Current Psychiatry Reports (2021) 23: 55
https://doi.org/10.1007/s11920-021-01267-3

GERIATRIC DISORDERS (JA CHEONG, SECTION EDITOR)

Clinical Neuropsychological Evaluation in Older Adults With Major Depressive Disorder

Shawn M. McClintock[1,2] · Lex Minto[3] · David A. Denney[1] · K. Chase Bailey[1] · C. Munro Cullum[1] · Vonetta M. Dotson[4,5]

Accepted: 25 May 2021 / Published online: 13 July 2021

Abstract

Purpose of the Review Older adults with major depressive disorder are particularly vulnerable to MDD-associated adverse cognitive effects including slowed processing speed, decreased attention, and executive dysfunction. The purpose of this review is to describe the approach to a clinical neuropsychological evaluation in older adults with MDD. Specifically, this review compares and contrasts neurocognitive screening and clinical neuropsychological evaluation procedures and details the multiple components of the clinical neuropsychological evaluation.

Recent Findings Research has shown that neurocognitive screening serves a useful purpose to provide an acute and rapid assessment of global cognitive function; however, it has limited sensitivity and specificity. The clinical neuropsychological evaluation process is multifaceted and encompasses a review of available medical records, neurobehavioral status and diagnostic interview, comprehensive cognitive and clinical assessment, examination of inclusion and diversity factors as well as symptom and performance validity, and therapeutic feedback. As such, the evaluation provides invaluable information on multiple cognitive functions, establishes brain and behavior relationships, clarifies neuropsychiatric diagnoses, and can inform the etiology of cognitive impairment.

Summary Clinical neuropsychological evaluation plays a unique and critical role in integrated healthcare for older adults with MDD. Indeed, the evaluation can serve as a nexus to synthesize information across healthcare providers in order to maximize measurement-based care that can optimize personalized medicine and overall health outcomes.

Keywords Major depressive disorder · Depression · Neuropsychology · Geriatric · Older · Cognition

Introduction

Major depressive disorder (MDD) is a chronic and complex neuropsychiatric illness that results in higher rates of morbidity, mortality, and disability in older adults (late-life depression, LLD) [1, 2]. Recent evidence suggested that for older adults (age 60+), the prevalence rate for any depressive illness was approximately 4.2–9.3% and for MDD was approximately 2.1% [3]. There are multiple antidepressant options for older adults with MDD including evidenced-based psychotherapy, pharmacotherapy, neuromodulation therapeutics (e.g., electroconvulsive therapy, transcranial magnetic stimulation), and behavioral interventions (e.g., exercise) [4–10]. Although some research has suggested that MDD has a unique symptom phenotype in older relative to younger adults, a relatively recent review suggested that the phenotype may be similar [2]. MDD symptoms common among older adults include sad mood, irritable mood, anhedonia, insomnia,

This article is part of the Topical Collection on *Geriatric Disorders*

✉ Shawn M. McClintock
shawn.mcclintock@utsouthwestern.edu

[1] Division of Psychology, Department of Psychiatry, UT Southwestern Medical Center, 5323 Harry Hines Blvd, Dallas, TX 75390-8898, USA

[2] Division of Brain Stimulation and Neurophysiology, Department of Psychiatry and Behavioral Sciences, Duke University School of Medicine, Durham, NC, USA

[3] Georgia State University, Atlanta, GA, USA

[4] Department of Psychology, Georgia State University, P.O. Box 5010, Atlanta, GA 30302-5010, USA

[5] Gerontology Institute, Georgia State University, Atlanta, GA, USA

decreased appetite, psychomotor retardation, decreased energy, poor self-esteem, and suicidal ideation [11]. Moreover, older adults report the experience of significant cognitive difficulties that vary in magnitude and can adversely impact functional abilities and benefits from antidepressant therapies [4, 6, 12–14].

The neurocognitive difficulties associated with MDD in older adults have been well characterized and consistently found to involve three primary cognitive domains: processing speed, attention, and executive function [15–17]. Inefficiency and impairment in those domains can then lead to difficulties in other cognitive domains such as language, memory, and working memory [17, 18]. Even when depression remission has been achieved, older adults have been found to have persistent cognitive difficulties in processing speed, visuospatial ability, and memory [19]. Consequently, MDD in older adults has been found to be associated with mild cognitive impairment (MCI) and dementia [20–23]. A recent meta-analysis found that the overall pooled prevalence of MDD was approximately 32% in adults diagnosed with MCI [24], and a recent study found that older adults with depression and MCI quickly (median of 27 months) progressed to develop Alzheimer's disease [25]. The etiology of the cognitive difficulties and progression towards MCI and dementia in older adults with MDD is complicated by comorbid medical illnesses (e.g., hypertension, diabetes) and psychiatric symptoms (e.g., apathy, anxiety, psychosis), use of multiple medications that can adversely affect brain health, and adverse brain changes (e.g., atrophy, cerebral infarct) [11, 21, 26–28]. To assist with identifying the presence or absence of cognitive difficulties and the severity and etiology of any difficulties, patients can work with a clinical neuropsychologist as part of their integrated healthcare team to complete a clinical neuropsychological evaluation [29].

The purpose of this review is to comprehensively describe the clinical neuropsychological evaluation procedure in older adults with MDD. Specifically, this review compares and contrasts neurocognitive screening and clinical neuropsychological evaluation and details the multiple components of the clinical neuropsychological evaluation. Such components include the neurodiagnostic interview, neuropsychological tests, psychiatric symptom measures, quality-of-life measures, and performance validity assessment. This review also highlights the importance of inclusion and diversity in the evaluation process and discusses the need to provide therapeutic feedback of the clinical neuropsychological evaluation findings to the patients and their carepartners.

Neurocognitive Screening

The amount of time a provider has available to spend with patients to clarify the nature of subjective cognitive complaints is becoming increasingly limited. Correspondingly, cognitive screening has become more widely accessible and practiced and can provide an efficient though crude method for identifying individuals whose cognitive concerns may warrant a comprehensive clinical neuropsychological evaluation. However, a total score on global cognitive screening tools such as the Mini-Mental State Exam (MMSE) [30] or Montreal Cognitive Assessment (MoCA) [31] can misidentify or misrepresent the nature of cognitive "impairment," as there is significant variability even among cognitively intact individuals on simple cognitive tasks (e.g., three-word recall on the MMSE) [32]. Attentional variability can impact performance on such tasks, and when assessment of a cognitive domain such as memory consists of only a few items, poor performance must be interpreted with caution. Accordingly, there is evidence to suggest that items assessing verbal fluency, visuospatial ability, and memory on the MoCA can be sensitive to the effects of depression [33]. Such findings illustrate that poor performance or "failure" on individual item(s) in global cognitive screening measures may not be reflective of neurological impairment and could be misleading when there are concerns about the possible presence of cerebral dysfunction that affects cognition. Further complicating cognitive screening results is the impact that demographic factors such as race/ethnicity may have [34, 35]. Nevertheless, concerns about changes in cognition coupled with a test performance that fails to meet expectations on a cognitive screening measure may signal the need for further evaluation. Fortunately, formal clinical neuropsychological assessment provides a more reliable index of cognitive and functional capabilities when more detailed examination is warranted. See Table 1 for a comparison and contrast of neurocognitive screening and clinical neuropsychological evaluation.

Clinical Neuropsychological Evaluation

The clinical neuropsychological evaluation currently represents the most comprehensive and sensitive means of assessing human cognitive function. Modern neuroimaging tools provide an exquisite structural view of the brain, with high-field magnetic resonance imaging (MRI) providing images that almost rival gross postmortem visualization. Functional imaging techniques (functional MRI, positron emission tomography (PET), etc.) can show areas of abnormal blood flow, changes in blood flow in response to stimuli, tracer uptake, and glucose utilization, and other specific imaging (i.e., amyloid and tau imaging) can yield indices of the associated underlying neuropathologies that are associated with various neurodegenerative diseases. While such imaging techniques have proven useful, continue to advance in their sensitivity and specificity, and in some cases have shown correlations with cognitive impairment in different disease conditions, none of these neuroimaging procedures is able to

Table 1 Comparison and contrast of neurocognitive screen and clinical neuropsychological evaluation

	Neurocognitive screen	Clinical neuropsychological evaluation
Length of time	•Brief, approximately between 10–30 minutes	•Length of time can vary, approximately between 2.5–4 hours
Administered by	•Multiple healthcare professionals	•Clinical neuropsychologist
Cognitive domain(s) assessed	•Global cognitive function •Orientation	•Multiple including: •Global cognitive function •Orientation •Processing speed •Psychomotor function •Attention •Language •Visuospatial ability •Learning and memory •Working memory •Executive function
Evaluation components	•Brief interview •Brief cognitive exam	•Comprehensive interview •Review and integration of medical record information •Comprehensive cognitive assessment •Clinical assessment (e.g., depressive symptoms) •Personality assessment as needed •Performance validity assessment •Therapeutic feedback

determine the extent of cognitive dysfunction or specific deficits in functional abilities that may be present in an individual. As such, the clinical neuropsychological evaluation represents the "gold standard" for the documentation and characterization of intact or impaired cognitive function.

Clinical neuropsychological assessment is a specialized clinical procedure that requires the selection of psychometrically sound and sensitive instruments in the hands of well-trained and experienced clinical neuropsychologists. There are a plethora of neuropsychological tests available for clinical and research use that rely upon standardized administration, scoring, and use of appropriate norm-referenced data. Careful clinical interpretation of test scores must take into consideration a host of factors including individual demographic variables such as age, education, sex, race, ethnicity, and socioeconomic status. Additional factors that must be considered include a patient's neuromedical history, family neuromedical history, known or suspected cognitive disorders, and current clinical state.

As neuropsychological tests require effort on the part of the individual being examined, it is of utmost importance to ensure adequate effort and cooperation by patients. Suboptimal and/or variable effort can impact test results in obvious or subtle ways, and a careful review of qualitative as well as quantitative test results, including item-level response analysis, can yield important information to assist in the neurodiagnostic process. In the case of MDD, clinicians must be aware of the potential influence of psychological and behavioral factors on test performance (e.g., psychomotor retardation can by itself impact performance on processing speed tests). It is also important to recognize the potential confound of this common condition on neuropsychological test performance in patients with neurologic disorders.

Practical Considerations for Testing

The effects of MDD and depressive symptoms on neuropsychological functioning vary, and knowing that an individual has depression provides very limited information about the unique qualities of their condition. This is important, as neuropsychological evaluative techniques rest upon the assumption that examinees are adequately engaged (i.e., providing "good effort") in the testing procedures. Depression, by its nature, may adversely influence test results, especially among older adults [36–39]. Older individuals may also have more difficulty perceiving the relevance of the tests and may require greater explanation. Thus, it is incumbent upon the clinician to promote cooperation and test engagement, provide encouragement and reassurance, be aware of potential confounding

factors that must be considered, and responsibly interpret test results when evaluating older adult patients with depression.

In order to answer the referral questions commonly accompanying requests to evaluate older adults, circumstances would ideally allow for a clinical neuropsychological test battery that assesses multiple cognitive domains. However, a time-consuming and mentally taxing approach may be infeasible in many cases, particularly when depression is a prominent feature of an individual's presentation. Gaining insight into an individual's depressive symptoms, including symptom severity and chronicity, may inform what can be achievable in a testing session. For example, individuals with prominent neurovegetative symptoms (e.g., low energy, psychomotor retardation) may struggle to stay consistently or adequately engaged in testing, and these situations may require abbreviated evaluations designed to obtain information about the individual's global cognitive status rather than comprehensive and detailed sampling of individual cognitive domains. Responses such as "I don't know" are more common among individuals with depression, and examiners must determine when these responses are valid or signal features of an examinee's depression such as poor concentration or attempts to avoid or curtail the examination. Patients who discover that their use of "I do not know" responses can curtail testing may be reinforced for their poor effort, which potentially undermines the quality and validity of the examination. Providing examinees with encouragement, reassurance, and support may increase engagement in the testing procedures, but this approach should be balanced with the understanding that some individuals may feel patronized at being prompted to do more than what comes naturally. Taking rest breaks during testing may also be useful to alleviate the effects of fatigue or improve engagement in test procedures, though this practice will necessarily extend the time required to complete the evaluation and should be used judiciously. When test results are suspiciously low or substantially inconsistent, clinicians must carefully consider what can actually be accomplished with further testing. The clinician should be respectful of an examinee's situation and be willing to modify (e.g., abbreviate the evaluation, complete the evaluation across 2 days), postpone, or discontinue the evaluation as appropriate.

Domains to Assess

Neuropsychological Function

Older adults with MDD can experience broad neurocognitive dysfunction; however, impairment is most often seen in the domains of psychomotor speed, attention, executive function, and learning and memory [40, 41]. For example, Thomas and colleagues found that above the effects of aging, LLD was associated with more severe impairment in verbal learning, memory, and motor speed, even after accounting for depression severity [42]. Depression-related cognitive difficulties are often worse in late life compared to depression in younger adults [43] and at times can mimic a dementia-like clinical picture. As a result, a detailed neuropsychological evaluation, including a detailed clinical history, is essential to identifying cognitive impairment in LLD and to differentiating between depression-related versus neurodegenerative-related impairment.

Evaluation of neurocognitive function in LLD should assess all of the major cognitive domains including global cognitive status, processing speed, psychomotor function, visuospatial function, attention, language, verbal and visual episodic memory, working memory, and executive function. Table 2 provides a summary of these cognitive domains along with examples of standardized tests to assess the respective domain. Potential limitations of these tests in older adult populations with depression should be considered when administering and interpreting evaluation results. For example, poor motivation or comorbid anxiety and apathy are common in depression and can impact performance across domains. Clinicians should also be aware of the possibilities of cognitive impairment due to alcohol and substance use as well as polypharmacy burden [44]. Furthermore, impairments in processing speed may be influenced by vascular factors or comorbid medical conditions that are often present in older adults [45].

Depressive Symptoms

While there is variability in the relationship between depression symptom severity and neurocognitive impairment, the majority of research has found the relationship to be insignificant in groups across the adult lifespan and that other depressive factors (e.g., MDD subtype, number of MDD episodes) may contribute to the magnitude of cognitive impairment [5, 46, 47]. Nonetheless, it is important to measure depressive symptoms and the magnitude of severity. There are many available depression symptom severity measures (see [48–50] for comprehensive reviews). As such, it is critical to choose those measures that are reliable and valid in older adults, capture the MDD domains and symptoms outlined in the Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition (DSM-5) [51], and are easy to administer, score, and interpret.

Per the DSM-5, there are nine depressive domains including sad mood, insomnia, appetite/weight changes, concentration, future outlook, suicidal ideation, involvement (e.g., level

Table 2 Examples of standardized measures for neuropsychological and functional domains

Domain	Examples of test options
Screening/general cognitive status	Mini-Mental State Examination
	Montreal Cognitive Assessment
	Dementia Rating Scale, 2nd Edition
	Repeatable Battery for Assessment of Neuropsychological Status
Learning and memory	Hopkin's Verbal Learning Test-Revised
	California Verbal Learning Test, 3rd Edition
	WMS-IV Logical Memory Subtest
	Brief Visuospatial Memory Test-Revised
	Benton Visual Retention Test, Fifth Edition
	WMS-IV Visual Reproduction Subtest
	Rey-Osterrieth Complex Figure Test
Attention and working memory	Brief Test of Attention
	WAIS-IV Digit Span
	WAIS-IV Letter-Number Sequencing
	Ruff 2 & 7 Test
Processing speed	WAIS-IV Digit Symbol Coding
	Symbol Digit Modalities Test
Executive function	Trail Making Test
	Booklet Category Test, 2nd Edition
	Stroop Color and Word Test
	Wisconsin Card Sorting Test
	Delis-Kaplan Executive Function System
Language function	Boston Naming Test, 2nd Edition
	Token Test
	Animal Naming Test
	Controlled Oral Word Association Test
Visuospatial ability	Judgment of Line Orientation
	Facial Recognition Test
	Rey-Osterrieth Complex Figure Test (copy trial)
	Clock Drawing Test
Psychomotor function	Finger Tapping Test
	Grooved Pegboard
	Luria Motor Tasks
Everyday functioning	Timed IADL Test
	Sheehan Disability Scale
	WHO Disability Assessment Schedule
	36-Item Short Form Survey (SF-36)
	Lawton and Brody IADL Scale
	Duke Depression Evaluation Schedule-IADL scale
	Behavior Rating Inventory of Executive Function, Adult Version
	Texas Functional Living Scale
	Neurobehavioral Function/Activities of Daily Living Scale
	NAB Daily Living

Note: The tests in Table 1 represent examples of tests for each neuropsychological domain. Also note that many tests tap into more than one cognitive function. *WMS-IV* Wechsler Memory Scale, 4th Edition, *WAIS-IV* Wechsler Adult Intelligence Scale, 4th Edition, *WHO* World Health Organization, *NAB* Neuropsychological Assessment Battery, *IADL* Instrumental Activities of Daily Living

of interests in activities), energy, and psychomotor retardation/agitation. The absence or presence and severity of these depressive domains and concordant symptoms can be documented by depression symptom severity measures that use patient self-report, informant (e.g., carepartner) report, and semi-structured clinical interview formats. The self-report format allows the patient to provide his/her view of depressive symptoms, the informant report format allows the carepartner to provide insights regarding the patient's depressive symptoms in the home environment, and the clinician-rated format provides an objective viewpoint of current depressive symptoms as assessed in the clinic. Importantly, agreement and/or disagreement among the three rating formats can be informative regarding the patient's insight into current mental health status as well as minimization or maximization of any depressive symptoms. If the clinical neuropsychologist is concerned about the patient's insight, then it would be useful to include an informant-rated and clinician-rated depression symptom severity measure. A recent study found a moderate association between self-report and informant report of patient depressive symptoms [52], though factors such as denial, unawareness, and/or reporting bias can obviously influence such ratings and must be considered in the interpretation of results.

Everyday Functioning

Major depressive disorder in older adults is associated with everyday functional limitations that at least in some cases are mediated by cognitive impairment, particularly in aspects of executive functioning [53]. In a recent study of older adults with depression [54], 81.2% had persistent mood disturbance and reported functional limitations over 2 years. That group was characterized as also having high anxiety levels and multiple chronic somatic diseases. Remission of depression was the biggest predictor of functional recovery in this study; however, other evidence suggests that lingering functional deficits could remain even after remission of LLD [55].

Neuropsychological evaluation of older adults with MDD should include an assessment of everyday functioning to document intact or impaired activities and instrumental activities of daily living. A detailed clinical interview can provide valuable information; however, standardized measures are also available to supplement the interview. Examples of everyday functioning tests are provided in Table 2, and the systematic review by Bingham and colleagues [56] provides a thorough listing of such measures. Most of these were developed in a self-, informant-, or clinician-rated format.

Quality of Life

Quality of life (QOL) is a multidimensional concept defined by the World Health Organization (WHO) as an individual's perception of their position in life in the context of the culture and value system where they live, and in relation to their goals, expectations, standards, and concerns [57]. The QOL concept can include overall feelings of well-being and life satisfaction as well as health-related and disease-specific aspects. Depression in older adults has consistently been found to be associated with poorer QOL ratings [58, 59]. Since QOL is multidimensional in nature, its relationship with depression in older adults may vary depending on the QOL specific factors that are assessed in clinical or research settings [59, 60].

There are multiple QOL measures that have been designed for use in older adult populations. Such specific QOL instruments include the Medical Outcomes Study General Health, Life Satisfaction Index, Philadelphia Geriatric Morale Scale, World Health Organization (WHO) Quality of Life Assessment for Older Adults, Control, Autonomy, Self-Realization and Pleasure Test (CASP-19), Purpose in Life Test, Life Purpose Questionnaire, and the Salamon-Conte Life Satisfaction in the Elderly Scale [59]. A thorough review of QOL in older adults with MDD, including a summary of commonly used assessment measures, can be found elsewhere [59].

Performance Validity

When considering the impact of depression on an older adults' ability to sustain engagement throughout a clinical evaluation, several pertinent factors must be considered. One is the use of formal performance validity tests (PVTs) to assess for concordance between findings (e.g., effort and test performance), and another is minimizing the length of the evaluation to mitigate the risk of low scores due to normal psychometric variability, variable effort, and/or fatigue. There is limited research regarding the intersection between PVT results and depression in older adults. Nonetheless, a brief review of available research that included information of PVTs in older cohorts provides a framework by which to integrate pertinent data from the above sections when interpreting clinical neuropsychological findings [61].

Neuropsychological test selection must always balance efficiency and thoroughness. Although there is no formal consensus regarding the number of PVTs that should be included when evaluating older adults, including more than one measure can enhance diagnostic accuracy. In a sample of veterans with a mean age of 54.2 (range = 24 to 82 years), predominately diagnosed with mild neurocognitive disorders (81%), validity misclassification was low (0–6%) when two or three PVTs were used alongside the commonly used Slick criteria for invalid results [62]. One way to minimize performance validity diagnostic misclassification without increasing time burden is to utilize abbreviated versions of effort measures [63, 64] such as the Test of Memory Malingering (TOMM) [65] or the Dot Counting Test (DCT) [66]. Another brief option, the Rey Fifteen-Item Test [67], has potential limitations in samples with low neurocognitive functioning given limited

sensitivity/specificity and lack of concordance with the DCT and TOMM [68].

One method of interpreting PVT data is to utilize a process approach when examining performance on simple vs. more challenging PVT subscales. For instance, an older adult with depression may perform worse on simple tasks but better on more challenging tasks, which is the inverse of what could occur if an individual was feigning cognitive impairment. The Victoria Symptom Validity Test (VSVT) and the Word Memory Test (WMT) have both "easy" and "hard" items and offer calculations to reduce false positive errors [69]. This allows clinicians to assess for concordance (e.g., consistent feigning) or lack thereof (e.g., cognitive impairment impacting performance) across the test item difficulty.

Options for embedded PVTs (e.g., tests of effort included in the neuropsychological measure) include recognition paradigms on the California Verbal Learning Test-3rd Edition (CVLT-3), Rey Auditory Verbal Learning Test (RAVLT), Hopkins Verbal Learning Test-Revised (HVLT-R), and the Digit Span test. For the RAVLT, cut scores of ≤10 for more advanced dementia and ≤ 12 for mild/moderate produced good sensitivity (88–92%) and specificity (89–95%) [70, 71]. Sawyer et al. [72] found that the HVLT-R discrimination index yielded 53% sensitivity and 93% specificity in identifying veterans who failed other PVTs, and an extension study found a cut score of ≤5 yielded 67% sensitivity/80% specificity for identifying invalid performance in a sample that included 14% of patients with depression (total sample $N = 80$) [73]. For non-memory PVTS, there is increasing support that the age-corrected scaled score for the Wechsler Adult Intelligence Scale (WAIS) Digit Span test can identify, with a cutoff of ≤ 5 (45% sensitivity/90% specificity) [74] and a ≤ 6 (60% sensitivity/87% specificity) [75], invalid performance. In a mixed clinical veteran sample, an age-corrected scaled cut score of ≤5 for cognitively unimpaired and ≤4 for cognitively impaired patients was recommended [76, 77].

Despite the utility of considering PVT performance in interpreting neuropsychological test results, it must be kept in mind that clinical observation and careful informed interpretation of the level as well as pattern of test performance is critical. Familiarity with the tests, their psychometric properties, and patterns of cognitive strengths and weaknesses that are known to be associated with various neuropsychiatric and neurodegenerative conditions (e.g., Alzheimer's disease) are essential in the evaluation of patients with known and suspected cognitive disorders. Insofar as confounding factors such as depression may at times interfere with patient motivation or effort during a neuropsychological evaluation or cognitive screening examination, clinical judgment regarding the potential influence of such factors is essential. For example, in the differential diagnosis of depression versus dementia, one of the questions to be addressed is whether the neuropsychological test results make sense or fit an expected pattern of cognitive impairment. For example, patients with various forms of dementia or other neuropsychiatric disorders tend to show different patterns of impairment in their neuropsychological profiles (e.g., Alzheimer's dementia vs. frontotemporal dementia) that can aid in diagnosis [78], though depression can be a precursor and/or comorbidity. For example, if a patient has a family history of Alzheimer's disease and gets diagnosed with AD by their primary care prior to their formal neuropsychological evaluation, the iatrogenic effects could present as a self-fulfilling prophecy where the individual starts behaving as they do have dementia. Furthermore, careful examination of total test scores, subtest scores, and qualitative aspects of individual item-level responses is important, particularly when evaluating the results of briefer test batteries and cognitive screening tools.

Clinicians must consider a variety of factors when evaluating the validity of neuropsychological test results. The addition of PVTs, utilization of empirical studies, and sound clinical decision making when interpreting scores can help minimize diagnostic misclassification and maximize diagnostic accuracy. The primary benefit of having objective PVT information is to augment clinical interpretation by helping to accurately attribute low scores on tests to true cognitive impairment or reduced and variable test engagement.

Interview and Collateral Information

A clinical interview is an essential component of a thorough neuropsychological evaluation. In the case of older adults with depression, the interview is important for distinguishing between MDD and a neurodegenerative condition, gathering information about cognitive complaints, and determining the timeline and pattern of mood and reported cognitive symptoms. Structured and semi-structured interviews are the *gold standard* of depression assessment, including the M.I.N.I. International Neuropsychiatric Interview [79], which is a short, semi-structured diagnostic interview comprising yes/no questions that can be administered in approximately 15 min. This measure has been shown to have a high risk for bias [80], but nonetheless has acceptable validity and reliability, and is reported to have greater than 80% sensitivity to MDD [81]. Structured or unstructured questions about depressive symptoms in the interview should be accompanied by detailed questions about cognitive concerns, particularly regarding the cognitive domains that are most often affected by depression and the impact of these concerns on the patient's functioning. Ascertaining the timeline of cognitive difficulties relative to mood symptoms can be useful to inform differential diagnoses.

Collateral information is also an important part of the neuropsychological evaluation in older adults with depression. Ideally, the collateral informant would be someone who either lives with or has regular contact with the patient and who has

known the patient long enough to be able to reliably report on changes in their cognitive functioning. In addition to the collateral informant's input during the clinical interview, there are a number of informant questionnaires designed for cognitive assessments that can also be used to obtain information about the cognitive and functional status of older individuals with MDD. The AD8 [82], the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) short form [83], and the Quick Dementia Rating System [84] are brief informant interviews that are available to supplement the clinical neuropsychological evaluation.

Inclusion and Diversity Factors

Studies of neuropsychological functioning in diverse older adults with depression are limited but suggest similar depression-related impairments in processing speed, executive function, and memory in older Black, Mexican American, and Asian samples [85–87] to that reported in predominantly White samples. However, there is some suggestion that the relationships of depressive symptoms with executive function and memory may be stronger in Black compared to White older adults [88]. Moreover, the etiology of depression in later life might differ across ethnic and racial groups, such as a more likely vascular origin (i.e., vascular depression) in ethnic minorities due to health disparities in vascular risk factors [89].

Diversity considerations must be made in both the assessment of depression and the interpretation of cognitive test scores in ethnic minority older adults. Ethnicity and culture can impact symptom presentation in older adults with depression, the interview process, and the psychometrics of assessment instruments [90]. Similarly, research has found that there are limitations of neuropsychological tests in diverse samples [91–93]. Despite the call for more culturally sensitive tests, Spanish-language measures, and demographically diverse normative data, there remains a relative dearth of neuropsychological tests and normative information that work the same across diverse groups. As a result, clinicians are encouraged to carefully consider inclusion and diversity issues when selecting tests, administering tests, and interpreting the results of their neuropsychological evaluation of diverse older adults with depression.

Other aspects of diversity have been shown to impact the relationship between depression and cognitive impairment and thus must be taken into account in the clinical neuropsychological evaluation. For example, there is evidence, albeit mixed, that depression-related cognitive impairment differs by sex [94, 95] and that socioeconomic status, depressive symptoms, and cognitive functioning are interrelated [96]. Additionally, there is evidence of a disproportionate risk for depression and cognitive impairment in older adults who are sexual or gender minorities, experience discrimination, or live in disadvantaged neighborhoods [97–103]. These relationships highlight the critical need for clinicians to be informed of the impact of diversity on depression and cognitive functioning and to incorporate that knowledge into the diagnostic and clinical decision-making process.

Providing Therapeutic Feedback

At the conclusion of the clinical neuropsychological evaluation of the older patient with MDD, therapeutic feedback is recommended. The feedback session would typically involve the clinical neuropsychologist, patient, and the patient's carepartner(s). The session would provide space to discuss the clinical neuropsychological evaluation findings, review cognitive strengths and weakness, provide information regarding the likely etiology of any identified cognitive weaknesses, discuss cognitive compensatory strategies, provide psychoeducation regarding brain health, and discuss strategies to optimize brain health.

In general, clinical neuropsychological therapeutic feedback has multiple advantages for patients and their carepartners including having a clearer understanding of the diagnosis, greater commitment to implementing recommendations, increased collaboration among the patient and healthcare providers, and improved quality of life [104]. The feedback session can help to clarify complex diagnostic and etiologic information as well as provide up-to-date and evidenced-based educational and information resources. Also, the session can be used to enhance patient and carepartner decision-making processes on how to proceed with the evaluation results and implement a healthcare plan course of action based on recommended treatment and compensatory strategies [105]. Importantly, depending on the results, the feedback session can be utilized to help the patient and carepartner process emotions and thoughts that are generated by the evaluation findings [104].

As MDD is often associated with subjective reports of cognitive difficulties without objective evidence of such difficulties [106–108], in some cases, the clinical neuropsychological evaluation may reflect completely intact cognitive abilities in patients with MDD. Providing feedback on such evaluation findings can be useful in that it provides an opportunity to discuss with older adults how MDD can affect patients' perceptions of their everyday functioning and produce negative self-schemas. This feedback should include psychoeducation regarding the differences between self-reports of cognitive difficulties and objective test performance, information regarding normal brain and cognitive changes with aging, and reassurance to the patient that they have intact cognitive capabilities. Also, the feedback session can be used to discuss the differences between the effects of MDD and other neurological illnesses on brain health and cognitive abilities and help

the patient gain new knowledge and insight regarding their self-perceptions and objective cognitive performance [109].

Conclusion

MDD can adversely impact neurocognitive function, with a particular impact on processing speed, attention, and executive function [4, 16, 43, 47]. Older adults with MDD may be particularly vulnerable to these cognitive effects due to multiple factors including age-associated brain changes (e.g., atrophy), cerebrovascular and cardiac disease, comorbid illnesses, and polypharmacy [11, 27, 110–114]. Moreover, older adults with MDD relative to those without may have a greater prevalence of MCI and dementia [20, 23]. As such, there is clinical benefit for older adults to undergo at a minimum a neurocognitive screening exam, and ideally a more detailed clinical neuropsychological evaluation, particular when questions about the possibility of a neurodegenerative condition exist.

Neurocognitive screening can be conducted by many healthcare providers and serves a useful purpose to provide a rapid assessment of global cognitive function [115]; however, it has limited sensitivity and specificity to subtle cognitive impairments and may not be particularly informative with respect to neurodiagnostic or clinical characterization [116]. Relative to a neurocognitive screening exam, a comprehensive clinical neuropsychological evaluation is conducted by specially trained clinical neuropsychologists. While these evaluations require more time to complete, they need not require extended time over multiple hours, depending upon the referral question. Nevertheless, the neuropsychological evaluation can provide a clinically significant return on the time investment [116] and reflects a multifaceted process [117] that goes beyond the administration of specific tests.

In conclusion, the clinical neuropsychological evaluation plays a critical and unique role in integrated healthcare [118] for older adults with depression. Given the overall health complexities related to advancing age, depression, comorbid medical, neurologic, and psychiatric illnesses, and polypharmacy, such an evaluation can help to optimize diagnostic information, discern brain and behavior relationships, identify cognitive strengths and weakness, and inform treatment recommendations [116]. The clinical neuropsychological evaluation can serve as a nexus for older adults with depression to synthesize information across healthcare providers, thereby maximizing measurement-based care to optimize personalized medicine and overall health outcomes.

Funding The writing of this manuscript was supported in part by the National Institute of Mental health (Grant ID: MH119285, PI: S. McClintock).

Compliance With Ethical Standards

Conflict of Interest Dr. Bailey reports none. Dr. Cullum reports research support from the National Institutes of Health and Texas Institute for Brain Injury and Repair/O'Donnell Brain Institute at UT Southwestern Medical Center. He also receives royalties from Pearson Assessment for the Texas Functional Living Scale. Dr. Denney reports none. Dr. Dotson reports research support from the National Institutes of Health. She is the founder and president of CerebroFit, LLC and serves on the external advisory board of the Enhancing Neurocognitive Health, Abilities, Networks, & Community Engagement Center and on the scientific advisory board for the Tourette Association of America. Dr. McClintock reports research support from the National Institutes of Health. He is a consultant to Pearson Assessment. Ms. Minto reports none.

References

Papers of particular interest, published recently, have been highlighted as:
- • Of importance
- •• Of major importance

1. Deng Y, McQuoid DR, Potter GG, Steffens DC, Albert K, Riddle M, et al. Predictors of recurrence in remitted late-life depression. Depress Anxiety. 2018;35(7):658–67.
2. Haigh EAP, Bogucki OE, Sigmon ST, Blazer DG. Depression among older adults: a 20-year update on five common myths and misconceptions. Am J Geriatr Psychiatry. 2018;26(1):107–22.
3. Sjöberg L, Karlsson B, Atti A-R, Skoog I, Fratiglioni L, Wang H-X. Prevalence of depression: comparisons of different depression definitions in population-based samples of older adults. J Affect Disord. 2017;221:123–31.
4. Kok RM, Reynolds CF. Management of depression in older adults: a review. JAMA. 2017;317(20):2114–22.
5. Lisanby SH, McClintock SM, Alexopoulos G, Bailine SH, Bernhardt E, Briggs MC, et al. Neurocognitive effects of combined electroconvulsive therapy (ECT) and venlafaxine in geriatric depression: phase 1 of the PRIDE study. Am J Geriatr Psychiatry. 2020;28(3):304–16.
6. Alexopoulos GS. Mechanisms and treatment of late-life depression. Transl Psychiatry. 2019;9(188):1–16.
7. Kaster TS, Daskalakis ZJ, Noda Y, Knyahnytska Y, Downar J, Rajji TK, et al. Efficacy, tolerability, and cognitive effects of deep transcranial magnetic stimulation for late-life depression: a prospective randomized controlled trial. Neuropsychopharmacology. 2018;43(11):2231–8.
8. Morimoto SS, Altizer RA, Gunning FM, Hu W, Liu J, Cote SE, et al. Targeting cognitive control deficits with neuroplasticity-based computerized cognitive remediation in patients with geriatric major depression: a randomized, double-blind controlled trial. Am J Geriatr Psychiatr. In Press.
9. Beyer JL, Johnson KG. Advances in pharmacotherapy of late-life depression. Current Psychiatry Reports. 2018;20(34):1–11.
10. Trevizol AP, Goldberger KW, Mulsant BH, Rajji TK, Downar J, Daskalakis ZJ, et al. Unilateral and bilateral repetitive transcranial magnetic stimulation for treatment-resistant late-life depression. International Journal of Geriatric Psychiatry. 2019;34(6):822–7.
11. Casey DA. Depression in older adults: a treatable medical condition. Primary Care Clinic Office Practice. 2017;44:499–510.
12. Mace RA, Gansler DA, Suvak MK, Gabris CM, Areán PA, Raue PJ, et al. Therapeutic relationship in the treatment of geriatric

depression with executive dysfunction. J Affect Disord. 2017;214:130–7.
13. Respino M, Hoptman MJ, Victoria LW, Alexopoulos GS, Solomonov N, Stein AT, et al. Cognitive control network homogeneity and executive functions in late-life depression. Biological Psychiatry: Cognitive Neuroscience and Neuroimaging. 2020;5(2):213–21.
14. Miebach L, Wolfsgruber S, Frommann I, Buckley R, Wagner M. Different cognitive complaint profiles in memory clinic and depressive patients. Am J Geriatr Psychiatr. 2018;26(4):463–75.
15. Wang K-C, Yip P-K, Lu Y-Y, Yeh Z-T. Depression in older adults among community: the role of executive function. International Journal of Gerontology. 2017;11:230–4.
16. • Riddle M, Potter GG, McQuoid DR, Steffens DC, Beyer JL, Taylor WD. Longitudinal cognitive outcomes of clinical phenotypes of late-life depression. Am J Geriatr Psychiatr. 2017;25(10):1123–34. **This longitudinal study found that older adults with depression relative to older adults without depression showed greater cognitive decline, and that such decline could be related to repeated episodes of major depression**.
17. Butters MA, Whyte EM, Nebes RD, Begley AE, Dew MA, Mulsant BH, et al. The nature and determinants of neuropsychological functioning in late-lifedepression. Arch Gen Psychiatry. 2004;61(6):587–95.
18. Zaremba D, Schulze Kalthoff I, Förster K, Redlich R, Grotegerd D, Leehr EJ, et al. The effects of processing speed on memory impairment in patients with major depressive disorder. Prog Neuro-Psychopharmacol Biol Psychiatry. 2019;92:494–500.
19. Bhalla RK, Butters MA, Mulsant BH, Begley AE, Zmuda MD, Schoderbek B, et al. Persistence of neuropsychologic deficits in the remitted state of late-life depression. Am J Geriatr Psychiatry. 2006;14(5):419–27.
20. Butters MA, Young JB, Lopez O, Aizenstein HJ, Mulsant BH, Reynolds CF III, et al. Pathways linking late-life depression to persistent cognitive impairment and dementia. Dialogues Clin Neurosci. 2008;10:345–57.
21. Rashidi-Ranjbar N, Rajji TK, Kumar S, Herrmann N, Mah L, Flint AJ, et al. Frontal-executive and corticolimbic structural brain circuitry in older people with remitted depression, mild cognitive impairment, Alzheimer's dementia, and normal cognition. Neuropsychopharmacology. 2020;45(9):1567–78.
22. Gallagher D, Kiss A, Lanctot KL, Herrmann N. Toward prevention of mild cognitive impairment in older adults with depression: an observational study of potentially modifiable risk factors. The Journal of clinical psychiatry. 2019;80(1).
23. Lenze EJ, Voineskos AN, Butters MA, Karp JF. Stopping cognitive decline in patients with late-life depression: a new front in the fight against dementia. Am J Geriatr Psychiatry. 2018;26(8):828–34.
24. Ismail Z, Elbayoumi H, Fischer CE, Hogan DB, Millikin CP, Schweizer T, et al. Prevalence of depression in patients with mild cognitive impairment: a systematic review and meta-analysis. JAMA Psychiatry. 2017;74(1):58–67.
25. Gallagher D, Kiss A, Lanctot K, Herrmann N. Depression and risk of Alzheimer dementia: a longitudinal analysis to determine predictors of increased risk among older adults with depression. Am J Geriatr Psychiatr. 2018;26:819–27.
26. Funes CM, Lavretsky H, Ercoli L, St. Cyr N, Siddarth P. Apathy mediates cognitive difficulties in geriatric depression. Am J Geriatr Psychiatr. 2018;26(1):100–6.
27. Victoria LW, Whyte EM, Butters MA, Meyers BS, Alexopoulos GS, Mulsant BH, et al. Improvement in depression is associated with improvement in cognition in late-life psychotic depression. Am J Geriatr Psychiatry. 2017;25(6):672–9.
28. Bingham KS, Dawson DR, Mulsant BH, Banerjee S, Flint AJ. Relationships among history of psychosis, cognition and functioning in later-life remitted major depression. Am J Geriatr Psychiatr. 2021;29(2):144–155.
29.•• Moller MD, Parmenter BA, Lane DW. Neuropsychological testing: a useful but underutilized resource: how to work with a neuropsychologist to fine-tune your diagnosis and treatment. Curr Psychiatr Ther. 2019;18:40–51. **This review article provides recommendations on how to increase collaborations among healthcare professionals with a particular focus on collaborating with clinical neuropsychologists**.
30. Folstein MF, Folstein SE, McHugh PR, Mini-mental state. A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res. 1975;12(3):189–98.
31. Nasreddine ZS, Phillips NA, Bédirian V, Charbonneau S, Whitehead V, Collin I, et al. The Montreal cognitive assessment, MoCA: a brief screening tool for mild cognitive impairment. J Am Geriatr Soc. 2005;53(4):695–9.
32. Cullum CM, Thompson LL, Smernoff EN. Three word recall as a measure of memory. J Clin Exp Neuropsychol. 1993;15:321–9.
33. Blair M, Coleman K, Jesso S, Desbeaumes Jodoin V, Smolewska K, Warriner E, et al. Depressive symptoms negatively impact Montreal cognitive assessment performance: a memory clinic experience. Canadian Journal of Neurological Sciences / Journal Canadien des Sciences Neurologiques. 2016;43(4):513–7.
34. Rossetti HC, Lacritz LH, Hynan LS, Cullum CM, Van Wright A, Weiner MF. Montreal cognitive assessment performance among community-dwelling African Americans. Arch Clin Neuropsychol. 2017;32(2):238–44.
35. Rossetti HC, Lacritz LH, Cullum CM, Weiner MF. Normative data for the Montreal cognitive assessment (MoCA) in a population-based sample. Neurology. 2011;77(13):1272–5.
36. Koenig AM, DeLozier IJ, Zmuda MD, Marron MM, Begley AE, Anderson SJ, et al. Neuropsychological functioning in the acute and remitted states of late-life depression. Am J Geriatr Psychiatry. 2015;23(3):S94–S5.
37. Luciano M, Pujals AMF, Marioni RE, Campbell A, Hayward C, MacIntyre DJ, et al. Current versus lifetime depression, APOE variation, and their interaction on cognitive performance in younger and older adults. Psychosom Med. 2015;77(5):480–92.
38. O'Shea DM, Fieo RA, Hamilton JL, Zahodne LB, Manly JJ, Stern Y. Examining the associations between late-life depressive symptoms, cognitive function, and brain volumes in the context of cognitive reserve. International Journal of Geriatric Psychiatry. 2015;6:614–22.
39. Valkanova V, Ebmeier KP, Allan CL. Depression is linked to dementia in older adults. Practicioner. 2017;261:11–5.
40. Koenig AM, Bhalla RK, Butters MA. Cognitive functioning and late-life depression. Journal of the International Neuropsychological Society : JINS. 2014;20(5):461–7.
41. Morimoto SS, Alexopoulos GS. Cognitive deficits in geriatric depression: clinical correlates and implications for current and future treatment. Psychiatr Clin N Am. 2013;36(4):517–31.
42. Thomas A, Gallagher P, Robinson L, Porter R, Young A, Ferrier I, et al. A comparison of neurocognitive impairment in younger and older adults with major depression. Psychol Med. 2009;39(5):725–33.
43.•• Dotson VM, McClintock SM, Verhaeghen P, Kim JU, Draheim AA, Syzmkowicz SM, et al. Depression and cognitive control across the lifespan: a systematic review and meta-analysis. Neuropsychol Rev. 2020;30(4):461–76. **This meta-analysis specifically focused on cognitive control, as defined by the National Institute of Mental Health (NIMH) Research Domain Criteria (RDoc) framework in adults across the lifespan with depression, and found an association between depressive symptoms and cognitive control, particularly in older adults**.

44. Wang S, Blazer DG. Depression and cognition in the elderly. Annu Rev Clin Psychol. 2015;11(1):331–60.
45. Brailean A, Comijs HC, Aartsen MJ, Prince M, Prina AM, Beekman A, et al. Late-life depression symptom dimensions and cognitive functioning in the Longitudinal Aging Study Amsterdam (LASA). J Affect Disord. 2016;201:171–8.
46.•• Keilp JG, Madden SP, Gorlyn M, Burke AK, Oquendo MA, Mann JJ. The lack of meaningful association between depression severity measures and neurocognitive performance. J Affect Disord. 2018;241:164–72. **This comprehensive analysis examined the association between depression symptom severity and performance on neuropsychological measures in adults and found that depression symptom severity was unrelated to cognitive performance**.
47. McClintock SM, Husain MM, Greer TL, Cullum CM. Association between depression severity and neurocognitive function in major depressive disorder: a review and synthesis. Neuropsychology. 2010;24(1):9–34.
48. McClintock SM, Haley C, Bernstein IH. Psychometric considerations of depression symptom rating scales. Neuropsychiatry. 2011;1(6):611–23.
49. Fried EI, Epskamp S, Nesse RM, Tuerlinckx F, Borsboom D. What are 'good' depression symptoms? Comparing the centrality of DSM and non-DSM symptoms of depression in a network analysis. J Affect Disord. 2016;189:314–20.
50. Fried EI. The 52 symptoms of major depression: lack of content overlap among seven common depression scales. J Affect Disord. 2017;208:191–7.
51. Association AP. Diagnostic and statistical manual of mental disorders. 5th edition ed. Washington, DC: American Psychiatric Association; 2013.
52. Calamia M, Bernstein JPK. Comparison of self-reported and informant-reported depressive symptoms in an outpatient neuropsychology clinic sample. J Clin Exp Neuropsychol. 2017;39(6):525–33.
53. Brewster GS, Peterson L, Roker R, Ellis ML, Edwards JD. Depressive symptoms, cognition, and everyday function among community-residing older adults. J Aging Health. 2017;29(3):367–88.
54. Wassink-Vossen S, Collard RM, Wardenaar KJ, Verhaak PFM, Rhebergen D, Naarding P, et al. Trajectories and determinants of functional limitations in late-life depression: a 2-year prospective cohort study. Eur Psychiatry. 2019;62:90–6.
55. Collard RM, Wassink-Vossen S, Schene AH, Naarding P, Verhaak P, Oude Voshaar RC, et al. Symptomatic and functional recovery in depression in later life. Soc Psychiatry Psychiatr Epidemiol. 2018;53(10):1071–9.
56. Bingham KS, Kumar S, Dawson DR, Mulsant BH, Flint AJ. A systematic review of the measurement of function in late-life depression. Am J Geriatr Psychiatry. 2018;26(1):54–72.
57. The World Health Organization Quality of Life assessment (WHOQOL): position paper from the World Health Organization. Social science & medicine (1982). 1995;41(10):1403-9.
58.•• Rhee TG, Steffens DC. Major depressive disorder and impaired health-related quality of life among US older adults. Int J Geriatr Psychiatry. 2020;35:1189–97. **This cross-secitonal analysis of epidemilogical collected data found an association between historical and current major depressive disorder and health-related quality-of life in older adults**.
59. Sivertsen H, Bjørkløf GH, Engedal K, Selbæk G, Helvik A-S. Depression and quality of life in older persons: a review. Dement Geriatr Cogn Disord. 2015;40(5–6):311–39.
60. Group W. The World Health Organization quality of life assessment (WHOQOL): position paper from the World Health Organization. Soc Sci Med. 1995;41(10):1403–9.
61. Millis SR, Kaufmann PM. Assessment of incomplete effort and malingering in the neuropsychological examination. In: E MJ, Ricker JH, editors. Textbook of clinical neuropsychology. 2nd Edition ed. USA: Routledge; 2018 927–41.
62. Soble JR, Alverson WA, Phillips JI, Critchfield EA, Fullen C, O'Rourke JJF, et al. Strength in numbers or quality over quantity? Examining the importance of criterion measures to define validity groups in performance validity test (PVT) research. Psychological Injury and Law. 2020;13(1):44–56.
63. Bailey KC, Webber TA, Phillips JI, Kraemer LD, Marceaux JC, Soble JR. When time is of the essence: preliminary findings for a quick administration of the dot counting test. Arch Clin Neuropsychol. 2019.
64. Denning JH. The efficiency and accuracy of the test of memory malingering trial 1, errors on the first 10 items of the test of memory malingering, and five embedded measures in predicting invalid test performance. Arch Clin Neuropsychol. 2012;27(4):417–32.
65. Tombaugh TN. Test of memory malingering (TOMM). Torrance, CA: Western Psychological Services; 1996.
66. Boone K, Lu P. The dot counting test. Torrance, CA: Western Psychological Services; 2002.
67. Rey A. L'examen clinique en psychologie. Paris: Presses Universitaires de France; 1964.
68. Bailey KC, Soble JR, O'Rourke JJ. Clinical utility of the Rey 15-item test, recognition trial, and error scores for detecting noncredible neuropsychological performance in a mixed clinical sample of veterans. Clin Neuropsychol. 2018;32(1):119–31.
69. Green P, Montijo J, Brockhaus R. High specificity of the word memory test and medical symptom validity test in groups with severe verbal memory impairment. Appl Neuropsychol. 2011;18(2):86–94.
70. Loring DW, Goldstein FC, Chen C, Drane DL, Lah JJ, Zhao L, et al. False-positive error rates for reliable digit span and auditory verbal learning test performance validity measures in amnestic mild cognitive impairment and early Alzheimer disease. Arch Clin Neuropsychol. 2016;31(4):313–31.
71. Poreh A, Bezdicek O, Korobkova I, Levin JB, Dines P. The Rey auditory verbal learning test forced-choice recognition task: base-rate data and norms. Applied Neuropsychology: Adult. 2016;23(3):155–61.
72. Rj S, Testa SM, Dux M. Embedded performance validity tests within the Hopkins verbal learning test-revised and the brief visuospatial memory test-revised. Clin Neuropsychol. 2017;31(1):207–18.
73. Bailey KC, Soble JR, Bain KM, Fullen C. Embedded performance validity tests in the Hopkins verbal learning test—revised and the brief visuospatial memory test—revised: a replication study. Arch Clin Neuropsychol. 2018;33(7):895–900.
74. Babikian T, Boone KB, Lu P, Arnold G. Sensitivity and specificity of various digit span scores in the detection of suspect effort. Clin Neuropsychol. 2006;20(1):145–59.
75. Jasinski LJ, Berry DTR, Shandera AL, Clark JA. Use of the Wechsler adult intelligence scale digit span subtest for malingering detection: a meta-analytic review. J Clin Exp Neuropsychol. 2011;33(3):300–14.
76. Webber TA, Critchfield EA, Soble JR. Convergent, discriminant, and concurrent validity of nonmemory-based performance validity tests. Assessment. 2020;27(7):1399–415.
77. Webber TA, Soble JR. Utility of various WAIS-IV digit span indices for identifying noncredible performance validity among cognitive impaired and unimpaired examinees. Clin Neuropsychol. 2018;32(4):657–70.
78. Barca ML, Persson K, Eldholm R, Benth JS, Kersten H, Knapskog A-B, et al. Trajectories of depressive symptoms and

their relationship to the progression of dementia. J Affect Disord. 2017;222:146–52.
79. Sheehan DV, Lecrubier Y, Sheehan KH, Amorim P, Janavs J, Weiller E, et al. The mini-international neuropsychiatric interview (M.I.N.I.): the development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. The Journal of clinical psychiatry. 1998;59 Suppl 20:22-33;quiz 4-57.
80. Pettersson A, Bostrom KB, Gustavsson P, Ekselius L. Which instruments to support diagnosis of depression have sufficient accuracy? A systematic review. Nordic Journal of Psychiatry. 2015;69(7):497–508.
81. Amorim P, Lecrubier Y, Weiller E, Hergueta T, Sheehan D. DSM-IH-R psychotic disorders: procedural validity of the mini international neuropsychiatric interview (MINI). Concordance and causes for discordance with the CIDI. European Psychiatry. 1998;13(1):26–34.
82. Galvin JE, Roe CM, Powlishta KK, Coats MA, Muich SJ, Grant E, et al. The AD8: a brief informant interview to detect dementia. Neurology. 2005;65(4):559–64.
83. Jorm AF. The informant questionnaire on cognitive decline in the elderly (IQCODE): a review. Int Psychogeriatr. 2004;16(3):275–93.
84. Galvin JE. The quick dementia rating system (Qdrs): a rapid dementia staging tool. Alzheimers Dement (Amst). 2015;1(2):249–59.
85. Hamilton JL, Brickman AM, Lang R, Byrd GS, Haines JL, Pericak-Vance MA, et al. Relationship between depressive symptoms and cognition in older, non-demented African Americans. J Int Neuropsychol Soc. 2014;20(7):756–63.
86. Johnson LA, Large SE, Izurieta Munoz H, Hall JR, O'Bryant SE. Vascular depression and cognition in Mexican Americans. Dement Geriatr Cogn Disord. 2019;47(1–2):68–78.
87. Tam CW, Lam LC. Cognitive and functional impairment in Chinese elderly with late-onset depression. East Asian Arch Psychiatr. 2012;22(1):25–30.
88. Zahodne LB, Nowinski CJ, Gershon RC, Manly JJ. Depressive symptoms are more strongly related to executive functioning and episodic memory among African American compared with non-Hispanic White older adults. Arch Clin Neuropsychol. 2014;29(7):663–9.
89. Reinlieb ME, Persaud A, Singh D, Garcon E, Rutherford BR, Pelton GH, et al. Vascular depression: overrepresented among African Americans? Int J Geriatr Psychiatry. 2014;29(5):470–7.
90. Gopalkrishnan N. Cultural diversity and mental health: considerations for policy and practice. Front Public Health. 2018;6:179.
91. Hestad KA, Menon JA, Serpell R, Kalungwana L, Mwaba SO, Kabuba N, et al. Do neuropsychological test norms from African Americans in the United States generalize to a Zambian population? Psychol Assess. 2016;28(1):18–38.
92. Howieson D. Current limitations of neuropsychological tests and assessment procedures. Clin Neuropsychol. 2019;33(2):200–8.
93.• Werry AE, Daniel M, Bergstrom B. Group differences in normal neuropsychological test performance for older non-Hispanic White and Black/African American adults. Neuropsychology. 2019;33(8):1089–100. **The findings of this study highlight the need to consider inclusion and diversity factors when providing clinical neuropsychological evaluation and feedback services**.
94. Caldirola D, Sangiorgio E, Riva A, Grassi M, Alciati A, Scialò C, et al. Does gender influence cognitive function in non-psychotic depression? Personalized Medicine in Psychiatry. 2017;4-6:25-31.
95. Regan CO, Kearney PM, Savva GM, Cronin H, Kenny RA. Age and sex differences in prevalence and clinical correlates of depression: first results from the Irish longitudinal study on ageing. Int J Geriatr Psychiatry. 2013;28(12):1280–7.
96. Chiao C, Weng LJ. Mid-life socioeconomic status, depressive symptomatology and general cognitive status among older adults: inter-relationships and temporal effects. BMC Geriatr. 2016;16:88.
97. Barnes LL, Lewis TT, Begeny CT, Yu L, Bennett DA, Wilson RS. Perceived discrimination and cognition in older African Americans. J Int Neuropsychol Soc. 2012;18(5):856–65.
98. Fernandez-Blazquez MA, Noriega-Ruiz B, Avila-Villanueva M, Valenti-Soler M, Frades-Payo B, Del Ser T, et al. Impact of individual and neighborhood dimensions of socioeconomic status on the prevalence of mild cognitive impairment over seven-year follow-up. Aging Ment Health. 2020:1–10.
99. Flatt JD, Johnson JK, Karpiak SE, Seidel L, Larson B, Brennan-Ing M. Correlates of subjective cognitive decline in lesbian, gay, bisexual, and transgender older adults. J Alzheimers Dis. 2018;64(1):91–102.
100. Hackett RA, Steptoe A, Lang RP, Jackson SE. Disability discrimination and well-being in the United Kingdom: a prospective cohort study. BMJ Open. 2020;10(3):e035714.
101. Ikram UZ, Snijder MB, Fassaert TJ, Schene AH, Kunst AE, Stronks K. The contribution of perceived ethnic discrimination to the prevalence of depression. Eur J Pub Health. 2015;25(2):243–8.
102. Joshi S, Mooney SJ, Rundle AG, Quinn JW, Beard JR, Cerda M. Pathways from neighborhood poverty to depression among older adults. Health Place. 2017;43:138–43.
103. Shankar A, Hinds P. Perceived discrimination: associations with physical and cognitive function in older adults. Health Psychol. 2017;36(12):1126–34.
104.• Rosado DL, Buehler S, Botbol-Berman E, Feigon M, León A, Luu H, et al. Neuropsychological feedback services improve quality of life and social adjustment. Clin Neuropsychol. 2018;32(3):422–35. **This article highlights the importance of providing feedback regarding the findings of the clinical neuropsychological evaluation**.
105. Meth MZ, Bernstein JPK, Calamia M, Tranel D. What types of recommendations are we giving patients? A survey of clinical neuropsychologists. Clin Neuropsychol. 2019;33(1):57–74.
106. Srisurapanont M, Suttajit S, Eurviriyanukul K, Varnado P. Discrepancy between objective and subjective cognition in adults with major depressive disorder. Sci Rep. 2017;7(1):1–7.
107. Serra-Blasco M, Torres IJ, Vicent-Gil M, Goldberg X, Navarra-Ventura G, Aguilar E, et al. Discrepancy between objective and subjective cognition in major depressive disorder. Eur Neuropsychopharmacol. 2019;29(1):46–56.
108.• Baeza-Velasco C, Guillaume S, Olié E, Alacreu-Crespo A, Cazals A, Courtet P. Decision-making in major depressive disorder: subjective complaint, objective performance, and discrepancy between both. J Affect Disord. 2020;270:102–7. **This article compares and contrasts object performance on neuropsychological measures and self-reported cognitive complaints in adults with major depressive disorder**.
109. Carone DA. But the scores don't show how I really function: a feedback method to reveal cognitive distortions regarding normal neuropsychological test performance. Applied Neuropsychology: Adult. 2017;24(2):160–8.
110. Mewton L, Reppermund S, Crawford J, Bunce D, Wen W, Sachdev P. Cross-sectional and prospective inter-relationships between depressive symptoms, vascular disease and cognition in older adults. Psychol Med. 2019;49(13):2168–76.
111. Christman S, Bermudez C, Hao L, Landman BA, Boyd B, Albert K, et al. Accelerated brain aging predicts impaired cognitive performance and greater disability in geriatric but not midlife adult depression. Transl Psychiatry. 2020;10(1):1–11.
112. Dotson VM, Szymkowicz SM, Sozda CN, Kirton JW, Green ML, O'Shea A, et al. Age differences in prefrontal surface area and

thickness in middle aged to older adults. Front Aging Neurosci. 2016;7:250.
113. Szymkowicz SM, Woods AJ, Dotson VM, Porges EC, Nissim NR, O'Shea A, et al. Associations between subclinical depressive symptoms and reduced brain volume in middle-aged to older adults. Aging Ment Health. 2019;23(7):819–30.
114. Kirton JW, Dotson VM. The interactive effects of age, education, and BMI on cognitive functioning. Aging Neuropsychol Cognit. 2016;23(2):253–62.
115. Ismail Z, Rajji TK, Shulman KI. Brief cognitive screening instruments: an update. International Journal of Geriatric Psychiatry. 2010;25(2):111–20.
116.•• Roebuck-Spencer TM, Glen T, Puente AE, Denney RL, Ruff RM, Hostetter G, et al. Cognitive screening tests versus comprehensive neuropsychological test batteries: a National Academy of Neuropsychology education paper†. Arch Clin Neuropsychol. 2017;32(4):491–8. **This article compares and contrasts cognitive screening and comprehensive clinical neuropsychological evaluation**.
117. Schroeder RW, Martin PK, Walling A. Neuropsychological evaluations in adults. Am Fam Physician. 2019;99(2):101–8.
118. Lanca M. Integration of neuropsychology in primary care. Arch Clin Neuropsychol. 2018;33(3):269–79.