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Assessment of Geriatric Depression: Construction of a New Screening Inventory

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Assessment of Geriatric Depression: Construction of a New Screening Inventory

by

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Each person whose signature appears below certifies that this dissertation in his/her opinion is adequate, in scope and quality, as a dissertation for the degree Doctor of Philosophy.

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ABSTRACT OF THE DISSERTATION

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Geriatric depression is strongly associated with increased healthcare costs, poor treatment outcomes, and mortality. Existing measures of depression in this population do not adequately account for more recent literature describing the presentation of depressed older adults, and thus may result in the underdiagnosis of depression in this population. The current study consistent of the development of a new, updated measure and examined its psychometric properties and potential clinical utility for diagnosing depression in adults over the age of 65. Participants were be recruited from multiple sources, including a community population from residential retirement communities, as well as inpatients and outpatients from two medical centers. All participants completed the 26-item Thorndyke Geriatric Depression Inventory (TGDI) and the Geriatric Depression Scale (GDS). A subset of participant completed the Mini Mental State Examination (MMSE). Factor analysis was used to identify a factor structure in the TGDI data, facilitated deletion of low quality items from the measure, and suggested that TGDI items represented a single factor of depression. Scores on the TGDI were then correlated with MMSE and GDS scores to establish convergent and divergent validity. A finalized version of the TGDI was developed for further research and validation.

CHAPTER ONE

INTRODUCTION AND LITERATURE REVIEW

Introduction

Depression in older adults is a major health concern. This population is at increased risk for new onset depression as well as recurrent depression from earlier life changes, medical illness, and loss (Penninx, Deeg, van Eijk, Beekman, & Guralnik, 2000). In addition to causing psychological distress and reduced quality of life, depression is associated with poorer medical treatment outcomes, increased healthcare costs, and mortality in the elderly (Byers et al., 2012; Chapman & Perry, 2008).

Early detection of depression has been shown to reduce the risk of adverse health outcomes in all adults (Han, McCusker, Abrahamowizc, Cole, & Capek, 2006). It follows that simple and sensitive screening for depression in older adults is needed to identify depressed individuals so that appropriate treatment may be accordingly provided. Such a measure must be time efficient and easily administered by a variety of healthcare professionals. Because older adults report depressive symptomatology differently than younger adults (Gallo, Anthony, & Muthen, 1994), a tailored screening measure is needed. The instruments currently used to screen for depression in older adults are either designed for research rather than clinical use, were designed primarily for other populations, or were developed several decades ago and therefore do not reflect more recent literature regarding depression in the elderly (Yesavage et al., 1982).

The goal of this study is to design a depression screening measure for clinical use with adults over 65 years of age that is brief, reliable, and more accurately assesses symptoms that are prevalent in older adults.

Depression occurs at a high rate in the geriatric population, reducing quality of life and life expectancy (Ganzini, Smith, Fenn, & Lee, 1997; Penninx et al., 2000), hampering medical treatments (Chapman & Perry, 2008), and exacerbating cognitive decline in neurodegenerative conditions (Zupan & Kogoj, 2008). Older adults are more frequently confronted with chronic health problems, phase of life changes, loss of loved ones, and isolation in long-term care facilities, placing them at greater risk for chronically depressed mood (Chapman & Perry, 2008).

In the general population of older adults, estimates of the rate of major depression varies from 3 to 21 percent, depending on the screening tools and score cutoffs used (NAMI, 2009; Penninx et al., 2000; Unützer et al., 1997). In long-term care facilities and skilled nursing facilities, rates of major depression may be as high as 42 percent (King, Heisel, & Lyness, 2005). In these types of care facilities, between 52 and 71 percent of depression cases represent a new onset in older age (Bruce et al., 2002; Fiske, Weatherell, & Gatz, 2009). More than half of new cases of depression diagnosed in care facilities are chronic, lasting more than three years (Chapman & Perry, 2008; Koenig, George, Peterson, & Pieper, 1997). Depression represents a prevalent mental health concern in older adults. Therefore detection and treatment should be a priority in the care of these individuals.

Implications

Depression is known to predict a variety of health outcomes in older adults. It has been previously found to increase the risk for incident disability by 67 percent (Penninx, Leveille, Ferucci, van Eijk, & Guralnik, 1999). Depressed older adults typically exhibit

social withdrawal and decreased physical activity, which may lead to reduced fitness and thereby deterioration in physical capacity (Penninx et al., 1999). In a self-report study of physical decline, older adults with depression were almost three times more likely to report a significant decrease in physical function over three years compared to those without diagnosed depression, even accounting for baseline physical function and sociodemographic factors. Participants with remitted depression did not exhibit significantly different physical deterioration than those without depression, indicating that early detection and treatment of depression was protective against future physical disability (Penninx et al, 2000).

Cognitive decline has also been repeatedly shown to be associated with depression, although causality in this relationship remains poorly understood (Saczynski et al., 2010). High levels of persistent depression were significantly associated with cognitive decline in a prospective study, where an MMSE (Folstein, Folstein, & McHugh, 1975) score decrease of three or more points was considered significant decline (Paterniti, Verdier-Taillefer, Dufouil, & Alperovitch, 2002). In a 17-year longitudinal study, depression was found to be associated with increased risk for development of a dementia syndrome; however, it was unclear if depression represented an early symptom of Alzheimer's disease or other neurodegenerative condition (Saczynski et al., 2010). These findings indicate that diagnosis of depression is complicated by cognitive status and that this relationship may negatively impact the discriminant validity of depression screening measures in general. In Saczynski's (2010) study, depression was found to be specifically associated with declines in processing speed, simple attention span, and verbal learning and memory for new information. Another study found that veterans with

depression and dysthymia had twice the rate of dementia as those without mood disturbance (Byers, Covinsky, Barnes, & Yaffe, 2012). Another study of the relationship between depression and gross cognitive function found that depression was associated with concurrent declines in cognitive function rather than predictive of prospective declines. Individuals whose depression remitted during the course of the study had less cognitive decline than those who remained depressed (Han et al., 2006).

The evolving understanding of the relationship between neuropsychological outcomes and depression is that the relationship between the two is bidirectional, and that the prompt detection and treatment of depression in older adults may forestall or slow cognitive decline and increase quality of life early in the course of neurodegenerative conditions (O'Hara, 2012). Depression also appears to modulate the role of acetylcholinesterase inhibitors in delaying conversion from amnestic mild cognitive impairment (aMCI) to Alzheimer's disease (Lu, Edland, Teng, Tingus, Petersen, & Cummings, 2009). In depressed aMCI participants, treatment with donezepil reduced rate of progression to dementia at 1.7 and 2.2 years from diagnosis compared to participants not treated with the drug. In the non-depressed aMCI group, there was no significant difference in rate of conversion between participants treated with donepezil and those given a placebo (Lu et al, 2009). Therefore, assessing for depression may help identify those who could benefit most from early donepezil treatment.

Beyond its apparent role in accelerating physical and cognitive decline in the elderly, depression is also predictive of mortality in older adults (Byers et al., 2012). Another study found that among medically ill older adults, only two factors were

predictive of death during the 36 month duration of the study: depression and severity of medical illness (Ganzini et al., 1997).

Geriatric depression is associated with a tremendous relative increase in healthcare costs. In an analysis of Medicare claims in the United States, older adults with diagnosed major depression were found to have had an average annual healthcare cost of $20,046, while those without a depression diagnosis had an average annual healthcare cost of $11,956. Mental health costs only accounted for approximately one percent of these total annual costs (Unützer et al., 2009). Consistent with the above, depression has been found to be strongly associated with overall number of emergency room and doctor's visits, most likely accounting for a large proportion of the increased cost of care associated with depression (Chapman & Perry, 2008; U.S. Department of Health and Human Services, 1999). Detection of depression in older adults, therefore, may be important for keeping healthcare costs low.

Older adults account for 13 percent of the general United States population, but account for 18 percent of suicides, meaning this group has the second highest rate of suicide (NIMH, 2003). Moderate to severe depression is a significant risk factor for suicide in older adults (Bartels et al., 2002). Approximately 75 percent of older adults who committed suicide had seen their physicians within the month preceding their death (NIMH, 2003). Another study found that 20 percent of older adults who committed suicide had seen a physician on the very same day (Conwell, 1994). Overtly stated suicidal ideation, death ideation, and severe hopelessness have been found to be significantly predictive of suicidal behavior (Brown, Bonger, & Cleary, 2004).

Therefore, specifically assessing for suicidal ideation and hopelessness in older adults is a vital part of evaluating depression in older adults.

Challenges in Diagnosis

Despite the high incidence of depression in elderly adults, depression often goes undetected in primary care settings. Depressed older adults often have cognitive complaints; depression frequently masquerades as dementia (APA, 2004). Some of the complaints depressed older adults make to their physicians are misperceived as normal aspects of aging, particularly chronic mild memory insufficiency, cognitive slowing, and anergia (Sable, Dunn, & Zisook, 2002). In a study of depressed individuals over the age of 85, only 25 percent had been diagnosed as depressed by their primary care physician, even though their physicians had seen 90 percent of them in the past 12 months (Stek, Gussekloo, Beekman, Tilburg, & Westendorp, 2004). Physicians are not alone in their failure to adequately identify depression in elderly adults. Only 20 percent of licensed psychologists have had supervised training in assessing and treating the geriatric population, making them ill equipped to identify the unique presentation of depression in this population (APA, 2004). It is therefore essential that there be a useful and rapid means to assess depression and suicidal ideation in older adults that is geared toward the presentation and complaints of older adults with depression. Older adults are more likely to seek treatment for depression from a primary care provider rather than a mental health specialist (Pincus, Davis, & McQueen, 1999), so it is therefore important that any screening measure be readily useful to both physicians and mental health specialists.

Multiple Etiologies of Late-life Depression

Existing literature suggests that there is some consensus that older adults with initial onset depression later in life have a presentation that is distinct from that of younger adults (Fiske et al., 2009). A study of the family history of older adults diagnosed with depression found that those who experienced onset of depression in old age were less likely to have a family history of major depression than those who had a history of chronic depression, suggesting that psychosocial factors and non-genetic biological factors may play a larger role in depression in this subset of depressed individuals (Heun, Papassotiropoulos, Jessen, Maier, & Breitner, 2001). Differing etiologies may serve to explain, at least in part, why older adults may experience different depressive symptoms. Even if late-onset depression were found be a unique form of depression, individuals who also have a prior history of depression in early life may still have a differing presentation later in life (Alexopoulos, 2005).

Depressed older adults are more likely to have vascular risk factors, such as hypertension, dyslipidemia, and cerebrovascular disease. Disruption of frontal-limbic and frontal-striatal pathways by deep white matter ischemia secondary to cerebrovascular disease has been associated with emotional dysregulation in older adults (Hickie et al., 2001). This phenomenon has been termed "vascular depression" and provides one possible explanation for why older adults experience depression in a manner inconsistent with younger adults and why concomitant cognitive complaints are so common in this population (Fiske et al., 2009).

A number of neurodegenerative conditions are also strongly associated with depression. Although depression due to one or more of these diseases would be

diagnosed as depression due to a general medical condition rather than major depression under current diagnostic guidelines, depression resulting from neurodegenerative changes should still be diagnosed and treated to maximize quality of life and minimize the impact of neurologic changes on future cognitive decline (Butters et al., 2000; Ownby, Crocco, Acevedo, John, & Loewenstein, 2006). In Parkinson's disease, depression is quite common, but anhedonia and dysphoria are not exemplars of depression in this population, occurring less in this group than in adults without a history of neurologic illness (Ehrt, Brønnick, Leentjens, Larsen, & Aarsland, 2006). This group instead endorsed more avolition and cognitive insufficiency.

Individuals with Alzheimer's disease have been found to commonly have depression early in the course of their illness to the extent that late onset depression in the absence of acute psychosocial distress has been described as prodromal to Alzheimer's disease (Olin et al., 2002). Although some cases of depression observed in Alzheimer's disease patients may be due to stress associated with receiving the diagnosis (Kozauer, Rosenberg, & Lyketsos, 2006), potential neurobiological mechanisms have also been identified. The interrelationship between Alzheimer's disease and depression appears to be complex and bi-directionally causal (Lopez et al., 2003). Depression has been associated with lower levels of Amyloid-beta$_{42}$ (Aß$_{42}$) in blood plasma (Sun et al., 2008). A lower level of Aß circulating in the blood plasma and cerebrospinal fluid has been associated with accumulation of Aß plaques in the brain and is therefore considered a biomarker of Alzheimer's disease (Sperling et al., 2011). Frontal lobe dysfunction in depressed Alzheimer's disease patients, as evidenced by decreased glucose metabolism in the right superior frontal gyrus, may play a role in the onset and severity of depression

(Lee et al., 2006). A noradrenergic and cholinergic deficit due to neuronal degeneration in the locus coeruleus and basal nucleus of Meynert may also represent an organic contribution to depression in Alzheimer's disease (Förstl et al., 1992).

The aforementioned findings serve to indicate that geriatric depression, although still diverse in presentation, may differ from earlier onset mood disturbance because new onset depression in old age may be due, in part, to neurologic changes associated with a variety of disease processes as well as severe psychosocial stressors. Some of the severe stressors older adults encounter include loss of loved ones and spouses, retirement, and loss of physical function. Older adults are subjected to these stressors with increasing frequency with age, and all of these events are associated with social isolations, loss of purpose and hopelessness, leading to increased depression (Chapman & Perry, 2008).

Distinctive Features and Symptoms of Depression in Older Adults

When depressed older adults present to their physicians and other healthcare providers, they tend to manifest differing symptoms of depression than younger adults on the whole; some symptoms of depression occur at higher or lower rates in older adults than younger adults, even at comparable levels of depression (Gallo, Anthony, & Muthen, 1994). Perhaps most notable is the tendency for depressed older adults to explicitly deny feelings of dysphoria and anhedonia more often than younger adults, which are hallmarks of depression in the latter group. A large-scale study of a community sample of older adults found that there was a significant effect of age on responses to questions on dysphoria/anhedonia items on a diagnostic interview. Adults over the age of 65 were found to be less likely to describe themselves as having

dysphoria or diminished pleasure than were younger adults (Gallo et al., 1994). This effect was observed even when accounting for severity of depression, cognitive impairment, employment status, and marital status. A follow up study similarly found that older adults were more likely to specifically deny feelings of sadness and other cognitive-affective symptoms, including worthlessness, and overtly stated feelings of depression (Gallo & Rabins, 1999). Whether this represents a cohort effect or a differential experience of depression in an aging population was not addressed.

Even though older adults have a tendency to deny a sense of sadness on mood questionnaires, sadness remains a key part of how older adults themselves define the experience of depression. One study found that older adults were more likely to describe a character in a vignette as depressed when the vignette included references to sadness alongside other depressive symptoms than the same vignette when mention of sadness was excluded (Gum, McDougal, McIlvane, & Mingo, 2010). These findings suggest that simply asking an elderly individual whether or not he/she is feeling depressed is insufficient; that person may not be feeling sadness specifically, but is still likely to report sadness as a key feature of their experience of depression. They are therefore at risk for denying depression even when they are, in fact, depressed. It is unclear if some older adults have this response pattern due to poor insight, denial, or lack of emotional awareness (Gum et al, 2010). Regardless, any future depression screening measure or assessment tool used in a geriatric population would need to ask about sadness as well as cognitive symptoms, but should give substantial weight to the most commonly reported symptoms of depression.

A study by Christiansen et al. (1999) found that older adults routinely endorse some depressive symptoms with greater frequency than other populations. Structural equation modeling was used to assess the relationship between age and other demographic variables on several scales of depression. Older age was found to be associated with several somatic symptoms and some psychological symptoms, even when the level of depression was equal to that observed in younger individuals. Somatic symptoms more frequently endorsed by older adults included psychomotor slowing, fatigue, and sleep disturbance, particularly waking early and being unable to return to sleep. Older adults were also more likely to endorse feelings of hopelessness about the future and loss of interest in previously engaging activities and social environments (Christiansen et al., 1999).

Similar results were obtained in another study of depressive symptoms in older adults, where the geriatric participants were found to endorse hopelessness, decreased motivation toward social engagement, difficulty concentrating, social isolation, and diminished appetite (Blazer, Landerman, Hays, Simonsick, & Saunders, 1988). Again, a constellation of social withdrawal, hopelessness about the future, and somatic symptoms characterized depression in older adults more than feelings of sadness.

Hopelessness in particular is characteristic of depression in the elderly. A study of the phenomenology of depression in older adults found that depressed individuals more commonly endorsed hopelessness than any other single symptom of depression (Brodaty et al., 2001). Hopelessness has also been identified as the symptom of depression that is most predictive of suicide attempts in this population (Hill, Gallagher,

Thompson, & Ishida, 1988). It is therefore important to inquire about feelings of hopelessness when assessing for depression in older adults.

Older adults have a rate of suicide that is relatively higher than other age groups (Fiske et al., 2009), and is therefore a significant concern. The experience of depression has been found to be more closely associated with suicidal ideation and suicide attempts in the elderly than at any other age (Conwell & Brent, 1996). In a study of completed suicides, a larger percentage of older adults were found to have suffered depression at the time they committed suicide than young adults or middle-aged adults. Suicide in younger adults was found to be more closely tied to substance abuse, while suicides in middle age were more likely to occur following other stressful life events such as the loss of a job (Conwell & Brent, 1996).

Passive suicidal ideation, which is probably more aptly termed death ideation, is much more common in older adults than true suicidal ideation or intent (Bartels et al., 2002). Death ideation is typically defined as the belief that one's life is no longer worth living, or wishing that one would simply be dead; individuals with death ideation will commonly make statements like, "I wish I would just die in my sleep" (Szanto, Reynolds, & Frank, 1996).

In a study of suicidal and death ideation, Bartels et al. (2002) found that depressed older adults endorsed some level of suicidal ideation at a relatively high rate of 10.4 percent. More than 27 percent of participants endorsed death ideation. Although almost all participants who reported suicidal ideation also endorsed death ideation, nearly 17 percent denied active suicidal ideation but endorsed death ideation. Rates of death ideation (but not suicidal ideation) were particularly high in women and in those who

still perceived that they had good social support (Bartels et al., 2002). Because death ideation is by definition passive, ordinary questions regarding suicidal ideation and intent that presume active pursuit of death may not always elicit affirmative responses in an individual who desires to die. When assessing depression and suicidality in older adults, it is vital to evaluate both active suicidal ideation and passive death ideation.

Another study of depressed and non-depressed older adults found that the experience of loneliness was characteristic of depressed older people (Barg et al., 2006). In a mixture of semi-structured interviews and depression scales, older adults were more likely to describe their experience of social isolation as caused by circumstantial loneliness as much as a consequence of self-imposed social withdrawal. Participants also generally believed loneliness was a normal part of aging. In interviews, they also tended to view loneliness as a precursor to depression more than a symptom of depressed mood. Loneliness was typically tied to deaths of family and friends, where bereavement was especially severe and protracted following the death of a spouse, particularly for men (Barg et al., 2006). The extent to which loneliness is characteristic of non-depressed older adults is unclear.

Fiske, Gatz, and Pedersen (2003) described a reciprocal process between depression and future life stress in older adults. Their longitudinal study of aging twin pairs found that negative life events (i.e., death of spouse) predicted depression after three years. Additionally, depressive symptoms also predicted future life stress, such as stress due to lack of an established support system. They suggested that depressed older adults engaged in greater self-imposed social isolation and rumination, alienating caregivers and diminishing the future availability of social support (Fiske et al., 2003).

The results of this study suggest that rumination and social isolation are important variables of interest in depressed older adults.

Previously, diagnostic criteria for major depression specified bereavement as an exclusionary criterion (American Psychological Association, 2000). The recently released DSM-5, however, contains no such bereavement exclusion, suggesting that the pain and grief associated with bereavement may constitute a Major Depressive Episode (American Psychological Association, 2013). Bereavement is a psychological stressor that is increasingly common with age, and bereavement-related depression is common in older adults and many of its features do not necessarily differ substantially from standard depression without bereavement (Kendler & Zisook, 2008). In a study comparing the symptom profile, duration, and functional impairment in bereavement-related depression and standard major depression, no significant differences were found between the etiologies of the depressed mood (Karam et al., 2009). Considering the rates at which the elderly suffer bereavement and their tendency to deny depression when explicitly asked, the presence of acute and protracted bereavement should be assessed as part of a depression-screening tool for older adults.

Some of the cognitive symptoms of depression displayed by older adults have been objectively measured by neurocognitive tests. Butters et al. (2004) found that depressed older adults without dementia or other neurologic illness demonstrated significantly lower scores on neurocognitive tests across domains (memory, attention, and processing speed) compared to older adults without depression. They found the magnitude of the difference between groups was largest for information processing speed, where mean scores of depressed participants were one half to one full standard

deviation below the mean scores of the non-depressed group. The authors suggested that reduced processing speed might partially explain other observed differences in memory, visuospatial function, and executive function. They further found that only 39 percent of depressed participants scored in the average range (above the 10th percentile) on more than two of the five assessed domains (Butters et al., 2004).

The aforementioned neuropsychological findings have been replicated numerous times with similar results; older adults with depression have been repeatedly found to have reduced processing speed, difficulties with memory, and diminished ability to render decisions, particularly when age of initial onset was greater. Deficits have been found to not be due to aging alone (Hermann, Goodwin, & Ebmeier, 2007; Thomas et al., 2009). These findings suggest that broad cognitive decrement is quite common in geriatric depression, lending credence to complaints of bradyphrenia, diminished memory, and increased difficulty with multitasking and decision-making. Although these symptoms are common to other neurocognitive syndromes in older adults, the presence of cognitive complaints in elderly individuals without a known neurological illness should raise questions about depression as well as possible neurodegenerative processes, especially when onset is simultaneous with life stressors or other symptoms of depressed mood (Thomas et al., 2009).

Current Measures of Geriatric Depression

There are a wide variety of depression screening measures that have been developed for use across the lifespan. The most popular and widely used screening tools are the Beck Depression Inventory—II (Beck, Steer, Ball, & Ranieri, 1996), Hamilton

Rating Scale for Depression (Hamilton, 1980), Center for Epidemiological Studies Depression Scale—Revised (Eaton, Muntaner, Smith, Tien, & Ybarra, 2004), and the Geriatric Depression Scale (Yesavage et al., 1982). All of the aforementioned screening measures have been used with older adults in both clinical and research applications; however, the Geriatric Depression Scale (GDS) is the only one that was developed specifically for use with this population.

The Beck Depression Inventory was initially published in 1961 and was the first measure to assess depression from a cognitive theoretical framework (Beck, 1961). The most recent version, the BDI-II (Beck et al., 1996), is a 21-item multiple choice self-report inventory of depression related symptoms such as hopelessness, irritability, feelings of guilt, fatigue, weight loss, appetite changes, poor libido, and insomnia. For each item, the respondent is asked to identify which of several options most closely resembles how they have felt in the last two weeks. Each response option is assigned a point value ranging from zero to three, where a higher value is associated with more severe depressive symptomatology. Total scores on the BDI-II range from 0 to 63 (Beck et al., 1996). The BDI, with its primarily cognitive framework for assessing depression, was developed with the intent of measuring changes in depression during the course of psychotherapy rather than as a screening tool for primary care physicians and other health professionals (Snaith, 1993).

Previous studies of the BDI in the elderly have produced mixed conclusions about its usefulness with this population. One study found that the BDI-II had good psychometric properties for research with older adults, but did not demonstrate sufficiently high validity or sensitivity for clinical application to this population (Segal,

Coolidge, Cahill, & O'Riley, 2008). Another study found that the multiple-choice format was confusing to older adults; many participants circled more than one response because the choices do not always appear to be mutually exclusive (Scogin, Beutler, Corbishley, & Hamblin, 1988). These studies evaluated the performance of the BDI in terms of its convergent validity with other measures of depression in adults, but not older adults, which was a methodological weakness in terms of the population under study. When the BDI was compared to the GDS, the GDS was found to have better simplicity and be easier for older adults to complete (Olin, Schneider, Eaton, & Zemansky, 1992).

The Hamilton Rating Scale for Depression (HRSD) was initially published as a measure for assessing depression in clinical research (Hamilton, 1969) and was revised in 1980, where its intended use as a research tool was reiterated (Hamilton, 1980). The HRSD consists of 17 items with either three or five multiple-choice responses, each of which is scored on a three or five point scale, depending on the item. Again, a higher point value is associated with higher levels of depression (Hamilton, 1980).

Although the HRSD has been used in both clinical and research settings, it was never designed for clinical use and has major weaknesses in this application (Bagby, Ryder, Schuller, & Marshall, 2004). The HRSD was initially designed to reflect changes in mood during antidepressant therapies, and therefore has a disproportionate number of items devoted to assessing insomnia (Bagby et al., 2004; Demyttenaere & De Fruyt, 2003). Although insomnia is a common complaint among older adults, the consensus has been that the HRSD is not ideal for clinical use in older adults (Gibbons, Clark, & Kupfer, 1993).

The Center for Epidemiological Studies Depression Scale—Revised (CESD-R), which was updated in 2004 to have improved psychometric properties for in-person, telephone, and self-administered applications (Eaton et al., 2004), is one of the most commonly used depression screeners for both clinical and research purposes (Nezu, Nezu, McClure, & Zwick, 2002). The CESD has good predictive value for a diagnosis of depression in the general population (Andresen, Malmgren, Carter, & Patrick, 1994; Radloff & Teri, 1986). Past research has indicated that the CESD is also promising for use in older adults (Radloff & Teri, 1986), but has several flaws for this application. Although the CESD is the only frequently used clinical screening tool that assesses both death ideation and suicidal ideation, it does not screen for loneliness or experiences of memory insufficiency and bradyphrenia that are very common complaints of depressed older adults.

Because older adults have unique experiences of depression and symptom profiles that are distinct from other age groups, it is important to have a depression screening tool that assesses depression in the elderly exclusively. The GDS is the only widely used screening tool that was developed with this population in mind. It is a 30-item yes/no questionnaire, where each item has a point value of zero or one, with a higher score associated with higher levels of depressive symptomatology. Respondents are asked to respond to each item based on their feelings in the past seven days (Yesavage, 1982). This instrument devotes seven items to assessing depressed mood. Four items relate to hopelessness and an additional four to perceived cognitive symptoms. Symptoms such as anergia, anhedonia, avolition, and irritability are also assessed with two items. The GDS does not contain any items that pertain to suicidal or

death ideation, loneliness, bradyphrenia, diminished sleep quality, or a variety of somatic difficulties endorsed by depressed older adults.

The GDS was developed using the DSM-III diagnostic criteria for depression (American Psychological Association, 1980). Although a short-form was developed (Sheikh & Yesavage, 1986), the most commonly used 30-item scale has not been revised since. This means that the GDS, the only depression measure designed for use in older adults, does not reflect the increased understanding of depression in this group that has come about in recent decades. Like its lengthier predecessor, the GDS-15 was developed using earlier diagnostic criteria and contains 15 of the original 30 items (Sheikh & Yesavage, 1986). The GDS-15 has been validated in a number of settings, including general geriatric inpatients (Lesher & Barryhill, 1994). It has further been validated for use among older adults greater than 85 years of age (de Craen, Heeren, & Gussekloo, 2003) and with Parkinson's disease patients (Meara, Mithelmore & Hobson, 1999). The GDS-15 has been shown to have positive predictive validity of 82 percent and a negative predictive validity of 83 percent, suggesting that approximately one in five respondents are misdiagnosed by this measure (Almeida & Almeida, 1999). Furthermore, like the original GDS, the short form does not contain any items assessing loneliness, death ideation, or suicidality.

The GDS has specifically and deliberately limited the number of items querying somatic symptoms and perceived neurocognitive function based on the theoretical assumption that such items would lead to over-diagnosis of depression in a population that has high rates of cognitive problems and medical disease (Montorio & Izal, 1996). Such a precaution, however, is not necessary. Mental health professionals and other

healthcare providers have been shown to make reliable and accurate judgments about the etiology of depressive symptoms. Average agreement between raters about the etiology of symptoms (medical or psychological) has been shown to exceed 80 percent (Koenig, Pappas, Holsinger, & Bachar, 1995).

As previously noted, these very somatic and neurocognitive symptoms are some of the most common symptoms of depression in the elderly, particularly diminished processing speed, psychomotor slowing, and sleep disturbance. This means that use of the GDS alone may result in a high rate of false negatives (Sharp & Lipsky, 2002). For an initial screening measure, it is preferable to risk false positives by assessing perceived neurocognitive dysfunction and sleep dysfunction rather than risk missing the diagnosis altogether, which is currently all too common.

A study of the psychometric properties of the GDS in institutionalized elderly individuals found that the measure was reliable, but yielded a high rate of false negatives when depression was not severe. This means that the GDS is sufficiently sensitive to identify severely depressed mood, but has a large probability of failing to identify mild or moderate depression. The false negative rate was similar across levels of neurodegenerative cognitive impairment and length of residence in the skilled nursing facility (Parmelee, Powell, & Katz, 1989).

Although the GDS has been repeatedly been validated for use in the elderly in a variety of settings (e.g., Debruyne et al., 2009; Pocinho, Farate, Dias, Lee, Yesavage, 2009), it has been shown to be no more effective than a single item depression screener such as: “Are you feeling depressed?” Responses to such a screener were strongly correlated to GDS scores and could be fairly well substituted for the GDS (McCormack,

Boldy, Lewin, & McCormack, 2011), most likely reflective of the high proportion of GDS items devoted to assessing depressed mood.

As has been previously discussed at length, older adults do not frequently describe themselves as depressed, even when they have depressed mood (Gallo & Rabins, 1999). Thus it is highly likely that simply asking older adults if they are depressed will yield an unacceptably high rate of false negatives, putting patients at significant risk. If the GDS is comparably as effective as asking a single screening question, there is need for a new measure to assess geriatric depression.

Despite its prevalence, the GDS is not viewed favorably by healthcare providers overall. In a study of nurses' and doctors' perceptions of the GDS, only 10 percent felt that it was appropriate for routine use, citing its tendency to inhibit rapport. They also noted that patients frequently responded negatively to the dichotomous yes/no format of the measure, though this format was widely believed to make the instrument less confusing for older adults (Hammond, 2004).

The Need for a New Measure

Older adults are at significant risk of late onset depression due to medical concerns, loss of loved ones, and existential issues. In this population, depression has been associated with mortality, poor health outcomes, and suicide at a high rate. Because older adults experience and describe depression differently than younger cohorts, they require their own tailored measures for assessing depressive symptomatology.

The GDS, although previously found to be useful in the evaluation of depression in older adults, is beset by several critical problems. First and foremost, the measure does

not reflect the current body of literature on the presentation of depression in the elderly because it fails to include a sufficient number of somatic symptom items and has no items assessing suicidality, death ideation, loneliness, or psychomotor slowing. Additionally, the GDS has been shown to have a relatively high rate of false negatives, a significant flaw in an initial screening measure, where it would be preferable to rule out some false positives with a clinical interview rather than miss depression cases entirely. Furthermore the GDS does not assess bereavement, which is no longer an exclusionary criterion for major depression in the DSM-5 (American Psychiatric Association, 2013). Although only designed for use as a screening measure, the GDS asks specifically about changes that have occurred in the past week, causing some patients to respond negatively because that change occurred prior to the preceding week (e.g., "Have you dropped many of your activities and interests [in the last week including today]?"). For the aforementioned reasons, a new, updated geriatric depression screening measure is necessary.

A new screening measure would require validation research before clinical implementation. A new measure must be shown to have construct validity in that it should demonstrably be a valid measure of the construct of depression (Cronbach & Meehl, 1955; Nunnally & Bernstein, 1994). In order to be deemed valid, the measure should initially demonstrate content validity (an adequate sampling of symptoms of geriatric depression). To this end, specific items on the measure should directly pertain to recent scientific findings about symptoms of geriatric depression (Nunnally & Bernstein, 1994). The new measure should furthermore be shown to have concurrent and convergent validity via significant correlations with previously validated measures of

geriatric depression administered at the same time (McIntire & Miller, 2005). Finally, the measure will need to have good predictive validity. In the case of a depression screening measure, relatively high scores should be predictive of a subsequent depression diagnosis or consistent with an existing, symptomatic depression diagnosis.

Hypotheses

The first hypothesis is that factor analysis and subsequent item deletion will produce a brief and usable questionnaire that addresses depression constructs related specifically to depression in the elderly. The second hypothesis is that the Thorndyke Geriatric Depression Inventory (TGDI) will be an internally consistent and reliable measure of depression. The third hypothesis is that TGDI scores will have a positive relationship with GDS scores and a non-significant relationship to measures of cognitive function, preliminarily demonstrating convergent and divergent validity, respectively.

Specific Aim One

According to the first hypothesis, factor analysis of TGDI responses will indicate a reduced number of constructs related to depression (e.g., hopelessness or suicidality). These factors will all have a significant correlation with one another, suggesting that the inventory represents a single higher order factor of depression.

Specific Aim Two

Cronbach's alpha will be used to evaluate the internal consistency of the final inventory, which will exceed .70, indicating that it is sufficiently reliable for use as a

screening instrument.

Specific Aim Three

The participant's scores on the TGDI will have a positive correlation with scores on the Geriatric Depression Scale (GDS), which is another measure of depression designed for use in the geriatric population. Because depression is often present as a co-morbid symptom of cognitive dysfunction in the elderly and is prodromal to some forms of dementia, the TGDI may have some correlation with the MMSE. However, it is hypothesized that the correlation between the TGDI and the MMSE will be non-significant or of lower magnitude than the correlation with between the TGDI and GDS. Individuals who endorse depression on the single-item questionnaire will have significantly higher scores on the TGDI.

Operational Definitions

Independent Variables

TGDI Score

Scores on the final version (after factor analysis and item deletion) of the measure ranged from zero to 40. Higher scores were indicative of greater depressive symptomatology. Scores on the finalized version of the measure were used to address specific aims two and three.

GDS Score

Scores will range from zero to 30 points. Higher scores are indicative of greater

depressive symptomatology.

MMSE Score

Scores range from zero to 30. Scores between 25 and 30 indicate relatively intact gross cognitive functioning, while scores of 24 and below indicate compromised or impaired gross cognitive functioning. Lower scores overall indicate lower levels of function.

CHAPTER TWO

METHODS

Participants

The primary aim of the current project was to refine and evaluate the new measure of the geriatric depression through factor analysis of TGDI response data and an evaluation of convergent and divergent validity. Data were collected from participants who were recruited from three locations. Of the 182 participants, 77 were recruited from the independent living community and skilled nursing units at the Hillcrest retirement community in La Verne, California. An additional 101 participants were recruited through inpatient and outpatient populations at Casa Colina Centers for Rehabilitation in Pomona, California. The remaining four participants were recruited from the geriatric inpatient psychiatric unit at the Loma Linda University Behavioral Medicine Center (BMC). Overall, 127 participants were recruited from patient populations at these sites, while 77 were recruited from a community (non-patient) population. Exclusionary criteria were delirium, intoxication, acute withdrawal, or any confusional state subsequent to traumatic brain injury. Participants were also required to be over the age of 65 and be able to communicate adequately in English for the purposes of the assessment in order to participate.

The sample consisted of 182 older adults over the age of 65. In total, 181 participants completed all items of the Thorndyke Geriatric Depression Inventory (TGDI), 100 completed the Mini Mental State Exam (MMSE), 180 completed the Geriatric Depression Scale (GDS), and 162 completed the single item depression questionnaire. These materials are described in detail below. Age was recorded for all

participants, and level of education was available for 180. Information regarding diagnosis of depression was available for 101 participants.

Participants ranged in age from 65 years old to 98 years old (M = 78.46, SD = 8.96). The sample consisted of more women (N = 106) than men (N = 76). A majority of the sample was Caucasian (N = 143), but also included African American (N = 20), Hispanic (N = 13), and Asian (N = 6) participants. The level of education ranged from 11 years (GED equivalent) to 20 years (doctoral equivalent). The mean level of education was 14.1 years (SD = 2.17 years).

Of the participants for whom information regarding current diagnosis of depression was collected, 53 did not have a current diagnosis of a depressive disorder and 48 had a current diagnosis of a depressive disorder.

Materials

Geriatric Depression Inventory (TGDI)

A preliminary version of the TGDI (Appendix 1) was created in preparation for data collection. This measure consisted of 26 items designed to assess eight constructs identified as the most salient features of geriatric depression in the literature (Table 1). Some items related to dysphoria, insomnia, and psychomotor slowing were adapted from the CES-D, which is not subject to copyright. One of the items related to hopelessness and avolition were adapted from the GDS, which is also not subject to copyright. Items assessing suicidality and death ideation were adapted from the Geriatric Suicidal Ideation Scale, which is also not subject to copyright. The remaining items were newly constructed for the purpose of this study.

Table 1 *Depression constructs with items per construct on the TGDI*

Depression construct	No. of items
Dysphoria	3
Insomnia	3
Cognitive dysfunction	4
Hopelessness	3
Bereavement	3
Loneliness/isolation	3
Suicidal/death ideation	4
Avolition	3

In the creation of this measure, specific steps were taken to maximize the usability of the questionnaire and minimize any difficulties or objections patients might have in completing it. The preliminary version of the TGDI was written with 26 items with the intent that several of these items would be eliminated based on relatively poor relationship to other items during factor analysis during the process of data analysis. Ideally, the final measure would contain approximately 18 items to ensure the measure remains simple and easy to understand. Individual items were kept deliberately brief to ensure the measure was short and easy to understand.

Although the GDS was designed with dichotomous yes/no responses to be easier for older adults to understand (Yesavage, 1982), this approach is often objectionable to patients who do not feel either of the choices accurately portray their personal experience and also results in a compressed range of total scores (Hammond, 2004). As a result, the TGDI was developed with three response options to increase the possible range of scores and permit respondents to select an intermediate or "sometimes" response in addition to the affirmative and negative responses. The TGDI, which is to be self-administered under the supervision of a health care professional, has an estimated administration time of 10 minutes.

Geriatric Depression Scale (GDS)

The GDS (Yesavage, 1982) consists of 30 dichotomous yes/no questions (Appendix 2). Respondents are asked to answer each question according to have they have felt in the past week. Although a short form is available (Sheikh & Yesavage, 1986), the original 30-item questionnaire is still the most commonly used and supported version of the measure (Debruyne et al., 2009). The original and most broadly used scoring criteria are: normal (zero to nine), mild depression (10 to 19), and severe depression (20 to 30). The estimated completion time for the GDS is 10 to 15 minutes. It is to be self-administered under the supervision of a health care professional. This measure has been shown to have a Cronbach's alpha of .92 and positive predictive validity of 83 percent (Ertan, Ertan, Kiziltan, & Uygucgil, 2005). In the current study, the Cronbach's alpha for the GDS was .85.

Mini-Mental State Exam

The MMSE (Appendix 3) is a broadly used screening measure designed to assess gross cognitive functioning and detect cognitive impairment in adults. The MMSE is a 30-point measure that briefly assesses orientation to time and place, immediate verbal memory and delayed recall, language (naming and repetition), and the ability to follow complex commands (Folstein et al., 1975). Higher scores indicate better cognitive functioning; generally scores of 25 to 30 indicate broadly intact functioning. Scores from 19 to 24 indicate mildly impaired cognition, while scores below 19 typically indicate significantly impaired cognitive function. Individuals who score below nine are typically unable to care for themselves, requiring constant supervision and assistance with all daily activities (Crum, Anthony, Bassett, & Folstein, 1993). Trained healthcare personnel with specialized training or certifications in a variety of healthcare fields, including physicians, psychologists, nurses, and supervised trainees in those fields are qualified to administer the MMSE, which requires approximately 10 minutes. The MMSE has been shown to have a Cronbach's alpha ranging from .54 to .96 with 75 percent positive predictive validity (Tombaugh & McIntyre, 1992).

Single-Item Depression Questionnaire

The single-item depression questionnaire was a single question designed for the purpose of this study to ask "Have you been feeling depressed lately?" Participants are asked to circle "yes" or "no." No validity data are available for this instrument, as it was developed for this study and is not an established measure.

Procedures

Because participants were recruited from a variety of settings, some variation in data collection procedures was necessary. Basic demographic data was collected via self-report, including age, sex, ethnicity, and number of years of education. Participants who were recruited from the BMC were recruited from new inpatient admissions. Consenting participants were reviewed for eligibility under the aforementioned criteria. The patients' medical records were then reviewed to confirm eligibility, gather data pertaining to current depressive symptoms and diagnosis during the present hospital stay, and determine if GDS and MMSE data were available for the present hospital stay. Individuals who were found to be eligible to participate in the study were then be asked to complete the TGDI, GDS, and MMSE, when the GDS and/or the MMSE were not already available in the patients' medical records from the current inpatient stay.

Some participants recruited at Casa Colina were recruited from new patient admits aged 65 years or older. The patients' medical records were reviewed to confirm eligibility, gather data pertaining to current depressive symptoms and diagnosis during the present hospital stay, and determine if GDS and MMSE data were available for the present hospital stay. Individuals who were found to be eligible were then asked to complete the TGDI, GDS, and MMSE, when the GDS and/or the MMSE were not already available in the patients' medical records from the current inpatient stay.

Other participants recruited at Casa Colina were recruited from the Senior Evaluation Program (SEP) in the outpatient neuropsychology service. SEP participants received a set battery of neuropsychological tests as part of an established research

protocol, which included the GDS and MMSE. They were asked to complete the TGDI as an addition to this existing research battery.

The remaining participants, who were recruited from the aforementioned residential retirement communities, participated in somewhat different data collection procedures. After consenting to participate, participants were asked to complete the TGDI and GDS. A randomly selected subset of these participants were asked to also complete the MMSE so that the correlation between the MMSE and the TGDI might be evaluated in a community sample as well as in a hospitalized sample.

Chart Review

The review of medical records was a critical component of data collection at hospital settings. Data collected from medical charts included MMSE records from the current hospital admissions, when available. MMSEs were typically administered by physicians and psychologists, and may have included psychiatrists, neurologists, and geriatricians that normally administer the MMSE as part of their patient assessments.

Diagnoses of depression were also collected from medical records; however, the validity of these depression diagnoses is not known. In some cases depression may be overlooked, or a diagnosis may be rendered without objective evidence or thorough assessment. Therefore, this information will not be used to establish actual diagnosis; however, these data will be used in exploratory analyses.

Analysis of Data

In order to initially address the first hypothesis, factor analysis was conducted on all TGDI responses for all participants. Parallel analysis was used to determine the number of factors to extract. In this procedure, the eigenvalues from 26 factors (equal to the number of items on the TGDI) were generated in SPSS using principle axis extraction, then compared to eigenvalues from analyses of multiple random data sets where the number of cases equals the number of study participants and where and the number of variables equals the number of items of the TGDI, as proposed by Horn (1965). The 95^{th} percentile of the random dataset eigenvalue distributions was used as the cutoff criterion to identify TGDI factor eigenvalues that exceeded random chance (Crawford et al., 2010). Syntax for SPSS developed by O'Connor (2000) was used to identify the random dataset eigenvalues. Factors with eigenvalues exceeding those found in random data were then identified as significant factors representing dimensions related to the overall construct of depression. The correlation between these factors was evaluated. Significant correlations indicated the presence of a higher order factor. Any item with loading onto the higher order factor at a level exceeding 0.300 was deemed significant. Any items that did not have sufficiently high loadings onto the higher order factor were deleted from the inventory and were not used for subsequent analyses. Because 22 items loaded saliently on this higher order factor, it was necessary to delete two additional items in order to produce a final measure that met the goals for brevity and usability in this instrument. The items with the lowest factors loadings on the higher factor were deleted, but deletions were not performed that would reduce the number of

items for any construct to less than two. The length of the final measure was 20 items. This finalized measure was used for all subsequent analyses.

The second hypothesis was addressed by evaluating the reliability of the measure using Cronbach's alpha (Cronbach, 1951) as a measure of internal consistency. Due to the relatively short nature of the inventory and intentional inclusion of multiple types of depressive symptoms in the scale, any alpha exceeding .70, was deemed adequately reliable for use as a depression screening measure (Tavakol & Dennick, 2011).

To address the third hypothesis, TGDI scores for all participants were correlated with GDS scores to evaluate convergent validity. A significant positive correlation was indicative of convergent validity between these two measures. The TGDI was then correlated with scores on the MMSE for all participants where data from both measures were available. A small or statistically non-significant correlation between the MMSE and the TGDI indicated divergent validity. An independent samples *t*-test was used to evaluate if individuals who endorsed depression on the single-item questionnaire had significantly different TGDI scores from those who did not.

CHAPTER THREE

RESULTS

Table 2. *Descriptive statistics for independent variables.*

Variable	N	Descriptives Mean	Std. Dev.	Min	Max
MMSE Score	100	27.51	2.70	22	30
GDS Total Score	181	10.59	7.19	0	29
TGDI (Preliminary version)	182	17.67	11.79	0	49
TDGI (22 item version)	182	14.23	14.23	0	42
TDGI (20-item version)	182	13.35	10.13	0	38
TGDI (final version)	182	10.73	8.01	0	30

Hypothesis One

In order to conduct exploratory factor analysis to address the first hypothesis, first an *r*-matrix was generated using data from 181 cases to examine intercorrelations between the items in the TGDI and to detect possible multicollinearity in TGDI data (Table 2). A review of this correlation matrix indicated that all variables had at least one significant correlation to at least one another variable. Although several items correlated with other items at a high level, no two variables were correlated at a level greater than 0.9, meaning there were no observed occurrences of multicollinearity.

These findings suggested that there might be latent variables in TGDI item response data. The Kaiser-Meyer-Olkin measure of sampling adequacy was .75,

indicating an adequate sample for factor analysis. The assumption that the correlation matrix was not an identity matrix was met, $\chi^2(253) = 4095.10$, $p < .00$.

Parallel analysis revealed that the eigenvalues for the first three factors extracted from observed data exceeded the 95th percentile of eigenvalues from the randomly generated data (Table 3), suggesting that there were three significant factors and supporting the first hypothesis (Figure 1). Therefore, three factors were extracted by principle axis extraction with Promax rotation. Thirteen of the TGDI items had salient loadings or cross-loadings on the first extracted factor, the second factor had 10 salient loadings and cross-loadings, while the third factor had 10 salient loadings and cross-loadings (Table 4).

The average of the absolute values of the correlations between the three extracted factors was .302, suggesting that there was substantial co-variation across the three factors, which are also theoretically related. A single factor was therefore extracted by principle axis extraction. All but four of the TGDI items had loadings on this higher order factor that exceeded .300 (Table 5). Those items below this cutoff were subsequently deleted, as they were not sufficiently associated with the overall measure construct. After this deletion, 22 of the original 26 items remained. Because the measure was intended to be brief in order to be clinically practical, two more items were deleted to meet this goal. Items 16 and 24 were deleted because these items had the lowest loadings, and would not, after deletion, reduce the number of items associated with each depression construct (Table 1) below the minimum required two items, making the length 20 items.

Table 3. *Intercorrelations of Thorndyke Geriatric Depression Inventory item responses (R-matrix).*

	Item																								
Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	--	.26*	.39*	.23*	.55*	-.10	.10	.23*	-.22	.14	.34*	.08	.44*	.35*	-.14	-.17*	.16*	.46*	.30*	-.30*	.05	-.17	.39*	.23*	.08	.30*
2		--	.25*	.47*	.53*	.25*	.29*	.66*	-.03	.69*	.32*	.50*	.45*	.35*	.24*	.20*	.68*	.64*	.40*	.03	.04	.41*	.58*	.34*	.26*	.69*
3			--	.01	.14	-.04	.28*	.25*	-.11	.18*	.21*	.16*	.79*	.31*	-.05	-.15*	.12	.57*	.02	-.15	.39*	-.21	.39*	.06	.10	.08
4				--	.41*	.40*	.28*	.63*	-.03	.59*	.64*	.54*	.40*	.35*	.34*	.37*	.67*	.34*	.54*	.06	-.06	.31*	.37*	.45*	.33*	.45*
5					--	.01	.04	.48*	-.31	.52*	.44*	.28*	.44*	.31*	.13	-.02	.56*	.41*	.29*	-.23*	-.11	.20*	.46*	.28*	.03	.64*
6						--	.36*	.28*	.58*	.37*	.25*	.69*	.64*	.32*	.69*	.82*	.35*	.28*	.32*	.70*	.39*	.58*	.26*	.35*	.82*	.20*
7							--	.39*	.39	.44*	.40*	.49*	.27*	.24*	.33*	.17*	.35*	.56*	.33*	.46*	.16*	-.03	.45*	.35*	.33*	.22*
8								--	.04	.83*	.54*	.63*	.36*	.16*	.39*	.26*	.82*	.50*	.40*	.11	-.01	.44*	.36*	.34*	.34*	.56*
9									--	.06	.10	.40*	.73*	.53*	.66*	.56*	.01	-.02	.12	.87	.49*	.43*	-.11	.12	.59*	-.23*
10										--	.49*	.68*	-.03	.09	.43*	.29*	.80*	.54*	.40*	.25*	.03	.43*	.32*	.43*	.38*	,57*
11											--	.66	.72	.31*	.49*	.12	.58*	.44*	.56*	.12	.09	.05	.34*	.26*	.22*	.38*
12												--	.35*	.46*	.79*	.50*	.69*	.52*	44*	.87*	.40*	.49*	.37*	.38*	.60*	.46*
13													--	.558	.20*	.24*	.71*	.66*	.39*	.25*	.08	.40*	.57*	.10	.28*	.68*
14														--	.45*	.19*	.45*	.37*	.14	.12	.36*	.33*	.32*	.17*	.29*	.32*
15															--	.54*	.49*	.20*	.19*	.54*	.37*	.60*	.13	.45*	.58*	.12
16																--	.29*	.04	.35*	.05	-.04	.65*	.06	.38*	.82*	.13
17																	--	.46*	.44	.15*	.29*	.51*	.37*	.26*	.30*	.62*
18																		--	.35*	.68*	.28*	.03	.75*	.57*	.29*	.57*
19																			--	.62*	.03	.18*	.35*	.22*	.28*	.46*
20																				--	.41*	.53*	-.05	.18*	.65*	-.07
21																					--	.24*	.16*	.15*	.46*	.09

* Correlation significant at the 0.05 level.

Table 3 Continued

	Item				
Item	22	23	24	25	26
22	--	.10	.15*	.53*	.27*
23		--	.29*	.13	.48*
24			--	.36*	.43*
25				--	.04
26					--

* Correlation significant at the 0.05 level.

Table 4. *Initial eigenvalues from observed data with the 95th percentile of eigenvalues generated from randomly observed data.*

Factor	Eigenvalues	
	Observed Data	Random Data (95th %ile)
1	9.81	1.9
2	4.78	1.73
3	2.22	1.63
4	1.49	1.54
5	1.34	1.47
6	1.2	1.4
7	0.78	1.33
8	0.68	1.27
9	0.65	1.22
10	0.5	1.16
11	0.47	1.12
12	0.38	1.07
13	0.3	1.02
14	0.24	0.98
15	0.21	0.93
16	0.19	0.88
17	0.15	0.84
18	0.13	0.8
19	0.1	0.77
20	0.09	0.73
21	0.08	0.67
22	0.06	0.65
23	0.05	0.61
24	0.03	0.57
25	0.02	0.52
26	0.01	0.47

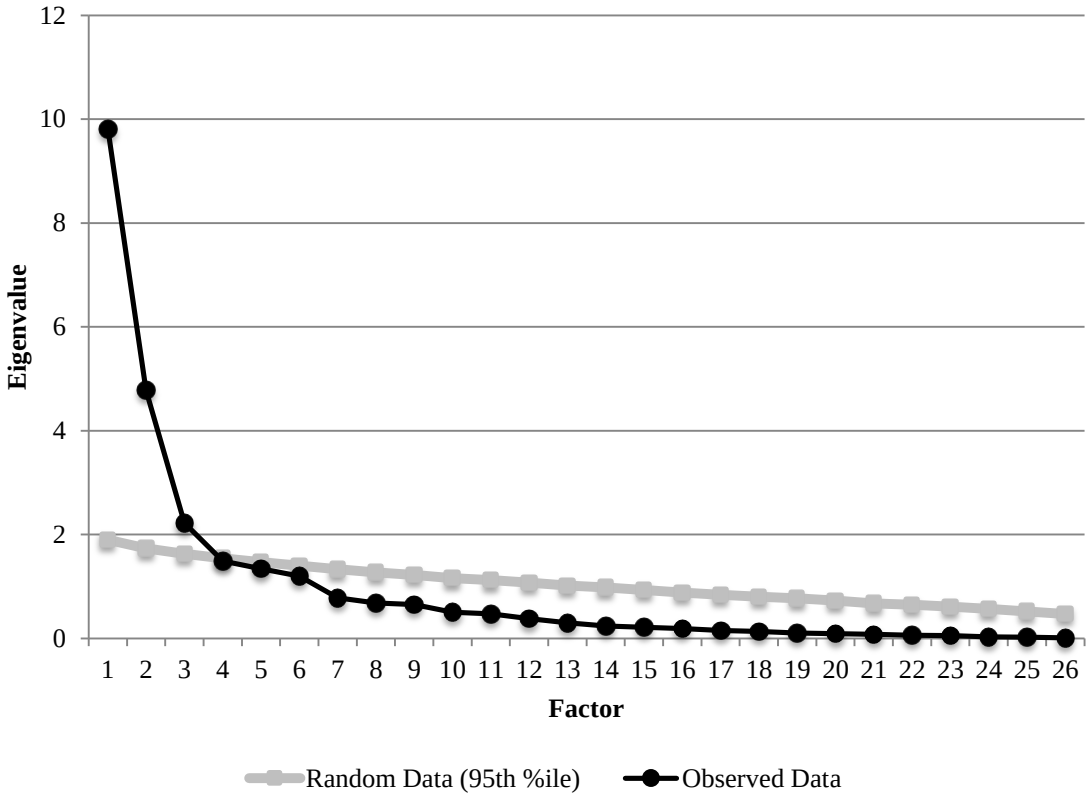

Figure 1. Observed-data eigenvalues for all thirteen extracted factors to the 95th percentile plotted with eigenvalues from randomly generated data.

Table 5. *Rotated item (with construct measured) loading matrix for significant extracted factors with amount of variance explained per factor.*

	Factor		
TGDI Item	1	2	3
1. I haven't been sleeping well.	.248	-.304	**.481***
2. I've been less interested in my usual activities.	**.737***	-.044	.142
3. My thinking is slower than usual.	-.117	-.086	**.799***
4. I've considered ending my life.	**.738***	.078	-.104
5 I've had more trouble sleeping than I used to.	**.750***	-.341	.078
6. I've been grieving over someone I lost.	.142	**.821***	-.012
7. I've felt like I've had nobody to talk to.	.114	**.338***	**.401***
8. I've been feeling sad.	**.845***	.048	.001
9. I've felt left out.	-.337	**.916***	.030
10. I've been feeling unhappy.	**.828***	.121	-.038
11. I don't have many reasons to go on in life.	**.494***	.104	.202
12. I don't feel hopeful about the future.	**.466***	**.567***	.157
13. I've had less motivation than usual.	**.729***	-.056	.263
14. My thinking has been foggy.	.284	.181	**.304***
15. I've been thinking that things aren't going to get better for me.	.189	**.751***	-.037
16. I'm having trouble accepting the death of a loved one.	.173	**.764***	-.214
17. I can't seem to stop feeling sad.	**.973***	.054	-.151
18. It has been hard for me to focus.	.300	.018	**.743***
19. I've felt life isn't worth living.	**.502***	.126	.050
20. There isn't anyone I can turn to.	-.167	**.938***	-.063
21. I've had trouble remembering things	.380	**.590***	**.493***
22. I've given up trying to get things done.	**.430***	**.525***	-.361
23. I can't seem to get to sleep at night.	.353	-.054	**.533***
24. I think things would be better if I were dead.	**.396***	.188	.057
25. I have felt a sense of loss.	.061	**.783***	.104
26. I haven't wanted to try anything new.	**.819***	-.203	.006
Variance Explained (%)	36.37	17.14	6.98
Cumulative Variance Expl. (%)	36.36	53.51	60.49

***** Salient (exceeds 0.3) variable loading.

Table 6. *Variable loadings for the higher order factor.*

TGDI Item	Factor Loading
1. I haven't been sleeping well. (Insomnia)	.278
2. I've been less interested in my usual activities. (Avolition)	**.719**
3. My thinking is slower than usual. (Concentration)	.238
4. I've considered ending my life. (Suicidality)	**.674**
5. I've had more trouble sleeping than I used to. (Insomnia)	**.503**
6. I've been grieving over someone I lost. (Bereavement)	**.617**
7. I've felt like I've had nobody to talk to. (Loneliness)	**.521**
8. I've been feeling sad. (Dysphoria)	**.806**
9. I've felt left out. (Loneliness)	.262
10. I've been feeling unhappy. (Dysphoria)	**.818**
11.I don't have many reasons to go on in life. (Suicidality)	**.628**
12. I don't feel hopeful about the future. (Hopelessness)	**.866**
13. I've had less motivation than usual. (Avolition)	**.764**
14. My thinking has been foggy. (Concentration)	**.532**
15. I've been thinking that things aren't going to get better for me. (Hopelessness)	**.609**
16. I'm having trouble accepting the death of a loved one. (Bereavement)	**.508**
17. I can't seem top stop feeling sad. (Dysphoria)	**.841**
18. It has been hard for me to focus. (Concentration)	**.646**
19. I've felt life isn't worth living. (Suicidality)	**.570**
20. There isn't anyone I can turn to. (Loneliness)	**.377**
21. I've had trouble remembering things. (Concentration)	.264
22. I've given up trying to get things done. (Hopelessness)	**.524**
23. I can't seem to get to sleep at night. (Insomnia)	**.556**
24. I think things would be better if I were dead. (Suicidality)	**.515**
25. I have felt a sense of loss. (Bereavement)	**.583**
26. I haven't wanted to try anything new. (Avolition)	**.618**

Note. Salient (exceeds 0.3) variable loadings in bold.

Hypothesis Two

The hypothesis that the measure, subsequent to item deletion, would have a Cronbach's alpha that exceeded .70 was confirmed (α = .83), indicating that the TGDI is sufficiently reliable for use as a screening instrument. Projected Cronbach's alpha-if-item-deleted values were also analyzed. Although deleting further items at this point resulted in a small reduction in Cronbach's alpha, brevity of the final instrument was prioritized over maximal internal consistency. Based on the Cronbach's alpha-if-item-deleted values, a further four items were deleted such that the total length of the measure was reduced to 16 items, with two items retained for each sub-construct so that content validity was maintained. Items selected for deletion had the highest Cronbach's alpha-if-item-deleted values (Table 6). Overall, this resulted in a reduction in Cronbach's alpha from .83 to the final level of .80; the second hypothesis is still supported at this level. In the community sample group, the Cronbach's alpha for the final 16-item scale was .79. In the patient sample group, the Cronbach's alpha for the final 16-item scale was .78. Further item deletion would have negatively impacted content validity by reducing the number of items and would have further reduced internal consistency (Table 7).

Table 7. *Cronbach's alpha-if-item-deleted values and item-total correlation for TGDI items before final item deletion.*

TGDI Item	Item-total correlation	Cronbach's alpha if item deleted
2. I've been less interested in my usual activities. (Avolition)	.656	.825
4. I've considered ending my life. (Suicidality)	.601	.828
5. I've had more trouble sleeping than I used to. (Insomnia)	.434	.830
6. I've been grieving over someone I lost. (Bereavement)	.534	.828
7. I've felt like I've had nobody to talk to. (Loneliness)	.443	.829
8. I've been feeling sad. (Dysphoria)	.735	.796
10. I've been feeling unhappy. (Dysphoria)	.751	.818
11.I don't have many reasons to go on in life. (Suicidality)	.55	.828
12. I don't feel hopeful about the future. (Hopelessness)	.796	.813
13. I've had less motivation than usual. (Avolition)	.700	.825
14. My thinking has been foggy. (Concentration)	.693	.829
15. I've been thinking that things aren't going to get better for me. (Hopelessness)	.461	.828*
17. I can't seem top stop feeling sad. (Dysphoria)	.547	.823*
18. It has been hard for me to focus. (Concentration)	.569	.827
19. I've felt life isn't worth living. (Suicidality)	.475	.829*
20. There isn't anyone I can turn to. (Loneliness)	.289	.830
22. I've given up trying to get things done. (Hopelessness)	.465	.810
23. I can't seem to get to sleep at night. (Insomnia)	.482	.819
25. I have felt a sense of loss. (Bereavement)	.481	.829
26. I haven't wanted to try anything new. (Avolition)	.553	.828*

* Items to be deleted for final version.

Table 8. *Cronbach's alpha-if-item-deleted values and item-total correlation for the final TGDI.*

TGDI Item	Item-total correlation	Cronbach's alpha if item deleted
2. I've been less interested in my usual activities. (Avolition)	.631	.792
4. I've considered ending my life. (Suicidality)	.565	.796
5. I've had more trouble sleeping than I used to. (Insomnia)	.387	.800
6. I've been grieving over someone I lost. (Bereavement)	.525	.796
7. I've felt like I've had nobody to talk to. (Loneliness)	.444	.798
8. I've been feeling sad. (Dysphoria)	.701	.789
10. I've been feeling unhappy. (Dysphoria)	.718	.789
11.I don't have many reasons to go on in life. (Suicidality)	.498	.796
12. I don't feel hopeful about the future. (Hopelessness)	.771	.788
13. I've had less motivation than usual. (Avolition)	.680	.790
14. My thinking has been foggy. (Concentration)	.449	.798
18. It has been hard for me to focus. (Concentration)	.580	.794
20. There isn't anyone I can turn to. (Loneliness)	.378	.804
22. I've given up trying to get things done. (Hopelessness)	.432	.799
23. I can't seem to get to sleep at night. (Insomnia)	.481	.797
25. I have felt a sense of loss. (Bereavement)	.496	.796

Hypothesis Three

The third hypothesis was supported overall, indicating expected convergent and divergent validity with other measures of depression and cognition. Specifically, a significant positive correlation was found between the final TGDI measure and the GDS, $r(181) = .72$, $p < .01$, confirming the first portion of the third hypothesis. There was a not a significant correlation between MMSE scores and the final TGDI measure, which also supported the third hypothesis, $r(99) = -.048$, $p > .05$. There was a significant effect for the single-item depression questionnaire, where those who endorsed depression on the single-item questionnaire had significantly higher TGDI scores, $t(160) = -9.77$ $p = < .01$, $d = -1.55$. One of the two items assessing the sub-construct of concentration was found to be significantly correlated to MMSE total score (Item 14) where $r(100) = -.234$, $p < .05$. The other item assessing the sub-construct of concentration (Item 18) was not found to be significantly correlated to MMSE total score, $r(100) = -.173$, $p > .05$.

CHAPTER FOUR

DISCUSSION

The goal of this study was to design a depression screening measure for clinical use with adults over 65 years of age that would be brief, reliable, and more accurately assesses depression symptoms that are known to be prevalent in older adults. The intent was to improve upon existing measures to create an instrument that could be quickly administered by a range of health professionals as an initial depression screen, allowing the rapid identification of depressive symptomatology and related critical factors, such as suicidality.

Detection of depression in the geriatric population is a major public health concern. In addition to depression that may be recurrent from earlier in life, older adults are frequently confronted with a host of chronic illnesses and psychosocial stressors that differ from their younger counterparts (Chapman & Perry, 2008). Depression is also known to be related to several neurodegenerative and neurological disease processes, including cerebrovascular disease, Parkinson's disease, and Alzheimer's disease (Ehrt et al, 2006; Hickie et al., 2001; Olin et al., 2002). The neurological changes and stressors associated with depression in this population are chronic in nature; depression in older adults similarly tends to be chronic (Chapman & Perry, 2008; Koenig et al., 1997). Chronic depression in this group is associated with numerous negative outcomes, including poorer medical treatment outcomes, increased healthcare costs, and mortality (Byers et al., 2012; Chapman & Perry, 2008). Early detection and treatment of depression, therefore, is likely to reduce the risk of health these outcomes.

Although numerous self-report measures of depression exist, only the GDS was developed specifically for use with the geriatric population (Yesavage, 1982). Although intended to measure the specific construct of geriatric depression, the GDS has several shortcomings that make an updated screening measure essential. The three-decade-old GDS was developed using the DSM-III diagnostic criteria for depression (American Psychological Association, 1980). It further fails to assess loneliness, death ideation, or suicidality, all of which characterize the presentation of depression in older adults (Barg et al., 2006; Bartels et al., 2002). Most significantly, somatic and neurocognitive symptoms of depression were deliberately excluded from the GDS. These symptoms are common in geriatric depression and the measure may therefore result in a high rate of false negatives (Parmelee et al., 1989; Sharp & Lipsky, 2002). Finally, the dichotomous yes/no format of the measure, although simple, has been objectionable to both patients and healthcare providers (Hammond, 2004).

The current study resulted an updated screening measure for depression in the geriatric population. An initial 26-item measure was developed; some items were adapted from public domain sources such as the CES-D. Other items were adapted from construct specific questionnaires such as the Geriatric Suicidal Ideation Scale. These 26 items were designed to capture eight relevant depression constructs in older adults, based on a comprehensive review of the existing literature. An analysis of participant responses was used to arrive at a shorter, finalized version of the TGDI for use in future validation research. Preliminary issues of convergent and divergent validity were also addressed.

The first hypothesis, that exploratory factor analysis would indicate a reduced number of factors, was confirmed; three significant factors were extracted, as was a

single higher-order factor. An interesting and useful factor structure was identified in the TGDI response data as a result of the factor analysis.

The first of the three extracted factors had salient variable loadings from 12 of the TGDI items, primarily items addressing the constructs of suicidality, avolition, and dysphoria, indicating that those items had the strongest relationship to this factor. This factor accounted for 36.37 percent of TGDI response variance. Individual items designed to address the constructs of hopelessness and insomnia also had salient loadings on the first factor. Predominantly the items that had salient loadings on the first factor pertained to these dysphoric symptoms of depression. Due to the strong relationship of items pertaining to depressed mood, sadness, and suicidality, this first factor may represent a construct of Dysphoria within the TGDI. The relatively large amount of variance accounted for by this factor is consistent with how people experience depression in general, considering that depressed mood is the core feature of depression and is the most commonly endorsed symptom in all populations, despite the fact that this feeling is somewhat less commonly endorsed by older adults than younger adults (Gallo et al., 2004).

Items addressing depressed mood, suicidality and avolition had the highest loadings on this first factor. Specifically, the highest item loadings were for items that addressed feelings of sadness directly. As a construct, suicidality was strongly associated with this first factor, indicating that those individuals who more strongly endorsed negative affective states more strongly endorsed both active and passive suicidal ideation.

One of the items assessing hopelessness had its highest loading on the first factor, and an additional two hopelessness items cross-loaded here. This finding is consistent

with existing literature, which suggests that hopelessness in older adults is strongly associated with rates of attempted and completed suicides (e.g. Brown et al, 2004). Broadly speaking, items that were strongly associated with this factor had to do with aversive mood states symptomatic of depression.

The second of the three extracted factors had salient variable loadings from seven TGDI items and accounted for 17.14 percent of the total variance in the TGDI response data. The items that loaded saliently on the second factor were items primarily associated with bereavement and loneliness. One additional item designed to assess hopelessness also cross-loaded onto this factor, but this item was not as highly associated with the second factor as the items related to bereavement and loneliness. Overall, items associated with loneliness were the ones most associated with this factor, followed closely by those intended to assess loneliness, and followed more distantly by a single item assessing hopelessness. Consequently, this second factor may represent Social Isolation in the TGDI response data.

The subconstructs of bereavement and loneliness are logically related as well. It is sensible that individuals who have recently sustained the loss of a loved one would feel comparatively isolated and be more acutely aware of their reduced social contacts as a result. One further item intended to assess hopelessness had its highest loading on the second factor. In the context of the other items that were associated with this factor, endorsement of feelings of hopelessness may be relatively realistic. For example, an individual coping with the death of a spouse or family member may be acutely aware during that time that they will never be able to have that particular relationship again, or may never remarry.

The remaining seven TGDI items loaded saliently on the third extracted factor, which explained a total of 6.98 percent of the variance in TGDI data. These items included the three items assessing reduced concentration, the three items assessing insomnia, and one item assessing loneliness, which was cross-loaded onto this factor and the second factor. The items assessing for reduced attention and concentration were very strongly associated with this factor, while items assessing insomnia were only moderately associated.

It should be noted that the inclusion of items assessing insomnia and cognitive factors was an area of concern during the initial development of the TGDI. These items were eventually included in the initial version of the measure because the literature indicates a relationship to depression in older adults (Gibbons et al., 1993; Ownby et al., 2006). Initially, the bidirectional nature of the causal relationship between depression and reduced (Lopez et al., 2003) was considered a possible threat to the validity of the study. The concern was that the TGDI would be strongly associated with cognitive decline not necessarily within the context of depression. This factor indicates that these items do, in fact, account for less than seven percent of the variance in the TGDI data, so the contribution to an individual's overall score on the TGDI is not likely attributable to their endorsement of cognitive changes in the domain of attention and concentration.

Both poor concentration and insomnia are often classified as vegetative symptoms of depression, whereas the constructs assessed by items loading on the other factors are not. Although without the inclusion of all three items assessing insomnia, this construct would have been most consistent with changes to cognition, taken together this set of items appears to represent the factor of Vegetative Symptoms.

There were no items that did not have a salient loading on at least one of the three factors, and thus no items were subject to deletion at this stage, leaving the original measure of 26 items unchanged after initial factor extraction. A review of degree to which each of these factors was correlated with another indicated that single, higher-order factor within the TGDI response data was probably present based on a positive correlation between the three extracted factors as well as a theoretical relationship between the factors that had been identified. When this single factor was extracted, 22 of the 26 items had salient loadings on this higher factor (Table 5). The fact that a large proportion of the TGDI items loaded onto a higher order factor signifies that these items are strongly related and can be interpreted as representing one overarching construct, which is identified as Geriatric Depression.

Because these items with low loadings on the higher order factor were not strongly associated with this factor, and because the measure was designed to be administered and interpreted as a single unified instrument with one total score, these four items were deleted from the measure. The deleted items included one item designed to assess insomnia and loneliness and two items assessing reduced concentration. After deletion, all of the depression constructs originally included on the measure had either two or three items intended to assess each symptom domain.

The goal for this study was to develop a measure that was concise and psychometrically sound. In order to ensure that the measure was sufficiently brief to minimize the time needed for completion and the burden on patients, an ideal length of 16 to 20 items for the final measure was identified, a length approximately consistent with that of other similar measures of depression, such as the BDI-II (Beck et al., 1996).

This meant that at least an additional two items needed deletion at this point in order to meet the maximum length requirement. One item assessing suicidality and another item assessing bereavement were deleted from the measure, each of which was relatively poorly associated with their respective factors. This step yielded a measure totaling 20 items in length that had either two or three items for each of the eight symptom constructs that comprise the measure.

The second hypothesis, that the finalized version of the measure would have internal consistency, as measured by a Cronbach's alpha exceeding .70, was supported. The measured Cronbach's alpha of the 20-item measure was .83, meaning that the measure has sufficient internal consistency for use as a screening measure. This level of internal consistency is comparable to other measures of depression. For example, the Cronbach's alpha of the GDS has been measured as high as .92 (Ertan et al., 2005). A meta-analysis has shown the BDI-II to have a Cronbach's alpha of .88 in psychiatric samples and .82 in non-psychiatric samples (Richter, Werner, Heerlein, Kraus, & Sauer, 1998).

An examination of hypothetical Cronbach's alpha-if-item-deleted values indicated that deleting any further items from the measure would result in a reduced Cronbach's alpha; however, several items were found to have a minimal impact on alpha in the event of their deletion. The decision to maximize the usability of the measure through a reduction in total length made was made at the expense of a small reduction of Cronbach's alpha. Because several symptom symptom domains retained three items each at this point (avolition, suicidality, dysphoria, and hopelessness), the item whose deletion would least impact the internal consistency of the measure from each of these sub-

constructs was deleted to bring the total length of the measure to 16 items. Even though internal consistency was not fully maximized, it is still at a level that is more than sufficient for use as a screening tool ($\alpha = .80$). Although the final Cronbach's alpha level is slightly lower than that observed in other depression measures as noted above and the Cronbach's alpha of the GDS in the current study (.85), the TGDI assesses a wider range of sub-constructs (depression symptoms) than does the GDS, which may make it less internally consistent. Thus some internal consistency is sacrificed in favor of greater content validity. The final length of the measure is consistent with another measure of depression increasing in popularity in younger adults, the Patient Health Questionnaire (PHQ-9), which is nine items long (Kroenke, Spitzer, & Williams, 2001).

The third hypothesis regarding convergent and divergent validity was supported overall. A strong, statistically significant positive correlation was found between scores on the TGDI and the GDS, which means that participant scores on the TGDI and GDS tended to covary; individuals with higher GDS scores tended to have higher TGDI scores, while individual with lower scores on the GDS also tended to have lower scores on the TGDI. The strength of the correlation ($r = 0.72$) indicates a strong relationship between these two scales. Although previous analysis in the current study has indicated a factor structure within the TGDI and a high level of correlation between each of the items, a strong positive correlation between the TGDI and the GDS is a preliminary indicator that the TDGI measures a similar construct to the GDS: depression in older adults. This finding demonstrates convergent validity for the TGDI.

The second portion of the third hypothesis was also confirmed. There was not a significant correlation between scores on a cognitive screening instrument (MMSE) and

scores on the TGDI. Although a very small negative correlation was observed, it was not approaching significance. This indicates that MMSE scores and GDS scores do not tend to co-vary; lower scores on the MMSE were not significantly associated with higher TGDI scores.

During the development of the GDS, items assessing cognitive symptoms of depression (e.g., poor concentration) were deliberately excluded because it was assumed this would confound scores on the measure overall (Yesavage, 1982). The findings of the current study, however, contradict this assumption. The TDGI has two items targeted at assessing reduced attention/concentration, and endorsement of symptoms on these items is not sufficient to distort the overall score on the TGDI. Only one of these two items was found to have a significant negative correlation to the MMSE Total Score; the other item also had a non-significant negative correlation. The lack of a significant negative correlation between the total MMSE score and the total TGDI score, however, demonstrates divergent validity for the TGDI by suggesting that the TGDI does not measure cognitive function overall. In the future, research related to the TGDI should endeavor to more thoroughly evaluate the correlation between TGDI scores and indices of cognitive function across functional cognitive domains, particularly attention/processing speed and memory.

The third portion of the third hypothesis was also confirmed. Those participants who self-reported depressed mood on the single-item questionnaire tended to have significantly higher scores on the TGDI than those who did not endorse depressed mood on the single-item questionnaire. This indicates that the TGDI, which is intended as a

face-valid measure of depression, does capture self-report of depressed mood. Overall, this finding supports initial validity testing of the TGDI.

The purpose of this study was to complete measure development and the initial steps for validation of a new geriatric screening measure that contains items that comprehensively assesses depression in older adults. Other goals were to create a measure that was sufficiently brief to be approachable and easy to use for both patients and healthcare providers to use, while assessing vital symptoms of depression in this population, particularly suicidality, hopelessness, bereavement and cognitive symptoms.

These goals were achieved overall; an initial pool of 26 items designed to assess eight symptoms shown in the literature to be associated with depression in the elderly was reduced to the 16 best-performing items that all loaded onto a higher order factor with high internal consistency. The resulting measure has a strong positive correlation with GDS scores, an existing measure of geriatric depression, but has several features absent in the GDS, including items assessing bereavement, sleep disturbance, cognition, and suicidality, demonstrating convergent validity. Divergent validity was demonstrated by no significant relationship to MMSE scores.

The inclusion of items inquiring about suicidal ideation can cue healthcare providers to ask follow-up questions about suicidal ideation or intent during clinical care and can serve as an additional data point in a comprehensive suicide risk assessment. Several other items included on the final TGDI also cue the need for further clinical follow up, including sleep disturbance and cognitive change, both of which are associate with depression as well as other conditions that severely impact health outcomes in the elderly.

The final version of the TGDI also has a larger range of responses for each item than the GDS, which is limited to only yes/no responding. The TGDI had an added "some of the time" response, which permits respondents to select a response more closely matching their symptoms as well as provide a greater total score range. A large proportion of participants availed themselves of the opportunity to select a "some of the time" response," although this often was generally not endorsed with greater frequency that the other two response options (Table 8).

Table 9. *Frequency of symptom endorsement level for each item of the TGDI.*

Item	Never	Some of the Time	Most of the Time
2. I've been less interested in my usual activities. (Avolition)	37.9	34.1	28.0
4. I've considered ending my life. (Suicidality)	74.0	23.2	2.8
5. I've had more trouble sleeping than I used to. (Insomnia)	36.3	33.0	30.8
6. I've been grieving over someone I lost. (Bereavement)	52.7	20.9	26.4
7. I've felt like I've had nobody to talk to. (Loneliness)	74.2	17.0	8.8
8. I've been feeling sad. (Dysphoria)	53.3	21.4	25.3
10. I've been feeling unhappy. (Dysphoria)	58.8	18.1	23.1
11.I don't have many reasons to go on in life. (Suicidality)	78.6	6.0	15.4
12. I don't feel hopeful about the future. (Hopelessness)	49.5	37.9	12.6
13. I've had less motivation than usual. (Avolition)	38.5	34.1	27.5
14. My thinking has been foggy. (Concentration)	30.8	56.6	12.6
18. It has been hard for me to focus. (Concentration)	44.0	37.9	18.1
20. There isn't anyone I can turn to. (Loneliness)	75.3	4.9	19.8
22. I've given up trying to get things done. (Hopelessness)	56.0	18.7	25.3
23. I can't seem to get to sleep at night. (Insomnia)	50.0	30.8	19.2
25. I have felt a sense of loss. (Bereavement)	40.1	31.9	28.0

The current study has demonstrated that the TGDI has some of the types of validity necessary for clinical application. The TGDI has good content validity; items in this measure are representative of a range of depression symptoms that have been empirically demonstrated to be relevant to the most common presentations of geriatric depression. The high correlation with scores on the GDS, which was administered simultaneously, is an indicator that the TGDI has concurrent validity. Although it would be desirable for the TGDI to have a positive correlation with other measures of depression, the GDS was the most appropriate indicator of concurrent validity as it is the only other measure also intended specifically for use in older adults. The current study also showed that the TGDI has convergent and divergent validity with both the GDS and the MMSE, respectively, which is a preliminary indicator of construct validity.

Overall, the current study demonstrates that the finalized version of the TGDI has good potential for application in healthcare settings as a screening instrument, although limitations of the current study may affect the generalizability of the findings and further research is needed to demonstrate the validity of the instrument. A significant limitation of the current study was in the nature and size of the sample. Attempts were made in the design of the study to include psychiatric inpatients, non-psychiatric inpatients and outpatients, and non-patient/community participants. The bulk of the participants, however, consisted of non-psychiatric patients who were medically ill and non-patient participants. Relatively few psychiatric patients, either inpatient or outpatient, participated in this study. The performance of the TGDI in these very important groups is therefore unknown. A larger sample that included these groups would have been ideal

and would have provided more comprehensive and robust measurement of the performance of the TDGI.

Other aspects of the sample composition limit the generalizability of the study. Many participants were recruited from a private hospital and a private senior-living community in the same geographic region and the majority of them were Caucasian and relatively well educated. Although data pertaining to socioeconomic status were not gathered, these participants most likely under-represent individuals from low socioeconomic groups. It is therefore not known how other groups would approach the TGDI and if their response would yield the same factor structure. In future research, recruiting participants from sites such as Veterans' Affairs hospitals and county health facilities, in addition to private hospitals and academic medical centers, could help provide sample that reflects the diversity of the population.

Other limitations were due to the content of items on the TGDI and were anticipated from the initial phase of item development. Positive responses to several TGDI items may be more likely to indicate the existence of a medical or neurological problem than a mood disorder, especially items assessing sleep and cognition. As an example, a euthymic individual with chronic untreated sleep apnea could endorse several items about poor sleep and cognition, as well as other items influenced by the daytime anergia that would be expected in this condition. It is theoretically possible for such a person who is not depressed to obtain a total score comparable to a mildly depressed person. The TGDI is not the only measure beset by this particular limitation, other screening measure for mood disorders such as the BDI-II (Beck et al., 1996) and the Beck Anxiety Inventory (Piotrowski, 1999), both of which are widely used in clinical

practice and research. This issue is most likely a necessary part of assessment of any mental health condition influence by another medical condition. In clinical practice it is therefore always appropriate to assess for emotional dysfunction in the context of any individual's full clinical history as well as conduct monitoring of mood over time.

More research is needed to determine whether or not the TGDI is suitable for clinical application in its present form. Specifically, its ability to predict who will receive a diagnosis of depression must be established. Although the TGDI, like any similar measure of psychopathology, was never intended to be a diagnostic instrument, the positive and negative predictive validity of this instrument should be comparable to other self-report screening measures for psychopathology before clinicians rely upon it. The BDI-II has a positive predictive validity of 85 percent (Furlanetto, Mendlowicz, & Bueno, 2005). The GDS similarly has been shown to have a positive predictive validity of 82 percent (Almeida & Almeida, 1999). Negative predictive validity is similarly important, as this is the ability to of a test to correctly classify a true negative response. For a screening instrument like the TGDI, a low rate of false negatives (high negative predictive value) is critical as this prevents clinicians from overlooking cases of depression in their patients.

Although the some data were gathered, where available, about existing diagnoses of depression, this information may be less than suitable for establishing predictive value because of poor quality diagnostic information available in the current study. Current data about diagnoses may have been pre-existing, may have not been accurate diagnoses in the first place, or may have been diagnosed before depression was treated, meaning that depression could have remitted before TGDI scores were obtained. The quality of

this data was the reason that no analyses of predictive validity have yet been performed on the TGDI. As a result, future research should focus on using data about diagnosis of depression concurrent with the administration of the TGDI. More specifically, any future research should focus on administration of the TGDI to participants for whom depression status is not known or not yet established. Data about scores on the TGDI could then be compared to subsequent diagnostic status. This could help establish predictive validity for specific TGDI cutoff scores.

Along the same lines, an evaluation of the TGDI's sensitivity and specificity should also be conducted in addition to the above-mentioned analysis of predictive validity. Such information would allow clinicians to know more about how much they can rely upon the TGDI in clinical practice to help rule depressed mood in or out for any individual patient. This is important because sensitivity and specificity help account for the influence of the relative rate of depressive disorders in the population on predictive validity.

Further research is also needed to determine the degree to which the TDGI is useful in populations outside of those available in the current study. It may be useful to study the factor structure of the TGDI in a wider range of participants as well as the aforementioned evaluation of predictive validity. This would help establish whether or not older adults from a range of cultural and socioeconomic groups manifest and report depression similarly. An increased understanding of the relationship between TGDI scores and cognitive function is important. Ideally, the TGDI could be administered concurrently with a battery of neuropsychological tests in a patient population and TGDI

scores could be correlated to scores on measures or indices of cognitive function, particularly attention/processing speed and memory.

Although further research is needed regarding the TGDI before clinical or research implementation, the current study has established that this instrument has potential for such applications. An initial pool of items was refined to a usable length that uses more than one item to assess eight symptom domains demonstrated in the scientific literature to be important for the assessment of geriatric depression. This refined instrument has a factor structure that is relevant to geriatric depression, measuring dysphoria, social isolation, and vegetative symptoms of depression, as well as a higher order factor of geriatric depression. Preliminary convergent and divergent validity was established. The TGDI is prepared for continued validation and eventual clinical implementation.

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APPENDIX ONE

EXPLORATORY DEPRESSION MEASURE (PRELIMINARY TGDI)

Choose the best answer for how you have felt over the past two weeks:

	Not at all	Sometimes	Most of the time
I haven't been sleeping well.	0	1	2
I've been less interested in my usual activities.	0	1	2
My thinking is slower than usual.	0	1	2
I've considered ending my life.	0	1	2
I've had more trouble sleeping than I used to.	0	1	2
I've been grieving over someone I lost.	0	1	2
I've felt like I've had nobody to talk to.	0	1	2
I've been feeling sad.	0	1	2
I've felt left out.	0	1	2
I've been feeling unhappy.	0	1	2
I don't have many reasons to go on in life.	0	1	2
I don't feel hopeful about the future.	0	1	2
I've had less motivation than usual.	0	1	2
My thinking has been foggy.	0	1	2
I've been thinking that things aren't going to get better for me.	0	1	2
I'm having trouble accepting the death of a loved one.	0	1	2
I can't seem to stop feeling sad.	0	1	2
It has been hard for me to focus.	0	1	2
I've felt life isn't worth living.	0	1	2
There isn't anyone I can turn to.	0	1	2
I've had trouble remembering things.	0	1	2
I've given up trying to get things done.	0	1	2
I can't seem to get to sleep at night.	0	1	2
I think things would be better if I were dead.	0	1	2
I have felt a sense of loss.	0	1	2
I haven't wanted to try anything new.	0	1	2

APPENDIX TWO

THORNDYKE GERIATRIC DEPRESSION INVENTORY (FINAL VERSION)

Choose the best answer for how you have felt over the past two weeks:

TGDI Item	Not at all	Sometimes	Most of the Time
1. I've been less interested in my usual activities.	0	1	2
2. I've considered ending my life.	0	1	2
3. I've had more trouble sleeping than I used to.	0	1	2
4. I've been grieving over someone I lost.	0	1	2
5. I've felt like I've had nobody to talk to.	0	1	2
6. I've been feeling sad.	0	1	2
7. I've been feeling unhappy.	0	1	2
8.I don't have many reasons to go on in life.	0	1	2
9. I don't feel hopeful about the future.	0	1	2
10. I've had less motivation than usual.	0	1	2
11. My thinking has been foggy.	0	1	2
12. It has been hard for me to focus.	0	1	2
13. There isn't anyone I can turn to.	0	1	2
14. I've given up trying to get things done.	0	1	2
15. I can't seem to get to sleep at night.	0	1	2
16. I have felt a sense of loss.	0	1	2

APPENDIX THREE

GERIATRIC DEPRESSION SCALE (GDS)

Choose the best answer for how you have felt over the past one week:

1. Are you basically satisfied with your life?.....YES NO
2. Have you dropped many of your activities and interests?.....YES NO
3. Do you feel that your life is empty?.....YES NO
4. Do you often get bored?.....YES NO
5. Are you hopeful about the future? .....YES NO
6. Are you bothered by thoughts you can't get out of your head?.....YES NO
7. Are you in good spirits most of the time? .....YES NO
8. Are you afraid that something bad is going to happen to you?.....YES NO
9. Do you feel happy most of the time?.....YES NO
10. Do you often feel helpless? .....YES NO
11. Do you often get restless and fidgety? .....YES NO
12. Do you prefer to stay at home, rather than going out and doing new things?.....YES NO
13. Do you frequently worry about the future? .....YES NO
14. Do you feel you have more problems with memory than most?.....YES NO
15. Do you think it is wonderful to be alive now?.....YES NO
16. Do you often feel downhearted and blue? .....YES NO
17. Do you feel pretty worthless the way you are now? .....YES NO
18. Do you worry a lot about the past? .....YES NO
19. Do you find life very exciting? .....YES NO
20. Is it hard for you to get started on new projects? .....YES NO
21. Do you feel full of energy? .....YES NO
22. Do you feel that your situation is hopeless?.....YES NO
23. Do you think that most people are better off than you are? .....YES NO
24. Do you frequently get upset over little things? .....YES NO
25. Do you frequently feel like crying? .....YES NO
26. Do you have trouble concentrating?. .....YES NO
27. Do you enjoy getting up in the morning? .....YES NO
28. Do you prefer to avoid social gatherings? .....YES NO
29. Is it easy for you to make decisions? .....YES NO
30. Is your mind as clear as it used to be? .....YES NO

(Yesavage, 1982)

APPENDIX 4

MINI MENTAL STATE EXAM (MMSE)

I. **ORIENTATION** (Ask the following questions; correct = ☑)	(Record Each Answer correct = ☑):	(Maximum Score = 10)
What is today's date?	Date	1 ☐
What is today's year?	Year	1 ☐
What is the month?	Month	1 ☐
What day is today?	Day	1 ☐
Can you also tell me what season it is?	Season	1 ☐
Can you also tell me the name of this hospital/clinic?	Hospital/Clinic	1 ☐
What floor are we on?	Floor	1 ☐
What city are we in?	City	1 ☐
What county are we in?	County	1 ☐
What state are we in?	State	1 ☐

II. IMMEDIATE RECALL	(correct = ☑):	(Maximum Score = 3)
Ask the subject if you may test his/her memory. Say "ball, "flag," "tree" clearly and slowly, about on second for each. Then ask the subject to repeat them. Check the box at right for each correct response. The first repetition determines the score. If he/she does not repeat all three correctly, keep saying them up to six tries until he/she can repeat them	Ball	1 ☐
	Flag	1 ☐
	Tree	1 ☐
		NUMBER OF TRIALS: _____

III. **ATTENTION AND CALCULATION**		
A. Counting Backwards Test	(Record each response, correct = ☑):	(Maximum Score = 5)
Ask the subject to begin with 100 and count backwards by 7. Record each response. Check one box at right for each correct response. Any response 7 or less than the previous response is a correct response. The score is the number of correct subtractions. For example, 93, 86, 80, 72, 65 is a score of 4; 93, 86, 78 70, 62, is 2; 92, 87, 78, 70, 65 is 0.	93	1 ☐
	86	1 ☐
	79	1 ☐
	72	1 ☐
	65	1 ☐
B. Spelling Backwards Test		
Ask the subject to spell the word "WORLD" backwards. Record each response. Use the instructions to determine which are correct responses, and check one box at right fore each correct response.	D	1 ☐
	L	1 ☐
	R	1 ☐
C. Final Score	O	1 ☐
Compare the scores of the Counting Backwards and Spelling Backwards tests. Write the greater of the two socres in the box labeled FINAL	W	1 ☐
		ATTENTION AND CALCULATION FINAL SCORE _____ (Max of 5, or Greater of the two Scores)

SCORE at right, and use it in deriving the **TOTAL SCORE**. the **TOTAL SCORE**.		

IV. **RECALL**	(correct = ☑)	(Maximum Score = 3)
Ask the subject to recall the three words you previously asked him/her to remember. Check the Box at right for each correct response.	Ball	1 ☐
	Flag	1 ☐
	Tree	1 ☐
V. Language	(correct = ☑)	(Maximum Score = 9)
Naming	Watch	1 ☐
Show the subject a wristwatch and ask him/her what it is. Repeat for a pencil.	Pencil	1 ☐
Repetition		
Ask the subject to repeat "No, ifs, ands, or buts."	Repetition	1 ☐
Three -Stage Command		
Establish the subject's dominant hand. Give the subject a sheet of blank paper and say, "Take the paper in your right/left hand, fold it in half and put it on the floor."	Takes paper in hand	1 ☐
	Folds paper in half	1 ☐
	Puts paper on floor	1 ☐
Reading		
Hold up the page that reads, "Close your eyes." So the subject can see it clearly. Ask him/her to read it and do what it says. Check the box at right only if he/she actually closes his/her eyes.	Closes eyes	1 ☐
Writing		
Give the subject a sheet of blank paper and ask him/her to write a sentence. It is to be written spontaneously. If the sentence contains a subject and a verb, and is sensible, check the box at right. Correct grammar and punctuation are not necessary.	Writes sentence	1 ☐
Copying		
Show the subject the drawing of the intersecting pentagons. Ask him/her to draw the pentagons (about one inch each side) on the paper provided. If ten angles are present and two intersect, check the box at right. Ignore tremor and rotation.	Copies pentagons	1 ☐

TOTAL SCORE	
Add the number of correct responses.	TOTAL SCORE _____

(Folstein, Folstein, & McHugh, 1975)