dementia and Depression in the Elderly: Implications for Early Mental Health Intervention

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SUMMARY

Background: Dementia and depression are major mental health concerns for the elderly, with significant implications for public health in the future. These conditions are associated with increased morbidity, healthcare utilization, and mortality. Early detection and treatment are crucial for mitigating the adverse effects of dementia and depression in the elderly. Therefore, large-scale screening is an important initial step in addressing these challenges.
Methods: Individuals aged ≥ 65 were screened for cognitive decline and depression in a university hospital outpatient department using the Ascertain Dementia 8 Questionnaire (AD8) and five-item Brief Symptom Rating Scale (BSRS-5), respectively.
Results: A total of 3,079 elderly individuals completed both the AD8 and BSRS-5 assessments. The prevalence rates of cognitive impairment and depression were 28.2% and 15%, respectively. Notably, 7.2% of the participants tested positive on both AD8 and BSRS-5. Females scored higher on AD8 ($p = 0.01$) and BSRS-5 ($p < 0.0001$) than males. AD8 scores peaked in the ≥ 85 age group, while BSRS-5 scores were highest in the 75–84 group but declined with age.
Conclusion: The high ratio of suspected dementia and depression among elderly outpatients underscores the need for routine, integrated mental health screening in this population. Given the significant clinical overlap — where depression can mimic or exacerbate cognitive impairment — implementing dual screening protocols in outpatient settings can facilitate timely differentiation and tailored interventions. These findings support the incorporation of combined cognitive and mood assessments into standard geriatric care to enhance early detection and improve treatment outcomes.

1. Introduction

Dementia and depression are prevalent psychiatric disorders among the elderly, characterized by chronicity and functional impairment, significantly impacting society. The global prevalence of dementia was estimated at 57.4 million in 2019, with projections rising to 152.8 million by 2050.[1] In Taiwan, dementia prevalence has risen significantly, reaching 87.1% in long-term care facilities,[2] with regional prevalence among adults aged 65 and older at 8.69% in rural areas, 6.63% in suburban areas, and 4.46% in urban areas.[3] Dementia patients often present with comorbid chronic diseases, resulting in increased burden on both the healthcare system and caregivers.[4] The annual global societal costs of dementia were estimated at US$1,313.4 billion for 55.2 million people, with an average cost of US$23,796 per person.[5] Timely detection and treatment are crucial for delaying the progression of dementia and reducing associated societal costs.[6]

According to a meta-analysis of 42 studies, the estimated prevalence of depression among old age was 31.74%.[7] Notably, this prevalence may be substantially higher among patients who have chronic medical conditions and frequent hospital visits.[8,9] Geriatric depression is associated with increased morbidity, mortality, and healthcare utilization,[10] imposing a significant societal burden. Furthermore, a meta-analysis of cost-of-illness studies found that depression may increase healthcare costs in the elderly by 1.73 times compared to those without depression.[11] Therefore, early diagnosis and intervention should be prioritized as cost-effective treatment strategies.

The relationship between late-life depression and dementia remains complex and inconclusive. However, an increasing body of research suggests that late-life depression may not be independent of dementia (including Alzheimer's disease). It could increase the risk of dementia or act as an early warning sign, indicating that both late-life depression and dementia should be considered together. Shared neurobiological mechanisms, such as chronic inflammation, dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis, and vascular risk factors, have been implicated in both depression and

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cognitive decline. Inflammatory markers like C-reactive protein (CRP) and interleukin-6 (IL-6) have been found elevated in both disorders, suggesting a potential link between neuroinflammation and neurodegeneration. Additionally, vascular dysfunction, including small vessel disease and cerebral hypoperfusion, is associated with both late-life depression and dementia, further reinforcing their bidirectional relationship. Given the importance of early detection and treatment initiation for both dementia and geriatric depression, large-scale screening programs are essential as a preliminary step in achieving this objective. In this study, we implemented a screening program for dementia and depression among elderly outpatients at a university hospital.

2. Materials and methods

2.1. Study design and participants

The study was conducted between October 2012 and December 2015 at Shuang Ho Hospital, a university hospital in Northern Taiwan, specifically in the outpatient departments of medicine and surgery. Convenience sampling was employed to select participants aged 65 or older who visited the outpatient departments. Trained research staff approached eligible patients in waiting areas, briefly introduced the study, and invited them to participate. Those who expressed interest received detailed information and provided verbal consent before proceeding with the screening. The screening program encompassed assessments for cognitive impairment and depression.

The exclusion criteria included: 1. Refusal or hesitancy to participate, 2. Communication difficulties, 3. Inability to complete the questionnaire for dementia and depression, and 4. Presence of active major illnesses that could compromise the reliability of responses. All participants voluntarily took part in the screening activity without any compensation.

To address potential selection bias, we recorded the reasons for dropout and collected basic demographic data, including gender and age, for comparison with fully recruited participants. We calculated the dropout rate, and differences between the dropout group and the fully assessed group were analyzed to evaluate potential recruitment bias.

The interviewers consisted of two senior nurses and two medical professionals, including occupational therapists. Prior to administering the Ascertain Dementia 8 Questionnaire (AD8) and five-item Brief Symptom Rating Scale (BSRS-5), they underwent a series of training courses covering dementia and depression related topics. They also practiced administering the AD8 and BSRS-5 with the general population under the supervision of a senior geriatric psychiatrist (Y.T. Lee) and/or an experienced neurologist (L.K. Huang). For ensure inter-rater reliability, periodic checks were conducted every 5–6 months. All interviews were conducted face-to-face in the outpatient department. Interviewers made every effort to assess the elderly outpatients directly. If accompanying family members provided additional relevant information, the AD8 and BSRS-5 scores were adjusted accordingly. In addition to the AD8 and BSRS-5, data on gender and age were collected. Each interview with a fully recruited participant lasted approximately 10 minutes. The study received ethical approval from the Institutional Review Board of Taipei Medical University Hospital (IRB number: 201211006), and all procedures adhered to relevant ethical guidelines and regulations. Informed consent was obtained from all participants before screening.

It should be noted that all participants were recruited from a single university hospital in Northern Taiwan. As a result, the findings may not be fully generalizable to elderly populations in different regions, healthcare settings, or cultural contexts. Future studies involving more diverse recruitment sites are warranted to enhance the representativeness of the findings.

2.2. Cognitive screening

We utilized AD8 to assess cognitive impairment. The AD8 consists of eight items completed by either the informant or the patient, providing valuable insights into functional decline associated with cognitive impairment. The AD8 has demonstrated effectiveness in detecting even very mild dementia and is widely used in various countries, including Taiwan.[12,13] Moreover, AD8 is less influenced by cultural, educational, sex, and age factors, and the screening process typically requires only approximately 3 minutes.[14] A score of ≥ 2 on the AD8 suggest suspected dementia, including very mild cases.[12]

2.3. Depression screening

To screen for depression, we employed the BSRS-5, a tool developed by Taiwanese researchers.[15] The BSRS-5 is widely used in Taiwan for assessing mental health and the severity of distress. It is a self-administered questionnaire that can be rapidly completed in various settings, including community, general medical, and psychiatric settings. The validity and reliability of the BSRS-5 have been well established.[16] The BSRS-5 consists of five items measuring the severity of psychological symptoms across five domains: anxiety, depression, hostility (feeling easily annoyed or irritated), interpersonal sensitivity, and additional insomnia symptoms. Each symptom is rated on a 5-point Likert scale, ranging from 0 (not at all) to 4 (extremely severe). The total BSRS-5 scores ranges from 0 to 20. The cutoff point for detecting depression is set between 5 and 6 points. Individuals with a BSRS-5 score < 6 are considered to have good mental health while those with a BSRS-5 score ≥ 6 are suspected of having depression.[17]

2.4. Statistical analysis

All statistical analyses were conducted using SPSS (version 12.0.1 for Windows, SPSS Inc, Chicago, IL, USA). Two-tailed tests were performed, with a significance level of $p < 0.05$ considered statistically significant. Age was categorized into three groups young elderly (65–74 years), old elderly (75–84 years), and super-old elderly (≥ 85 years) for comparative analysis (Table 1). Chi-square tests were utilized to examine the impact of gender on the mean scores of AD8 and BSRS-5. Additionally, ANOVA tests were conducted to assess the effect of age on the mean scores of AD8 and BSRS-5. To account for potential outliers and non-normality, Spearman's rank correlation coefficient analysis was employed to investigate the correlation between AD8 and BSRS-5 scores. Furthermore, independent t-tests were performed to compare the mean scores of subgroups among participants who screened positive on AD8 or BSRS-5.

3. Results

A total of 3,130 elderly individuals participated in the program, of whom 3,079 completed both AD8 and BSRS-5 assessments. The dropout rate was 1.6%, with primary reasons cited as concerns about potential fraud and time constraints. No significant differences were observed in gender and age distribution between the dropout group and the fully recruited participants. Participants were stratified into four groups based on their AD8 and BSRS-5 screening results (Figure 1).

Table 1
Demographic characteristics of the recruited participants.

	Total
Number (N, %)	3079, 100%
Age (mean ± SD)	
Overall	77.2 ± 6.8
Men	78.5 ± 6.9
Women	75.5 ± 6.3
Age, years (N, %)	
65–74	1054, 34.2%
75–84	1390, 45.1%
≥ 85	635, 20.6%
Gender (N, %)	
Men	1731, 56.2%
Women	1348, 43.8%
AD8 (mean ± SD)	1.0 ± 1.1
< 2	2211 (71.8%)
≥ 2	868 (28.2%)
BSRS-5 (mean ± SD)	2.4 ± 2.7
< 6	2618 (85.0%)
≥ 6	461 (15.0%)

AD8: Ascertain Dementia 8 Questionnaire; BSRS-5: five-item Brief Symptom Rating Scale.

To provide a clearer understanding of the participant characteristics, Table 1 summarizes the demographic information of the recruited elderly outpatients. The mean age of the samples was 77.2 years, with male participants being slightly older than females. Age distribution was as follows: young elderly (65–74 years, N = 1,054, 34.2%), old elderly (75–84 years, N = 1,390, 45.1%), and super-old elderly (≥ 85 years, N = 635, 20.6%). The number of male participants slightly exceeded that of female participants. Based on AD8 scores, 28.2% of participants were classified as suspected dementia cases, whereas 15.0% were classified as suspected depression cases according to BSRS-5 scores. Figure 1 provides a visual representation of the four categories: Group 1: AD8 (–), BSRS-5 (–) (N = 1,973, 64.1%); Group 2: AD8 (+), BSRS-5 (–) (N = 645, 21.0%); Group 3: AD8 (+), BSRS-5 (+) (N = 223, 7.2%); and Group 4: AD8 (–), BSRS-5 (+) (N = 238, 7.7%).

Figures 2A and 2B illustrate the effects of gender and age on AD8 and BSRS-5 scores. After adjusting for age, female participants exhibited significantly higher AD8 ($p = 0.01$) and BSRS-5 ($p < 0.0001$) scores compared to males. The mean AD8 score increased significantly with age, reaching its highest level in the ≥ 85 years age group. However, BSRS-5 scores were highest in the 75–84 years age group and declined with increasing age.

To examine the association between cognitive and affective screening scores, Table 2 presents the correlation between AD8 and BSRS-5 which demonstrates a positive and statistically significant correlation.

To explore the clinical relevance of the comorbidity between cognitive impairment and depression, Table 3 presents subgroup analyses based on positive screening results. Among participants screening positive on AD8, those who also screened positive for BSRS-5 exhibited significantly higher mean AD8 scores than those who screened negative for BSRS-5. Similarly, among BSRS-5-positive participants, those who also screened positive on AD8 had significantly higher BSRS-5 scores. These findings underscore the clinical relevance of the observed overlap, emphasizing integrated screening approaches. The presence of depressive symptoms may exacerbate cognitive decline, while cognitive impairment may contribute to affective distress. For instance, patients screening positive for both conditions had significantly higher mean scores, with suspected depression increasing the risk of cognitive impairment (mean AD8: 2.74 vs. 2.50, $p < 0.001$), and suspected dementia likewise associated with elevated depressive symptoms (mean BSRS-5: 7.76 vs. 7.36, $p = 0.029$). These results suggest that elderly patients presenting with symptoms of either dementia or depression should be evaluated for both conditions to ensure timely intervention.

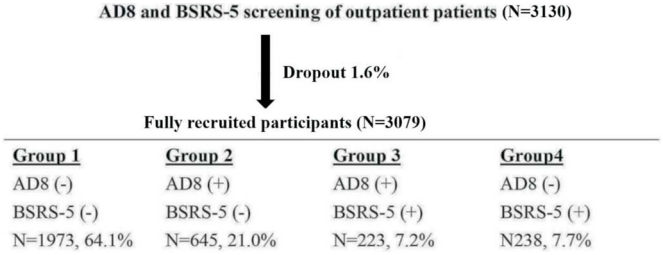

Figure 1. Study participant enrollment flowchart. AD8: Ascertain Dementia 8 Questionnaire; BSRS-5: five-item Brief Symptom Rating Scale.

4. Discussion

To our knowledge, this study represents the first large-scale screening program to simultaneously assess both dementia and geriatric depression. The key findings can be summarized as follows: (1) a substantial proportion of elderly outpatients at a university hospital were identified as having suspected dementia and suspected depression, and (2) a significant overlap between these conditions was observed within this population.

The prevalence of suspected dementia identified using the AD8 in this study was 28.2%. This finding is consistent with previous investigations conducted in hospital-based settings with the AD-8.[18,19] In comparison with global data, reported prevalence rates of suspected dementia have varied considerably, reflecting differences in methodology, population characteristics, and healthcare environments. Overall, our results align with those observed in hospital-based settings[18,19] but tend to be higher than estimates reported in non-hospital situations.[20,21] This discrepancy may be attributable to several factors. First, dementia prevalence varies by clinical setting, with the estimated rates in primary care and hospital being 1.4% and 15%–42%, respectively.[22,23] Elderly individuals seeking hospital-based care often present with more systemic illnesses, which may contribute to an increased risk of dementia.[24] Second, this study targeted an old population (mean age: 77.2 years), whereas previous investigations reported lower median and meanages (66 and 69.9 years, respectively).[18,19] Given that age is a well-established risk factor for dementia, this difference may partially account for the higher positive rate observed. Third, AD8 had demonstrated high sensitivity in dementia screening, but its specificity may be lower in secondary care settings, potentially leading to false positives.[25] Further analysis of positive screening cases indicated that anxiety symptoms may have contributed to an overestimation of cognitive impairment. Elderly patients attending a university hospital outpatient department are typically more medical complex and more concerned about their cognitive health, which may have amplified AD8 scores. Additionally, rural medical studies have reported elevated AD8 positive rates, potentially due to cultural influences and questionnaire item appropriateness for elderly populations unfamiliar with modern appliances.[26] These findings underscore the necessity of evaluating AD8 sensitivity in diverse healthcare settings. Moreover, AD8 has been validated for detecting mild cognitive impairment (MCI), which may also contribute to the higher positive rate in our study.[27] Overall, the higher positive rate of AD8 in a hospital-based cohort is justifiable given these factors. Generally, dementia prevalence rates vary due to cultural factors, healthcare accessibility, and diagnostic criteria. Our re-

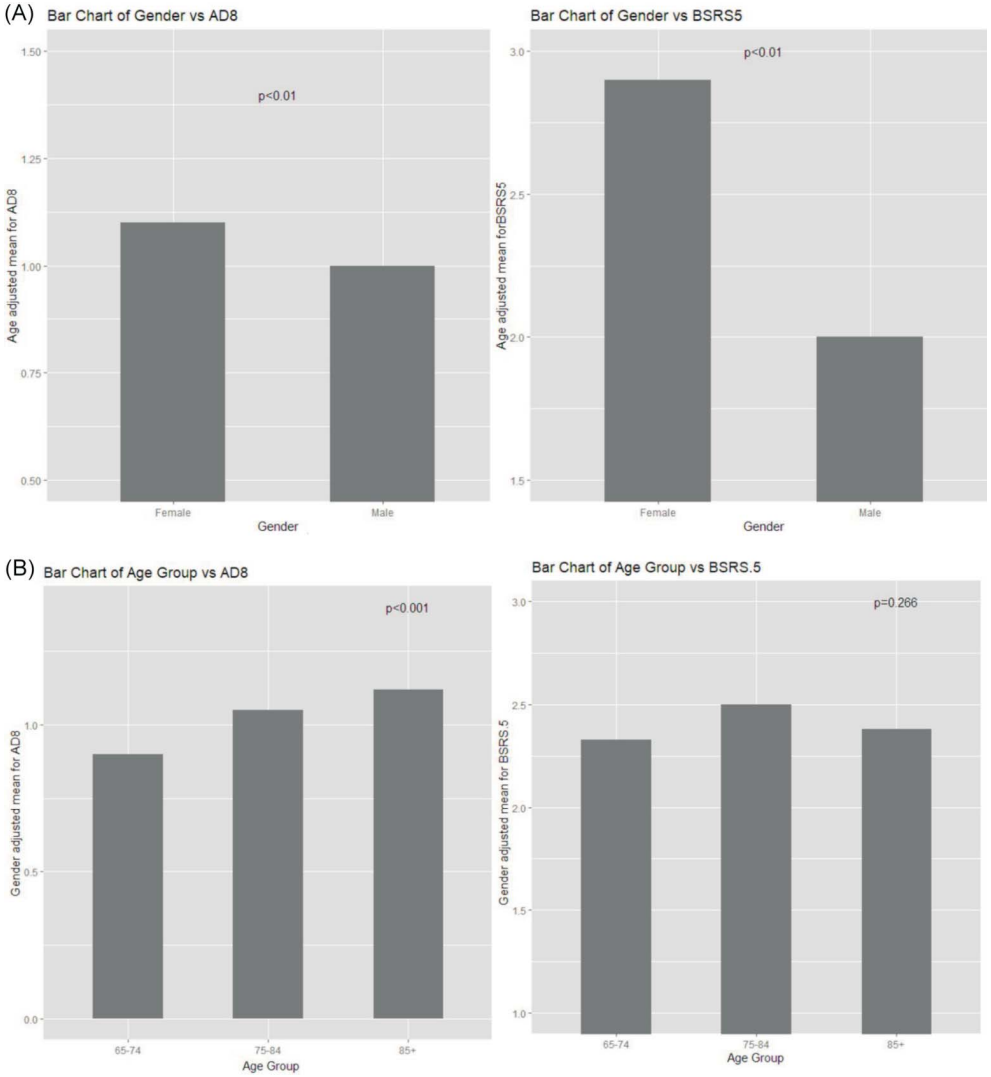

Figure 2. (A) Effect of gender on mean score of AD8 and BSRS-5, adjust for age. (B) Effect of age on mean score of AD8 and BSRS-5. AD8: Ascertain Dementia 8 Questionnaire; BSRS-5: five-item Brief Symptom Rating Scale.

Table 2
The correlation between AD8 and BSRS-5.

Spearman's rank correlation, N = 3079	BSRS-5
AD-8	0.26162**

** p < 0.001.
AD8: Ascertain Dementia 8 Questionnaire; BSRS-5: five-item Brief Symptom Rating Scale.

Table 3
Subgroup analyses of AD8-positive and BSRS-5-positive screening participants.

AD8 (+), suspected dementia participants			
	BSRS-5 (–) (N = 645)	BSRS-5(+) (N = 223)	*p*
BSRS-5 (mean (SD))	1.87 (1.64)	7.76 (2.08)	< 0.001*
AD8 (mean (SD))	2.5 (0.76)	2.74 (1.06)	< 0.001*

BSRS-5 (+), suspected depression participants			
	AD8 (–) (N = 238)	AD8 (+) (N = 223)	*p*
BSRS-5 (mean (SD))	7.36 (1.85)	7.76 (2.08)	0.029*
AD8 (mean (SD))	0.48 (0.5)	2.74 (1.06)	< 0.001*

* $p < 0.05$.
AD8: Ascertain Dementia 8 Questionnaire; BSRS-5: five-item Brief Symptom Rating Scale.

sults suggest that comparing regional data provides deeper insights into these variations and contributes to developing more globally applicable screening strategies.

Regarding geriatric depression, our study identified a 15.0% prevalence of suspected depression among elderly outpatients based on the BSRS-5 screening tool. This rate falls between previously reported rates in community settings (9.5%)[28] and inpatient settings (25.3%),[29] positioning our findings within this expected range. As a depression screening tool developed in Taiwan, the BSRS-5 has been relatively underutilized in studies assessing the prevalence of depression among elderly outpatients in hospital settings. Previous studies have reported varying prevalence rates of geriatric depression depending on the definition and target population. Hospital-based studies tend to yield higher prevalence estimates relative to community-based research.[30] Compared to studies using diagnostic criteria like DSM-5 or ICD-10, studies using depressive symptom checklists tend to report higher prevalence rates. Compared to another study conducted in a tertiary care geriatric outpatient setting, the BSRS-5 positive rate in our study was lower than that observed with the GDS-15 but more closely aligned with of ICD-10 defined depressive disorders.[31] These variations underscore the necessity for standardized assessment tools across healthcare systems.

Gender and age were found to influence both AD8 and BSRS-5

scores. After adjusting for age, female participants exhibited significantly higher mean scores than males for both AD8 and BSRS-5. These findings are consistent with previous studies indicating that women are at a higher risk for dementia and geriatric depression.[32,33] Additionally, while AD8 scores increased with age, BSRS-5 scores did not show a significant age-related trend. This aligns with previous studies suggesting that age is a risk factor for dementia but not for depression.[32,34] These trends suggest that screening strategies should be adapted to account for gender-specific risks and age-related variations in screening effectiveness. Cognitive assessments should be prioritized for older adults, while depression screenings may be more beneficial for the old elderly population (75–84 years). Additionally, recognizing that women have a higher predisposition to both conditions may help refine targeted intervention strategies, ensuring early detection and timely treatment. Clinicians should be particularly vigilant about the increased risk of cognitive decline and depression among elderly individuals with chronic illnesses, particularly women. Real-world screening strategies should integrate both cognitive and depression assessments while considering gender- and age-specific risk factors to optimize early intervention and treatment outcomes.

Furthermore, our study revealed a significant 7.2% overlap between suspected dementia and suspected depression among elderly outpatients, as illustrated in Figure 3. Correlation analysis supported the notion that the screening tools used for dementia and depression are not completely independent. These findings highlight the limitations of screening for only one condition in outpatient settings, as relying on a single screening approach may introduce bias. This overlap is clinically significant, as depressive symptoms can mimic cognitive impairment, complicating diagnosis and potentially delaying appropriate interventions. The association between suspected dementia and suspected depression may be attributed to the high prevalence of depressive symptoms in dementia patients[35] and the existence of undiagnosed and untreated depression in pseudo-dementia.[36] The bidirectional relationship between these conditions may suggest some shared underlying mechanisms, including vascular disease[37] and inflammatory processes,[38] which may contribute to both conditions. Recognizing this overlap is crucial for refining screening methodologies and ensuring timely and accurate diagnosis. An integrated screening approach that utilizes both AD8 and BSRS-5 may enhance diagnostic accuracy and facilitate early intervention.

Consequently, screening programs for elderly outpatients should incorporate assessments for both dementia and depression to ensure comprehensive evaluation and early detection. Healthcare providers should recognize the frequent co-occurrence of these conditions and adopted an integrated assessment and treatment approach. Primary care clinicians may benefit from concurrently using the AD8 and BSRS-5 to identify outpatients with suspected dementia and/or depression, thereby facilitating timely referrals for differential diagnosis and specialized treatment. Integrated treatment plans are crucial for patients who screen positive for both conditions. Clinicians should maintain a high index of suspicion for depression in patients with early dementia and continuously monitor cognitive function in elderly patients diagnosed with depression. Implementing this comprehensive approach can significantly enhance the quality of care for elderly individuals facing these dual challenges.

In clinical practice, particularly in primary care and geriatric settings, the combined use of AD8 and BSRS-5 can be incorporated into routine assessments. These brief, cost-effective tools allow trained staff to identify high-risk individuals, facilitating timely referrals and interventions. Their integration can streamline workflow, especially in resource-limited settings, and help prioritize patients with dual risk for further evaluation.

Our study has several strengths. First, it represents the first large-scale screening study to simultaneously assess both dementia and geriatric depression. Second, we specifically targeted at-risk elderly outpatients in the departments of medicine and surgery, a population often overlooked in similar studies. Third, we utilized AD8 and BSRS-5 as screening tools, both of which are validated and widely used in Taiwan. The AD8 is capable of detecting MCI, while the BSRS-5, developed by Taiwanese researchers, has been implemented for over a decade in Taiwan as a depression screening tool, minimizing cultural barriers.

However, several limitations should be acknowledged. These limitations may affect the generalizability of our findings and should be carefully considered when interpreting the results. First, participants were not randomly selected, introducing the possibility of selection bias. Additionally, the dropout rate (1.6%) may have further influenced the screening results. Second, we did not differentiate between informant-based and self-administered AD8, which may have impacted screening accuracy. Furthermore, the absence of education level and comorbidity data limits our ability to provide more comprehensive descriptive statistics. Given that comorbid conditions increase healthcare utilization, they may also influence screening outcomes. Elderly patients with depression or dementia are known to have higher rates of chronic conditions,[39,40] suggesting that comorbidities may impact screening results. Future studies should consider incorporating these variables. Additionally, the sensitivity and specificity of AD8 may vary across healthcare settings. It has been reported to exhibit higher sensitivity in hospital settings, leading to more false positives. This variability suggests that AD8 may be less effective in non-hospital settings, such as primary care, highlighting the need for further validation across diverse healthcare environments. Cultural factors may affect how older adults report depressive symptoms, as stigma and generational norms often lead to somatization or underreporting. This dynamic may contribute to under-detection and should be considered when interpreting BSRS-5 results. Lastly, as our study was conducted in a single hospital, findings may not be fully generalizable to all elderly outpatient populations. Differences in healthcare accessibility and cultural attitudes toward mental health may also impact screening participation and outcomes, thereby limiting the generalizability of our findings in Taiwan. Stigma surrounding mental illness and cognitive decline may reduce participation rates, while healthcare disparities may lead to underrepresentation of certain populations. Efforts to destigmatize late-life depression and raising awareness are crucial for improving

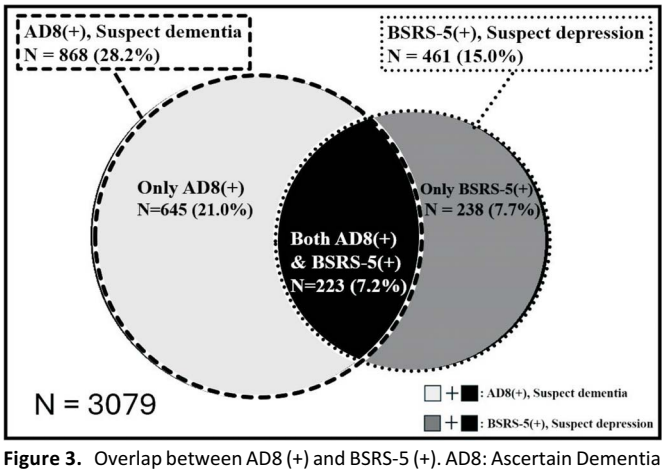

Figure 3. Overlap between AD8 (+) and BSRS-5 (+). AD8: Ascertain Dementia 8 Questionnaire; BSRS-5: five-item Brief Symptom Rating Scale.

screening rates and facilitating early intervention. Addressing these barriers will be essential for ensuring broader applicability of screening programs.

In conclusion, our study underscores the importance of screening for both dementia and depression in elderly outpatients, given the high prevalence and significant overlap of these conditions. Large-scale screening programs are essential for early detection and intervention, particularly as the elderly population continues to grow. Screening in outpatient settings is cost-effective and should include both dementia and depression assessments. To integrate these tools into routine clinical practice, clinicians can administer AD8 and BSRS-5 during regular outpatient visits, with positive screening results prompting further evaluation, such as neuropsychological testing or psychiatric referral. Future research in community-based and multi-center settings is needed to validate our findings and facilitate the wider implementation of integrated dementia and depression screening programs.

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Competing interests

The authors declare that there is no conflict of interest.

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