Concordance Between Objective Psychometric Neuropsychological Test Findings and Subjective Self-Report and its Relationship to Functional Impairment in Depression

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Abstract

Depression is associated with a number of cognitive deficits that are associated with increased functional impairment. Cognitive functioning can be examined by way of subjective self-report measures and/or objective performance-based neuropsychological test measures grounded in psychometrics. Depression is associated with impairment on objective psychometric neuropsychological test measures in the domains of attention, memory, executive functioning, and visuospatial functioning. Using subjective self-report of cognitive functioning, depression has also been found to be associated with greater self-reported impairments in attention, memory, and executive functioning. Previous research on the concordance between these types of measures has however produced mixed findings and none have made domain-specific comparisons. Furthermore, if research is able to identify whether one type of measure is a better predictor of functional impairment, this would eliminate the need to use both types of measures, thereby decreasing health care costs. The purpose of the present study was to investigate the concordance between objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning and its relationship to functional impairment in depression. Participants included individuals who had a history of a major depressive episode or major depressive disorder (depressed group: 27 women, 18 men, *M*(age) = 34.98, *SD* = 15.73) and university students who had no history of depression (control group: 20 women, 9 men, *M*(age) = 19.76 years, *SD* = 5.22). Diagnoses were obtained using a semi-structured clinical interview. Groups were compared on psychometric measures of attention, memory, language, visuospatial functioning, and executive functioning using a neuropsychologist test battery and in terms of subjective self-report of cognitive functioning in the same domains using two self-report measures. Participants also completed questionnaires that examined functional impairment,

severity of depression and anxiety symptoms, as well as medical and sociodemographic questionnaires. Results demonstrated that the control group performed significantly worse on objective measures of executive functioning and self-reported greater visuospatial deficits than the depressed group. Furthermore, the depressed group was found to self-report greater functional impairment than controls. Within the depressed group, severity of depression was related to subjective attention, memory, executive functioning, and language, and functional impairment in all domains, but not with objective psychometric neuropsychological test performance. Significant correlations were also found between objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning in the domains of attention and executive functioning. Finally, results suggest that subjective self-report of cognitive functioning may be a better predictor of self-reported functional impairment than objective psychometric neuropsychological test measures.

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Introduction

Depression is a common syndrome characterized by low mood, loss of interest, and other symptoms (see Appendix A for the *Diagnostic and Statistical Manual of Mental Disorders* 5th edition (*DSM-5*; American Psychiatric Association, 2013) diagnostic criteria for major depressive disorder and major depressive episode). The lifetime prevalence rate of major depressive episode (MDE) is estimated to be between 16.6% and 19.1% in the United States (Kessler, Petukhove, Sampson, Zaslavsky, & Wittchen, 2012; Kessler & Üstün, 2008) and between 8.3% and 12.2% in Canada (Bromet et al., 2011; Patten et al., 2006). Lifetime prevalence rates of major depressive disorder (MDD) are slightly lower, ranging from 13.2% to 16.2% in the United States (Hasin, Goodwin, Stinson, & Grant, 2005; Kessler et al., 2009), and from 6.7% to 11% in Canada (Patten et al. 2006; Patten, 2009; Waraich, Goldner, Somers, & Hsu, 2004).

The Burden of Depression

Social and economic burden. Although many individuals are affected by depression, the burden imposed by this condition goes beyond the single sufferer as it also has been shown to impact on society as a whole. In 2000, the World Health Organization's Global Burden of Disease study identified unipolar depressive disorders as the leading cause of YLDs (years lived with disability) and the fourth leading cause of disability worldwide (Üstün, Ayuso-Mateos, Chatterji, Mathers, & Murray, 2004). Major depressive disorder (MDD) is projected to become the second leading cause of disability worldwide, second to ischemic heart disease, by 2020 (Murray & Lopez, 1997). The annual cost of depression in Canada is estimated to be approximately $51 billion, which includes direct health care costs, lost productivity on the job, and reductions in health-related quality of life (Lim, Jacobs, Ohinmaa, Schopflocher, & Dewa,

2008). Furthermore, treatment resistant depression, which occurs in approximately 50% to 80% of those with depression, poses further financial burden as it has been associated with up to a 50% increase in direct and indirect medical care costs in Canada (Olchanski et al., 2013).

Work impairment. One domain that is often compromised in depression and has been linked to significant economic burden is work performance. The annual cost of decreased work productivity (presenteeism) and significant hours or days missed from work (absenteeism) has been estimated to be approximately $83.1 billion in the USA (Woo et al., 2000). A study conducted by Gilmour and Patten (2007) found that approximately 79% of the individuals with depression reported that their depressive symptoms had interfered with their ability to work as reflected in decreased work productivity or significant absenteeism. Individuals with depression are also at high risk for early termination of education, unemployment due to detrimental work performance (Kessler & Bromet, 2013), and increased risk of absenteeism from work (Broadhead, Blazer, George, & Tse, 1990). They also experience impairments in multiple domains of job performance, including performance of mental-interpersonal tasks, time management, output, and physical tasks (Adler et al., 2006).

Personal impairment and quality of life. In addition to the economic and social burdens mentioned above, depression also presents a significant personal burden. Individuals with depression often report functional impairment or limited ability to carry out certain functions in daily living (Üstün & Kennedy, 2009). At an individual level, those with depression display poorer personal health activities, such as decreased exercise, not eating breakfast, irregular sleep habits, and smoking (Allgöwer, Wardle, & Steptoe, 2001). In the social and family domains, depression is associated with a number of difficulties which may negatively affect quality of life, such as poorer family functioning (Weinstock, Keitner, Ryan, Solomon, &

Miller, 2006), marital dissatisfaction and discord (Coyne, Thompson, & Palmer, 2002; Kessler & Bromet, 2013), and poorer parent-child relationships (Kessler and Bromet, 2013) that can lead to future adolescent problem behaviours, including the development of antisocial behaviours (Deković, Janssens, & van As, 2003). Depression can also negatively affect the quality of relationships with friends (Johnson, Meyer, Winett, & Small, 2000; Mickelson, 2001; Nasser & Overholser, 2005; Windle, 1994).

Not only do individuals with depression display functional impairments in their daily lives, they also perceive themselves to be functionally impaired. Subjective quality of life (QOL) refers to an individual's "subjective perception of his or her physical health, psychological health, social functioning, environment, and general life quality" (Kuehner & Buerger, 2005, p. 206) and has been identified as an important outcome measure in those with mental illnesses (IsHak et al., 2011). Overall, those with depression tend to report poorer quality of life than nondepressed individuals (Brenes 2007; Daly et al., 2010; Kuehner & Buerger, 2005; Rapport, Clary, Fayyad, & Endicott, 2005).

Cognitive Deficits in Depression

Cognitive deficits are one of the key characteristics in depression expressed as a "diminished ability to think or concentrate, or indecisiveness, nearly everyday" (DSM-5, APA, 2013, pg. 161) and have been explicitly identified as a significantly disabling aspect of the disorder as early as 1952 (Madden, Luban, Kaplan & Manfredi, 1952). Cognition has been described as the "process of knowing" (Gazzangia, Ivry, & Mangun, 2009, p. 2) and includes a number of mental functions including awareness, perception, memory, attention, and reasoning. Research suggests that 60% to 90% of individuals with depression experience impairments in cognitive functioning (Alfridi, Hina, Qureshi, & Hussain, 2011; Gaynes et al., 2007).

Direct cost estimates of the cognitive deficits associated with depression have not been adequately evaluated (Mackin, Delucchi, Bennett, & Areán, 2011). However, cognitive deficits associated with depression have been linked to other factors that have the potential to significantly increase both personal and mental healthcare costs, such as increases in health services utilization (Xiang & An, 2015) and disruptive job performance (McIntyre et al., 2013). A number of studies (Conradi, Ormel, & de Jonge, 2011; Fava, Ruini, and Belaise, 2007; Hasselbalch, Knorr, Hasselbalch, Gade, & Kessing, 2012; Nierenberg et al., 1999; Potter, Kittinger, Wagner, Steffens, & Kristnan, 2004; Rock, Roiser, Riedel, & Blackwell, 2014) have also shown that the cognitive deficits associated with depression are resistant to treatment even after symptomatic remission has been achieved, and that these cognitive symptoms continue to interfere with daily functioning (Lam, Kennedy, McIntryre, & Khullar, 2014). Furthermore, residual symptoms have been associated with risk of relapse in depression (Paykel, 2008).

Interestingly, other research shows that the pattern of cognitive functioning during the different phases of unipolar and bipolar depression is similar. For example, several studies have reported no significant difference in the self-rated experience of cognitive functioning or performance on objective psychometric neuropsychological tests during the euthymic (i.e. asymptomatic) phase in unipolar and bipolar depression (Kessing 1998; Marvel & Paradisø, 2004; Miskowiak, Vinberg, Christensen & Kessing, 2012; Quraishi & Frangou, 2002). Although there is sparse research comparing the cognitive deficits present during the depressive phase of unipolar and bipolar disorders, the available results suggest similar results. One review (Cueller, Johnson, & Winters, 2010) suggests that both patients with bipolar and unipolar depression display negative cognitive styles during depressive episodes, including lowered self-esteem and increased distraction from negative words of the Stroop task, but that this negative thinking style

diminishes during euthymic periods for those with bipolar but not unipolar depression. A more recent study conducted by Godard, Baruch, Grondin, and Lafluer (2012) found that patients with unipolar and bipolar depression who were currently in a depressive phase displayed similar neurocognitive profiles with the most frequently impaired cognitive domains being alertness, information processing speed, sustained and divided attention, and spontaneous flexibility. Taken collectively, these results show that there are no significant differences in cognitive functioning between patients with unipolar and bipolar depression during the depressive phase (i.e. those currently experiencing an MDE) and the euthymic phase (i.e. those not currently experiencing an MDE). This suggests that research and treatment aimed at ameliorating the cognitive deficits seen in depression may be applicable to, and beneficial for, patients with both unipolar and bipolar depression.

Other research suggests that cognitive deficits may play an important role in functional recovery (i.e., improvement in life functioning) for patients with depression. In support of this, Jaeger, Berns, Uzelac, and Davis-Conway (2006) found that in a sample of patients hospitalized for MDD, cognitive deficits in the domains of visuospatial functioning, learning, and motor measures were predictive of functional recovery six months after discharge and that in five out of seven cognitive domains, the presence of cognitive deficits were significantly associated with functional disability, after controlling for residual depressive symptoms and psychosis. The authors also found that cognitive improvement over time was associated with a higher likelihood of functional recovery and those who showed no improvement or worse cognitive functioning were more likely to be significantly or totally disabled.

Taken together, the literature suggests that cognitive impairments seen in depression are associated with poorer outcomes and significant personal and mental healthcare costs. However,

despite the fact that impaired cognition is a core symptom of depression and that research has established a link between cognitive impairment and functional outcomes in depression, cognitive issues often do not receive specific attention in assessment and treatment by mental health professionals (Greer, Kurian, & Trivedi, 2010). Since cognitive symptoms play an important role in improving functional outcomes for patients with depression, this area is a valuable target for future interventions (Rock et al., 2014).

Factors Affecting Cognitive Performance in Depression

A number of factors have been found to influence the extent and manifestation of cognitive impairment in individuals with depression, including severity of depression and age. Studies assessing the nature and extent of cognitive impairment in depression should take these factors into account.

Severity of depression. Although findings have been conflicting, there is some evidence of consistent patterns between severity of depression and extent of cognitive impairment (Austin, Mitchell, & Goodwin, 2001). For example, in one study (Naismith et al., 2003) individuals diagnosed with severe depression scored significantly lower on a test of semantic fluency, had more perseverative errors on the Wisconsin Card Sorting Test, and had lower scores on the Rey Auditory Verbal Learning Test. Thus, greater severity of depression was associated with greater impairment in attention, executive functioning, and verbal memory. In their meta-analysis analyzing depression severity and cognitive dysfunction, McDermott and Ebmeier (2009) found significant negative correlations between depression severity and the cognitive domains of episodic memory, executive functioning, and processing speed. Greater severity of depression is also associated with poorer performance on visuospatial tasks such as visuospatial and pattern recognition and delayed matching (Porter, Gallagher, Thompson, & Young, 2003). Thus, those

with more severe depression show greater deficits in attention, memory, visuospatial functioning, executive functioning, and processing speed.

Age. Age is another factor that can profoundly influence performance on cognitive tasks. Studies have documented the finding that cognitive performance, especially psychomotor speed, declines with age, independent of depression (Harada, Natelson, & Triebel, 2013; Salthouse, 2012). Other research suggests that that late-life depression is associated with a distinct profile of cognitive deficits that differs from that of younger individuals with depression. In support of this, Fossati, Coyette, Ergis, and Allilaire (2002) found a significant effect of age on verbal memory performance in young and elderly patients with depression, with elderly patients performing more poorly than younger patients on a verbal memory task.

Research on Cognitive Deficits in Depression

Research on cognitive deficits in depression has used subjective self-report of cognitive functioning or objective psychometric neuropsychological test measures. Self-report measures are questionnaires that are completed either by the individual or a collateral informant and are considered to be subjective measures because they measure the individual's subjective experience of cognitive functioning as reported by the self or another party. Self-report questionnaires can be direct or have high face validity in which the person being assessed is aware of the construct being measured, or indirect or have low face validity in which the construct being measured is obscured (Paulhus & Vazire, 2009). Self-report measures are often used in clinical settings because they are inexpensive and easy to administer. However, a serious limitation to self-report measures is that they suffer from limited reliability and validity (Priddy, Mattes, & Lam, 1988; Tanaka-Matsumi & Kameoka, 1986). One issue is that patients' response sets may influence the reliability of self-report measures. Specifically, patients may over-report

or under-report their symptoms for a variety of reasons (e.g. social desirability, inconsistency of responses due to negligence) and these effects may be exaggerated on highly face-valid self-report measures (Murphy & Davidshofer, 2005). Despite their limitations, self-report measures of cognitive symptoms are an important indicator of neuropsychological functioning because they communicate an individual's perception of his or her neuropsychological impairments or deficits and their impact on everyday activities (Gordon, Haddad, Brown, Hibbard, & Sliwinski, 2000).

Cognitive functioning in depression can also be examined using objective psychometric neuropsychological test measures. Neuropsychological assessment can be defined as "a performance-based method to assess cognitive functioning and is performed with a battery approach, which involves a variety of cognitive ability areas" (Harvey, 2012, p. 91). These tests are considered objective because they make use of normative comparison stratified by various demographic variables, such as age, sex, and education, based on standardized samples. There are several specific uses of neuropsychological assessment, including collection of diagnostic information, differential diagnostic information, assessment of treatment response, and prediction of functional potential and functional recovery. Neuropsychological testing has important practical implications in depression treatment settings. Results from these types of tests can inform treatment planning which might be tailored in accordance with patients' identified cognitive strengths and weaknesses with the hope of improving treatment response and outcome.

In primary care settings, objective psychometric neuropsychological test measures are not routinely used due to lack of consensus about their relevance (Svendsen, Kessing, Munkholm, Vinberg & Miskowiak, 2012), as well as time and resource (i.e. cost and labour) restraints

(Grohman & Fals-Stewart, 2004). Rather, assessment of cognitive complaints is usually achieved by use of subjective self-report. This may be problematic since patients with depression are prone to cognitive biases in their thinking (Joormann, Waugh, & Gotlib, 2015), which can affect their subjective self-report. Research shows that the cognitive deficits associated with depression impacts upon quality of life and daily social and occupational functioning (Jaeger et al., 2006), thus highlighting the need for paying closer attention to cognitive functioning in assessment and treatment processes in order to improve patient functioning and reduce risk of relapse. Examination of the relationship between subjective self-report of cognitive functioning and objective psychometric neuropsychological test measures in patients with depression is important to clarify whether patients' self-reported cognitive complaints reflect underlying objective performance-based deficits. This would help inform clinicians about whether they can rely on patients' cognitive complaints or, on the other hand, would need to implement an objective neuropsychological assessment to guide diagnostic and treatment efforts.

Findings from subjective self-report of cognitive functioning. The most common self-reported cognitive deficits in depression are attention/concentration and memory (Gaynes et al., 2007). In a study of 164 outpatients with depression, 96% noted difficulty concentrating and 93% reported problems with memory. Furthermore 52% of these patients perceived these cognitive symptoms as interfering substantially with their occupational functioning (Lam et al., 2012)

The presence of memory and attentional complaints also differentiates individuals with depression from nondepressed, healthy controls. Those with depression are more likely to have subjective memory complaints than nondepressed controls (Antikainen et al., 2001). These

memory problems were rated as less severe with the improvement of depressed mood over time. Naismith, Longlet, Scott, and Hickie (2007) found that patients meeting criteria for an MDE rated themselves as experiencing higher levels of cognitive dysfunction in the domains of speed, concentration, and short-term memory than nondepressed controls. Thus, it appears that subjective memory complaints are directly related to the presence and severity of depressive symptoms.

In sum, depression is associated with a number of self-reported cognitive complaints, most notably in the domains of memory and attention. No studies have looked at subjective self-reported cognitive complaints associated with depression in visuospatial and executive functioning domains. Although self-report measures suffer from a number of limitations, their use does offer a number of benefits for the assessment of cognitive functioning in depression. Notably, they communicate an individual's subjective perception of his or her impairments or deficits.

Findings from objective psychometric neuropsychological test measures. There is ample research on cognitive functioning in depression using objective psychometric neuropsychological test measures. Many studies have used full neuropsychological batteries, while others have used only a few subtests from these batteries to tap into the various cognitive domains. Overall, the empirical research on objective performance-based cognitive deficits in depression has led to inconsistent results. This is likely due to differences across studies in sample characteristics (depression subtype, severity) as well as methods used to assess cognitive dysfunction (Burt, Zembar, & Niedereche, 1995; Zakzanis, Leach, & Kaplan, 1998). Despite these inconsistencies, important patterns have emerged. Neuropsychological deficits in depression occur in the domains of attention, memory, visuospatial functioning, and executive

functioning (Alfridi et al., 2011; Papakostas, 2014; Rock et al., 2014; Zakzanis et al., 1998). A comprehensive review conducted by Ottowitz, Dougherty, and Savage (2002) revealed that cognitive deficits in unipolar depression were reported by half of the studies that used performance-based attention tests and by over 90% of studies that used demanding, 'pre-frontal' executive functioning tests.

Attention. Impaired attention is considered to be one of the cardinal features of depression (Mialet, Pope, & Yurgelun-Todd, 1996). According to Lezak, Howieson, and Loring (2004), attention is defined as "several different capacities or processes that are related aspects of how the organism becomes receptive to stimuli and how it may begin processing incoming or attended-to excitation" (p. 34). Attention can include both automatic (involuntary) and deliberate (voluntary) processes. Research on perceptual load and the influence of distractors has shown that an important characteristic of attention is its limited capacity (e.g. Lavie, 2005). There are many conceptualizations of the different types of attention; however Lezak et al. (2004) have identified and described five important domains of attention. *Immediate span of attention* involves the amount of information that can be grasped at once. *Focused* or *selective attention* refers to an individual's ability to process one or two events or stimuli to the detriment of others. Tests that tap this domain often require individuals to attend to certain stimuli while rejecting stimuli that are irrelevant. *Sustained attention,* also called *vigilance*, involves maintaining attention on an activity over some time period. *Divided attention* involves the ability to engage and respond to several tasks at the same time. Tasks that tap this domain often require individuals to engage in more than one cognitive task simultaneously. *Alternating attention* refers to the ability to shift focus in alternating tasks.

One of the most basic neuropsychological tests that is routinely used to assess attentional abilities is the Digit Span Test. In the Digit Span Test, individuals listen to a series of digits presented verbally by the examiner and are required to repeat them back. This test measures immediate auditory attentional capacity and immediate recall. Numerous studies have found that those with MDD perform significantly worse on the Digit Span Test than healthy controls (Fossati, Amar, Raoux, Ergis & Allilaire, 1999; Lim et al., 2013; Martin, Oren, & Boone, 1991).

Depression has been found to be associated with deficits in selective attention, sustained attention, and divided attention. In terms of selective attention, several studies have found that individuals with depression show a negative cognitive bias in that they are more likely to attend to negative stimuli rather than positive or neutral stimuli (e.g. Harmer, Goodwin, & Cowen, 2009; Joorman & Gotlib, 2007; Joormann, et al., 2015; Koster, Raedt, Goeleven, Franck, & Crombez, 2005; Mathews, Ridgeway, & Williamson, 1996; Rinck & Becker, 2005; Surguladze et al., 2005). Depression is also associated with deficits in sustained attention. Specifically, people with depression show more errors of omission and commission and display longer reaction times on a continuous performance task that requires participants to respond to specific stimuli contained within a string of serially presented letters (Gualtieri, Johnson, & Benedict, 2006; Lim et al., 2013; Porter et al., 2003). Furthermore, using the Sustained Attention to Response Task (SART), which measures vigilance, Farrin, Hull, Unwin, Wykes, and David (2003) found that the group with depression made more errors on the task than did the non-depressed controls, suggesting that individuals with depression have impairments in sustaining their attention. Using a dual task paradigm, a test of divided attention which requires participants to simultaneously pay attention to two different stimuli and respond only to target stimuli, Majer et al. (2004) found that participants with depression were slower to react to target

stimuli than non-depressed controls. Digit Span Backwards, which requires individuals to repeat numbers in the reverse order of presentation, and is another measure of divided attention, has also been found to differentiate between individuals with depression and controls (Majer et al. 2004; Stordal et al., 2004). Finally, cognitive deficits in depression have also been shown with the use of the letter cancellation task, which measures sustained attention, selective attention, and psychomotor speed. For this task, individuals must cancel or cross out one or more target letters in a sequence of random letters and/or numbers within a certain amount of time. Several studies utilizing different versions of the letter cancellation task have shown that individuals with depression score significantly lower on the task than healthy controls (Agarwal, Kalra, Natu, Dadhich, & Deswal, 2002; Zakzanis et al., 1998).

Taken together, these results suggest that depression is associated with quantifiable deficits in selective, sustained, and divided attention. Specifically, individuals with depression are less able to divide their attention as needed, are less able to sustain their attention, and often show attentional biases that influence what information they attend to. This may explain why concentration complaints are so common for this population.

Memory. In addition to attentional problems, depression is also commonly associated with a number of memory deficits. At a general level, research has established that there are a number of distinct memory systems (Squire & Knowlton, 2000). One important distinction is between explicit and implicit memory. Explicit memory, also referred to as declarative memory, involves knowledge that is consciously available, whereas implicit memory involves knowledge that is not consciously available but is often expressed in performance (Lezak et al., 2004). Depression is associated with impairments in declarative memory (Marvel & Paradisø, 2004;

Zakzanis et al., 1998); however, implicit memory does not seem to be affected in depression (Ellwart, Rinck, & Becker, 2003; Ilsley, Moffoot, & O'Carroll, 1995).

Another important distinction is that between verbal and visual (nonverbal) memory. Verbal memory is typically assessed using stimuli consisting of words, sentences and paragraphs. Several studies have shown that depression is associated with impaired verbal memory (e.g. Burt et al., 1995; Hammar, Isaksen, Schmid, Årdal, & Strand, 2011; Hermens, Naismith, Hodge, Scott, & Hickie, 2010). Specifically, compared to healthy controls, individuals with depression recall fewer words on immediate recall and show deficits in story learning and recall (Hammar et al., 2011; Watts & Cooper, 1989).

Visual memory has also been found to be impaired in individuals with depression and is examined using visual designs, spatial positions, and faces (Sohlberg & Mateer, 2000). Visual memory is often assessed using the Rey-Osterrieth Complex Figure Task, in which individuals are asked to copy, recall and recognize elements from a complex figure. Using this task, several studies have found that individuals with depression performed significantly worse than controls in delayed recall and recognition (Behnken et al., 2010; Hammar et al., 2011; Hammar & Schmid, 2013). One study using the Rey-Osterrieth Complex Figure Task found that individuals with depression recalled significantly fewer parts of the figure, and had lower total recognition scores, compared to healthy controls (Hammar et al., 2011). Furthermore, research suggests that patients with depression are more likely to show impairments in recall, rather than recognition, as the latter is considered to be more cognitively demanding (Brand, Jolles, & Gispen-de Wied, 1992). Other frequently used visual memory tasks used to assess cognitive deficits in depression include the delayed match to sample and paired associated learning subtests of the Cambridge Automated Neuropsychological Test Battery (CANTAB; Fray, Robbins, & Sahakian, 1996;

Sahakian et al., 1988), which tap into delayed visual recognition and simple visual pattern and associative learning respectively. Using these subtests, Egerhazi et al. (2013) found that individuals with depression performed more poorly than healthy controls. Greater severity of depression is also associated with poorer memory performance on visuospatial tasks such as spatial and pattern recognition and delayed matching (Porter et al., 2003). Thus, depression is associated with impairment in a number of different types of memory including verbal and visual memory.

Visuospatial functioning. Another area in which deficits are commonly seen in depression is in visuospatial functioning (Asthana, Mandal, Khurana, & Haque-Nizamie, 1997). Visuospatial functioning includs a "constellation of complex visual processing abilities, including spatial awareness and attention, awareness of self-other and of self-object spatial relationships, visuospatial memory, and interpretation and navigation of extrapersonal space" (Arciniegas, McAllister, & Kaufer, 2007, p. 67). Three important aspects of visuospatial functioning include perceptual, constructional, and spatial awareness skills (Mapou, 1995). Perceptual skills refer to the initial processing of visuospatial information that occurs beyond the basic sensory level but is separate from motor responses; thus, these skills involve the input of visuospatial information. Constructional skills reflect both input (e.g., basic visual skills such as seeing and perceiving a drawing) and output skills (e.g., basic motor and organizational skills, such as copying a drawing). Spatial awareness refers to an individual's awareness of intra- and extra-personal space and reflects both input and output of visuospatial information**.** Deficits in spatial awareness are often seen as disruptions in functional skills, such as following directions. All three aspects are important contributors to one's overall visuospatial functioning.

In terms of visuospatial perceptual skills, individuals with depression show deficits in rapid visual processing (Egerhazi et al., 2013). Further supporting this, other research has demonstrated that a deficit of the right posterior hemisphere, which is predominantly responsible for the processing of visuospatial information, is involved in depression (Keller et al., 2000). Additionally, Nissen et al. (2010) found that patients with depression showed impaired performance on a visual texture discrimination task compared to controls. Finally individuals with depression performed more poorly than nondepressed controls on the line orientation task, which involves the identification of two target lines out of an array of lines (Baune 2010; Coello, Ardila, & Rosselli, 1990). Thus, it appears that individuals with depression are less able to process and discriminate visuospatial information than their healthy counterparts.

Deficits are also seen in constructional and spatial awareness skills. For example, individuals with depression also show impaired visual tracking and scanning abilities (Veiel, 1997) and are less able than controls to accurately copy a drawing on the Rey-Osterrieth Complex Figure Task (Baune et al., 2010; Rossi et al., 1990). Deficits have also been found using the Block Design Task (Gorlyn, et al., 2006; Veiel al., 1997), suggesting that individuals with depression may have difficulties in assembling objects and following instructions, which are both part of constructional and spatial awareness skills.

Finally, research has also found that compared to healthy controls, individuals with depression are more impaired on tasks of visuospatial learning and memory (Porter et al., 2003). Specifically, people with depression are more likely to complete fewer trials of a paired-associated learning task, which requires participants to learn and replicate the matching of two complex stimuli to spatial locations on a screen, and are also less able to learn and later

remember patterns, object stimuli, and spatial positions of stimuli (Beblo, Baumann, Bogerts, Wallesch, & Herrmann, 1999; Porter et al., 2003).

In sum, the deficits seen in depression seem to reflect impairments in a number of visuospatial domains including perceptual, constructional, and spatial awareness skills. However some of these areas may overlap with other cognitive domains. For example, the deficits seen in visuospatial learning and memory may be due to a more general memory impairment. Furthermore, rapid visual processing, tracking and scanning deficits may be linked to attentional difficulties. Thus, although depression is associated with a number of visuospatial deficits, at least some of these may be due to more broad attentional and memory impairments.

Executive functioning. Executive functioning (EF) is another domain in which deficits associated with depression are found. EF has been defined in a number of different ways. Most definitions of EF propose that EF includes self-regulated, higher-level cognitive processes that control and regulate lower, more automatic processes towards goal-directed behavior (Snyder, 2013). Inherent in these definitions is the notion that higher-level cognitive processes are distinct from automatic processes. Across models of EF, it is recognized that although there is a unitary aspect of EF, a number of these components are separable (e.g. Friedman et al., 2008; Miyake, Friedman, Emerson, Witzki, & Howerter, 2000). Empirical studies have found evidence of EF deficits due to depression on measures of verbal fluency, set-shifting, planning, executive control of attention, emotional salience, and response bias (Rogers et al., 2004).

Two areas of EF that have received a significant amount of attention in the depression literature are verbal fluency and planning. Verbal fluency refers to the ability to generate words from either semantic categories (semantic verbal fluency) or starting with certain letters (phonemic verbal fluency) within a specified time limit (Snyder, 2013). Significant impairments

have been found in patients with MDD on tasks of both semantic and phonemic verbal fluency (e.g. Henry & Crawford, 2005; Zakzanis et al., 1998), with individuals with depression generating fewer words.

A second important area of EF, planning, is defined as identifying and organizing a sequence of steps to achieve a goal (Lezak et al., 2004). Planning is often measured using the Tower of London Task (Shallice, 1982), in which individuals must move beads across pegs from a starting position to a target position in as few moves as possible while following a set of rules. Using this test, individuals with depression have been found to be less accurate than healthy controls and this performance varied with the level of difficulty of the task. That is, the individuals with depression showed greater impairment on the more difficult tasks (Naismith et al., 2003).

In sum, research has looked at specific cognitive deficits associated with depression in the domains of attention, memory, visuospatial functions, and executive functioning. Using a variety of tasks in each of these domains, the literature supports the notion that depression is linked to a variety of cognitive deficits.

Comparison of Findings from Subjective Self-report of Cognitive Functioning and Objective Psychometric Neuropsychological Test Measures

Understanding the relationship between subjective self-report of cognitive functioning and objective psychometric neuropsychological tests in depression is important because of its relevance to clinical treatment. Patients without awareness of their cognitive deficits can lack motivation for treatment, fail to utilize recommended compensatory strategies, set unrealistic goals, or experience difficulties with social adaptation (McGlynn & Schacter, 1989; Wagner & Cushman, 1994). Alternatively, cognitively intact patients who perceive themselves as

cognitively impaired could report themselves as such, resulting in incorrect diagnoses or inappropriate treatments. Furthermore, self-report of cognitive functioning are often affected by the presence of other conditions such as schizophrenia, in which lack of insight is a key symptom, and as a result may not have the same value as objective performance-based measures (Bowie et al., 2007).

Various studies have investigated the relationship between subjective self-report of cognitive functioning and objective psychometric neuropsychological test measures in depression and have produced mixed findings. Hueng et al. (2011) found that subjective self-report of cognitive functioning and objective psychometric neuropsychological test measures were correlated for Taiwanese individuals with depression in the domains of sustained attention, memory, and executive functioning but not for psychomotor speed. However, the authors noted the limitation of their findings due to their small sample size. Another study found that in a population of Finnish patients with depression, subjective memory complaints were significantly correlated with their objective performance on neuropsychological memory tests (Antikainen et al. 2001). In contrast, Svendsen et al. (2012) found that patients with MDD self-reported greater cognitive deficits and performed more poorly on objective psychometric neuropsychological test measures compared to the control group but that there was no correlation between the total scores on these two types of measures. Furthermore, they found that severity of depression predicted general subjective self-report of cognitive functioning but not objective psychometric neuropsychological test findings.

The absence of a concordance between subjective self-report of cognitive functioning and objective psychometric neuropsychological test measures has been found for a number of other psychiatric and medical disorders such as substance abuse (Horner, Harvey, & Denier, 1999),

multiple sclerosis (Julian, Merluzzi, & Mohr, 2007), bipolar disorder (Burdick, Endick, & Goldberg, 2005; van der Werf-Eldering et al., 2011), and schizophrenia (Tomida et al., 2010).

In sum, it appears that the literature is divided, with some studies finding a relationship between objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning depression, while others do not. A major issue with the research conducted to date on the relationship between these types of measures in depression is the large variation in both the patient samples (see Hueng et al. 2011; Antikainen et al. 2001) and the neuropsychological batteries used to assess cognitive impairment (Russo, Mahon, & Burdick, 2014). Furthermore, the objective psychometric neuropsychological test measures and subjective self-report measures that are used to assess cognitive functioning may not directly map onto each other. For example, in the study conducted by Svendsen et al. (2012), subjective experience of cognitive difficulties was measured using the Massachusetts General Hospital Cognitive and Physical Functioning Questionnaire (CPFQ; Fava et al., 2006), which assesses the following subcategories: Apathy/Motivation, Wakefulness/Alertness, Energy Level, Focus/Sustain Attention, Memory/Recall, Word Finding Ability and Sharpness/Mental Acuity (Fava et al., 2009). Meanwhile, objective cognitive performance in this study was measured using the Screen for Cognitive Impairment in Psychiatry (SCIP), which assesses the following cognitive domains: verbal learning and memory, delayed memory, working memory, verbal fluency and processing speed, but not attention (Purdon, 2005). Therefore, the extent to which a consensus about the relationship between subjective self-report of cognitive functioning and objective psychometric neuropsychological test measures in depression can be drawn from these results is limited. This issue can be addressed with studies in which these different types of measures assess the same domains of cognitive functioning.

As the need for more inexpensive means of evaluation and treatment in the health care system increases, research on the concordance between subjective self-report of cognitive functioning and objective psychometric neuropsychological test measures has become more important. This type of investigation is important to elucidate whether or not self-reported cognitive difficulties reported by patients with depression can be used in place of more expensive and time-intensive objective neuropsychological assessments, or whether these types of measures provide different information to guide treatment strategies.

The Relationship between Measures of Cognitive Functioning and Functional Impairment

Research shows that depression is associated with high levels of impairment and poorer quality of life (Brenes 2007; Daly et al., 2010; Kuehner & Buerger, 2005; Rapport et al., 2005). Depression is also associated with both objective performance-based and subjective self-reported cognitive impairment, as discussed above. That is, individuals with depression show poorer performance on objective psychometric neuropsychological test measures and also rate their cognitive functioning as worse than nondepressed controls on subjective self-report. However, the research that examines the link among depression, cognitive measures, and functional impairment is sparse. Specifically, there is a lack of studies investigating which domains of either subjective self-rated cognitive functioning or objectively measured cognitive performance are associated with functioning in daily life (Svendsen et al., 2012). If research findings are able to identify which type of measurement is a better predictor of functional impairment, then this would eliminate the need to use both types of measures, thereby decreasing health care costs.

Research has shown that subjective self-reported complaints of cognitive functioning in depression are related to greater impairment. Individuals with depression who have memory complaints are more likely than depressed individuals without memory complaints to rate their

health status and psychosocial functioning as poor (Antikainen et al., 2001). Another study found that 52% of patients with depression who had self-reported memory problems also perceived these symptoms as interfering substantially with their occupational functioning (Lam et al., 2012).

A study by Naismith et al. (2007) looked at how subjective self-report of cognitive functioning and objective psychometric neuropsychological test measures relate to physical, mental, and functional impairment among individuals with depression. The authors found that objective psychomotor speed was related to limitations of physical activities (such as climbing stairs) and objective memory retention was related to functional impairment (i.e. how many days the individual was unable to carry out their usual activities). Performance on objective psychometric neuropsychological test measures did not predict mental health functioning (motivation, efficiency for engagement in daily activities, quality of social relationships). Subjective self-report ratings of overall cognitive dysfunction were strongly related to physical limitations, while deficits in self-rated speed, short-term memory, and overall cognitive functioning were related to functional impairment. Furthermore, self-rated deficits in speed, short-term memory, concentration, and overall cognitive functioning were related to compromised mental health functioning. However, mental health functioning was not related to any objective psychometric neuropsychological test measures. Overall, findings from this study suggest that objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning might predict different forms of impairments and limitations in depression.

General Summary

Individuals with depression report functional impairment (Üstün & Kennedy, 2009) and compromised quality of life (Brenes 2007; Daly et al., 2010; Kuehner & Buerger, 2005; Rapport et al., 2005). Cognitive deficits are part of the clinical presentation of depression (Gaynes et al., 2007), contribute to functional impairment (McIntyre et al., 2013), and persist even after treatment (Fava et al., 2007) in some individuals. This underscores the importance of studying cognitive deficits in depression as the remediation of these deficits can lead to improved outcomes for patients with depression. Cognitive deficits can be measured through subjective self-report or objective psychometric neuropsychological test measures. Examinations on the degree of concordance between these types of measures have produced mixed findings. Some studies find no concordance (Svendsen et al., 2012) while others report that it depends on the type of cognitive domain under investigation (Hueng et al., 2011). Furthermore, there is some evidence to suggest that objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning are related to physical and mental health impairment, respectively, and that both are related to functional impairment (Naismith et al., 2007). Most of the research to date has focused on the use of objective psychometric neuropsychological test measures and functional impairment, but relatively little work has looked at subjective self-report of cognitive functioning in depression. Similarly, there is scant investigation on the direct comparison of objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning in depression.

Purpose of the Present Study

The purpose of the present study was to examine the concordance between objective psychometric neuropsychological test measures and subjective self-report of cognitive

functioning and its relationship to functional impairment (in work, social life, family life) in depression. The domains of cognitive impairment examined were attention, memory, language, visuospatial functioning, and executive functioning. Participants consisted of individuals between the ages of 18 and 65 with a history of depression (depressed group) and nondepressed individuals (control group).

It was hypothesized that:

i) The depressed group would perform more poorly than the control group on objective psychometric neuropsychological test measures in the domains of attention, memory, visuospatial functioning, and executive functioning.

ii) The depressed group would report greater impairment than the control group on subjective self-report of cognitive functioning in the domains of attention, memory, and executive functioning.

iii) The depressed group would report greater functional impairment than the control group in work, social life, and family life.

It was also expected that within the depressed group:

iv) Greater severity of depression symptoms would predict poorer performance in objective psychometric neuropsychological test measures in the domains of attention, memory, visuospatial functioning, and executive functioning and greater self-rated cognitive dysfunction in the domain of memory.

v) There would be a positive correlation between subjective self-report of cognitive functioning and objective psychometric neuropsychological test measures in the domains of attention, memory, and executive functioning.

vi) Poorer performance on objective psychometric neuropsychological test measures would predict greater functional impairment associated with work.

vii) Poorer subjective self-report of cognitive functioning would predict greater functional impairment in all domains (work, social life, family life).

Method

The data for this project was derived from a larger study that was conducted at two sites: the START Clinic for Mood and Anxiety Disorders, a tertiary care clinic located in Toronto, Ontario, and the University of Toronto, Scarborough Campus (UTSC). The project received ethics clearance from Optimum Ethics Review Board (see Appendix B) and the UTSC research ethics board (see Appendix C). The researcher for this project (R. Tzalazidis) was part of the team for the study and was principally involved in the recruitment and assessment of participants and in the data collection.

Participants

In total, 101 individuals participated in the study (61 women, 40 men), with 53 individuals recruited from the START Clinic and 49 recruited from UTSC. All participants were between 18 and 65 years old (mean age = 31.71 years, *SD* = 15.31). These age limits were chosen because the START Clinic only assesses patients who are aged 18 or older, and late-life depression (above age 65) is associated with a distinct profile of cognitive deficits that differs from that of younger individuals with depression (Fossati et al., 2002). Participants with a current DSM-IV-TR diagnosis of manic episode or psychosis were excluded because the presence of a thought disorder would have made it difficult for the participant to engage in a lengthy neuropsychological assessment. Participants with a current diagnosis of Attention-Deficit/Hyperactivity Disorder (ADHD) were also excluded, as research has shown that the co-

occurrence of ADHD with depression is associated with additional cognitive impairment above that seen in depression alone (Larochette, Harrison, Rosenblum, & Bowie, 2011). Inclusion of such individuals would have invalidated the findings, as the presence of psychotic features or mania, and attentional difficulties associated with ADHD can influence the manifestation of cognitive impairment in depressive disorders (Bakkour et al., 2014; Mohanty & Heller, 2002).

Out of the 108 individuals who took part in the study, 28 were excluded for various reasons. Twenty individuals were excluded from the depressed group and one individual was excluded from the control group because they met criteria for ADHD, four individuals did not meet inclusionary or exclusionary criteria (two due to age and two met criteria for current psychosis), and three individuals had a significant amount of incomplete data (greater than 5% of scale or subscale items). This resulted in a final study sample of 74 individuals (47 women, 27 men).

Sample characteristics. The mean age of the study sample was 29.01 years (*SD* = 14.68). Over half of individuals were on current medication (55.4%) and the majority of the sample was right-handed (90.5%). The majority of the sample identified their relationship status as single (56.8%), with 75.7% reporting that their highest degree completed being a high school diploma, and about one-fifth (20.3%) reporting that their annual family income to be $100, 000 or greater. The majority of the sample identified as either Caucasian (39.2%), with a smaller percentage identifying as Asian (36.5%). In terms of religion, 27.0% identified as 'Other', 14.9% identified as Protestant, and 12.9% as Hindu. For a complete summary of the demographic characteristics of the sample, please see Table 1.

It was also observed that 59.2% of individuals in the sample met criteria for a past major depressive episode, with 22.4% meeting criteria for a current major depressive episode, and

39.5% meeting criteria for major depressive disorder. Many of the individuals in the depressed group also met criteria for one or more anxiety disorders, the most common of which was generalized anxiety disorder (39.5%), followed by panic disorder lifetime (22.4%), and generalized social phobia (21.1%). See Table 2 for the complete diagnostic findings from the structured clinical interview using the MINI.

Group classification. Individuals in the depressed group met DSM-IV-TR criteria for current or past MDE or MDD. Incentive for participation for this group was free neuropsychological testing at the START Clinic, for which they would have paid otherwise. The control group consisted of nondepressed university students with no history of depression. They were offered course credit for their participation.

The total sample was divided into depressed and control groups. Within the depressed group, 31 individuals were recruited from the Start Clinic and 14 were recruited from UTSC. For the control group, all 29 individuals were recruited from UTSC. Incentive for participation for those individuals recruited from the START clinic was free neuropsychological testing, which they would have paid for otherwise. Individuals recruited from UTSC were offered course credit for their participation. Since the individuals in the depressed group came from different sites, they were examined separately for demographic characteristics. Table 1 shows the demographic characteristics and Table 2 displays information on the psychiatric diagnoses for each group and for the total sample.

START depressed group. A total of 31 individuals were included in the START depressed group (16 women, 15 men). The mean age of the sample was 42.35 years (*SD* = 13.45). The majority of individuals was on current medication (93.5%) and was right-handed (90.3%). Almost all identified their relationship status as dating (96.8%), almost half (48.4%)

reported that their highest degree completed was a high school diploma, and about one-third (35.5%) of the sample reported their annual family income to be $100, 000 or greater. Approximately three-quarters of the sample identified as Caucasian (74.2%). In terms of religion, 29.0% chose not to identify and 25.8% identified as 'Other'.

All 31 (100%) of the individuals in the START depressed group met criteria for major depressive episode past, with 35.5% meeting criteria for a current major depressive episode, and 64.5% meeting criteria for major depressive disorder. Many of the individuals in the depressed group also met criteria for one or more anxiety disorders, the most common of which was generalized anxiety disorder (80.6%), followed by generalized and non-generalized social phobia (58.1%), panic disorder lifetime (48.4%), and agoraphobia (35.5%).

UTSC depressed group. A total of 14 individuals were included in the UTSC depressed group. The mean age of the sample was 18.64 years (*SD* = 1.78). Half of the sample was on current medication (50.0%) and 92.9% were right-handed. The majority of the sample identified their relationship status as single (75.9%) and almost all (93.1%) individuals reported that their highest level of education was a high school diploma or GED. Almost one-third (28.6%) of the sample reported that they did not know their annual family income, with 21.4% reporting an annual family income between $16,000 and $24,999 and 21.4% over $100,000. Over half of the sample identified as Asian (57.1%) and close to half (42.9%) of the sample identified their religion as Hindu.

All 31 (100%) of the individuals in the UTSC depressed group met criteria for major depressive episode past, with 42.9% meeting criteria for a current major depressive episode, and 71.4% meeting criteria for major depressive disorder. Many of the individuals in the UTSC depressed group also met criteria for one or more anxiety disorders, the most common of which

was generalized anxiety disorder (35.7%), followed by post-traumatic stress disorder (21.4%), and panic disorder limited symptoms (21.4%).

Control group. A total of 29 individuals were included in the control group (20 women, 9 men). The mean age of the sample was 19.76 years (*SD* = 5.22). A small portion of individuals was on current medication (17.5%) and the majority of the sample was right-handed (89.7%). The majority of the sample identified their relationship status as single (75.9%) and almost all (93.1%) individuals reported that their highest level of education was a high school diploma or GED. Over half (58.6%) of the sample reported that they did not know their annual family income and 48.3% identified as Asian (48.3%). In terms of religion, one-third (31.0%) of the sample identified as 'Other', 20.7% identified as Protestant, and 20.7% identified as Muslim.

For individuals in the control group, 6.9% met criteria for substance abuse, 3.4% for panic disorder lifetime, 3.4% for obsessive compulsive disorder, 3.4% for alcohol dependence, and 3.4% for alcohol abuse. No individuals from either depressed groups or the control group met criteria for bipolar NOS, a psychotic disorder, an eating disorder, or ADHD.

Measures

Mini International Neuropsychiatric Interview (M.I.N.I.). The MINI (Sheehan et al., 1998) is a short, semi–structured diagnostic inventory intended to explore 17 disorders based upon the Diagnostic and Statistical Manual for Mental Disorders, fourth edition (DSM-IV-TR, American Psychological Association, 2000). It consists of standardized, structured, closed-end questions throughout its diagnostic procedure. Psychiatric diagnosis is made according to the number of affirmative replies to the specific questions. The MINI has demonstrated excellent inter-rater and test-retest reliabilities (Sheehan et al., 1998) and good convergent validity relative to the Structured Clinical Interview for Diagnostic and Statistical Manual (SCID) (Sheehan et al.,

1997). For the purpose of the current study, an extended version of the MINI (MINI-Plus) was used to describe the sample and establish diagnoses, as it covers a larger time frame (including current and lifetime diagnoses; see Appendix D).

Neuropsychological Assessment Battery Screening Module (S-NAB). The Neuropsychological Assessment Battery (NAB; Stern & White, 2003) is used in the current study to assess objective psychometric neuropsychological test performance. The NAB is a comprehensive battery of tests comprised of the following domain-specific modules: screening, attention, language, memory, visuospatial, and executive functioning. The first module, the Screening Module (S-NAB), is an abbreviated version of the full NAB. The S-NAB consists of 14 brief individual tests, which yield five index scores reflecting the five cognitive domains assessed by the full version of the NAB. The domains (and individual tests) of the S-NAB are listed below:

1. Attention (Orientation, Digits Forward, Digits Backward, Numbers & Letters Efficiency-Part A and Part B)
2. Language (Auditory Comprehension and Naming)
3. Memory (Shape Learning Immediate Recognition, Shape Learning Delayed Recognition, Story Learning Immediate Recall, and Story Learning Delayed Recall)
4. Spatial (Visual Discrimination and Design Construction)
5. Executive Functioning (Mazes and Word Generation)

The Screening Module takes less than one hour to administer. The Screening Module yields standardized scores similar to IQ scores ($M = 100$, $SD = 15$) for the five indexes. The primary test scores are represented as *T*-scores ($M = 50$, $SD = 10$). There are two parallel forms (Form 1 and Form 2) for each of the domain modules. Only Form 1 was used because Form 2

was reserved to reassess participants if the first NAB administration using Form 1 was invalid. The *T*-scores were used as the primary measure of objective psychometric neuropsychological test performance in the present study. Higher *T*-scores indicated better cognitive functioning.

Internal consistency of the five domains assessed in the S-NAB range from .24 to .79 and test-retest reliabilities range from .11 to .71. Cronbach's alpha for the whole S-NAB was found to be .60 (Zgaljardic & Temple, 2010). The S-NAB has also been found to display good construct validity and discriminative ability (Grohman & William Fals-Stewart, 2004; Zgaljardic & Temple, 2010).

Patient Health Questionnaire (PHQ-9; see Appendix E). The PHQ-9 (Kroenke, Spitzer, & Williams, 2001) is a brief self-report instrument designed to assess depression. Although it can be used to establish provisional MDD diagnoses, it is used in the present study to assess the severity of depressive symptoms. The PHQ-9 consists of nine items, each of which maps onto the nine DSM-IV criteria for MDD. Patients indicate how much they have been bothered by the nine symptoms over the past two weeks by responding to a scale that ranges from 0 ("*not at all*") to 3 ("*nearly every day*"). The cut-off scores for severity levels of depressive symptoms are as follows: no depression (0-4), mild depression (5-9), moderate depression (10-14), moderately severe depression (15-19), and severe depression (20-27).

Test sensitivity for the PHQ-9 ranges from 68%-95%, while the test specificity ranges from 84%-95% for MDD. The positive predictive value of the PHQ-9 ranges from 31% to 51% depending on the cut-off value and is similar to those of other instruments. Internal consistency estimates of the PHQ-9 range from .83 to .92 (Cameron, Crawford, Lawton & Reid, 2008). The PHQ-9 was used in the present study to measure the severity of depressive symptoms in the depressed and control groups.

There are a number of reasons for using the PHQ-9 instead of the Beck Depression Inventory (BDI-II) and the Hamilton Rating Scale for Depression (HAM-D), both of which are often cited as the gold standard measure of depression severity. The PHQ-9 has been shown to demonstrate psychometric properties similar to that of the BDI-II, but because it is both shorter and based directly on the DSM-IV diagnostic criteria of depression, it has an advantage over the BDI-II (Titov et al., 2011). A review on the use of the HAM-D (Bagby, Ryder, Schuller, & Marshall, 2005) found that the HAM-D's internal reliability is adequate, but many scale items are poor contributors to the measurement of depression severity, while others have poor interrater and retest reliability. Furthermore content validity was found to be poor and convergent validity and discriminant validity were found to be adequate. The authors argue that it may be time to embrace a new gold standard. In addition to its psychometric limitations, the HAM-D also requires 15 to 30 minutes of clinician time to administer and is therefore not feasible in many practice settings. Furthermore, it can be difficult to score and requires significant training to obtain inter-rater agreement.

Generalized Anxiety Disorder Scale (GAD-7; see Appendix F). The Generalized Anxiety Scale (GAD-7) (Spitzer, Kroenke, Williams, & Lowe, 2006) is a brief, 7-item self-report measure to assess the severity of anxiety symptoms. Individuals are asked to rate their symptoms over the past two weeks on a 4-point Likert-type scale ranging from 0 ("*not at all"*) to 3 ("*nearly every day*"). There is also a final question assessing functional impairment of the symptoms endorsed by the individual. The maximum score for the GAD-7 is 21 with higher scores indicating more severe anxiety symptoms. The GAD-7 was used in the present study to measure anxiety symptoms in both the depressed and control groups.

The GAD-7 has displayed excellent internal consistency (Cronbach $\alpha = .92$) and good test-retest reliability (intraclass correlation = .83). The GAD-7 has also displayed good construct validity, with higher scores more strongly associated with greater functional impairment. Although the comorbidity between Generalized Anxiety Disorder (GAD) and depression is high, factor analysis on the GAD-7 confirmed them as distinct dimensions. There was also good agreement between self-report and interviewer-administered versions of the scale (Spitzer et al., 2006). The GAD-7 has been shown to demonstrate psychometric properties similar to that of the Hamilton Rating Scale for Anxiety (HAM-A) (Kummer, Cardoso, & Teixeira, 2010), but its brevity indicates its advantage over the HAM-A.

Perceived Deficits Questionnaire (PDQ; see Appendix G). The Perceived Deficits Questionnaire (PDQ; Sullivan, Edgley, & Dehoux, 1999) is a 20-item self-report scale used in the present study to measure subjective self-reported cognitive functioning. It assesses perceived cognitive deficits in several domains of cognitive functioning that have been found to be compromised in multiple sclerosis (MS): prospective memory, retrospective memory, attention/concentration, and planning/organization. Individuals indicate how often they have experienced such difficulties during the previous four weeks. Each of the 20 items is scored on a 5-point Likert scale (0 = *never*, 1 = *rarely*, 2 = *sometimes*, 3 = *often*, 4 = *almost always*). The total score for the PDQ is calculated by taking the sum of the raw scores for each of the 20 items. Total scores range from 0 to 80, with higher scores indicating greater cognitive impairment. The PDQ also generates scores for each of the four subscales. Subscale scores range from 0 to 20 and are generated by calculating the sum of the raw scores of specific sets of items as follows: attention/concentration (items 1, 5, 9, 13, 17), retrospective memory (items 2, 6, 10, 14, 18), prospective memory (items 3, 7, 11, 15, 19), and planning/organization (items 4, 8, 12, 16, 20).

Marrie, Miller, Chelune, and Cohen (2003) found that the PDQ demonstrated acceptable test-retest reliability when re-administered one to four weeks after initial administration, with test-retest reliability coefficient of .85 in a cognitively unimpaired MS sample and .84 in a cognitively impaired MS sample. The PDQ has demonstrated good internal consistency. Cronbach's alpha for the cognitively unimpaired MS sample was .93 and alpha for the cognitively impaired MS sample was .95. Sullivan et al. (1999) reported that the full-length version of the PDQ has a Cronbach's alpha of .93.

The PDQ has also been found to differentiate between levels of depression; PDQ scores for severely depressed individuals has been found to be significantly higher than PDQ scores for nondepressed controls on all four subscales (Lawrence, Roy, Harikrishnan, Yu, & Dabbous, 2013). The PDQ was used to measure subjective self-reported cognitive functioning in both the depressed and control groups. Since the PDQ does not assess the cognitive domains of language and visuospatial functioning, the PCIQ (see below) was used to cover the full range of cognitive functioning.

Perceived Cognitive Impairment Questionnaire (PCIQ; see Appendix H). The Perceived Cognitive Impairment Questionnaire (PCIQ) was developed by the investigator for the purposes of this study and was designed specifically to be a subjective self-report measure that corresponds to the S-NAB in the assessment of five cognitive domains: attention, memory, language, visuospatial, and executive functioning. The PCIQ was created by adapting questions from an Alzheimer's screening questionnaire (Masellis & Black, 2008) that assesses attention, memory, language, visuospatial problems, judgment, praxis, mood, personality and behaviour, and daily functioning. Only questions that pertained directly to the cognitive domains of interest

were used and were modified to be similar in structure as questions on the Perceived Deficits Questionnaire (PDQ).

The PCIQ is a 17-item self-report scale that measures five areas of cognition: attention, memory, visuospatial, language, and executive functioning. Individuals answer how often they have experienced such difficulties during the previous four weeks. Scores for each of the 17 items of the PCIQ is scored on a 5-point Likert-type scale (0 = *never*, 1 = *rarely*, 2 = *sometimes*, 3 = *often*, 4 = *almost always*). The total score for the PCIQ is calculated by taking the sum of the raw scores for each of the 17 items. Total scores range from 0 to 68, with higher scores indicating greater cognitive impairment. The PCIQ was used in addition to the PDQ, since it covers additional areas, as a measure of subjective self-reported cognitive functioning. Where there is an overlap in the cognitive domains (attention, memory, executive functioning) covered by both PDQ and PCIQ, the PDQ was considered to be the primary measure for these domains because it is a more established scale. Since the PDQ does not measure the full range of cognitive domains assessed by the S-NAB, specifically the domains of language and visuospatial functioning, the PCIQ was created as a supplementary measure to address these domains.

Sheehan Disability Scale (SDS; see Appendix I). The Sheehan Disability Scale (SDS) is a three-item self-report scale assessing the impact of symptomology on functional impairment (Sheehan, 1983) in three domains: work, social and family. Responses are scored on an 11-point scale having response options labeled none (0), mild (1-3), moderate (4-6), severe (7-9), and very severe (10). The scale generates four scores: a work disability score, a social life disability score, a family life disability score, and a total score. A total score is derived by adding up the other three individual scores (work, social life, family life). The maximum possible score is 30 where higher scores indicate more severe functional impairment. The SDS has high internal

consistency reliability (α = 0.89) and construct validity (Leon, Olfson, Portera, Farber, Sheehan, 1997). The SDS also displays high discriminative validity, as patients with major depression or panic disorder have been found to score higher on the SDS than patients with chronic medical conditions or with no chronic pathology. Furthermore, a cut-off score of 8 in the SDS has been found to adequately discriminate between patients with and without depression, with a sensitivity of 82% and a specificity of 71% (Luciano et al., 2010). The total score on the SDS was used to establish functional impairment in both the depressed and control groups.

Procedure

Patients at the START Clinic were informed about the present study. Those who expressed interest were scheduled for individual appointments by the current investigator. The standard consent form that they completed for assessment at the clinic (see Appendix J) served as the research consent form; the standard form covers consent for assessment data to be part of on-going research efforts at the clinic. At the UTSC site, introductory psychology students logged onto a website that listed various studies that students could participate for course credit. The description for this study indicated that students would undergo performance-based neuropsychological tasks and complete self-report measures looking at cognition, mental health, and functional impairment. The description also indicated that the experiment would take a maximum of three hours and that students would be credited with three points for their participation. Those students who were interested were able to sign up for individual appointments at the lab.

Part 1. Part 1 included an introduction and overview of the research study to potential participants, followed by a review of the consent form (see Appendix J and K, respectively, for START Clinic and UTSC participants). Participants were informed that they would be engaging

in a number of game-like tasks meant to tap functions such as attention, memory, concentration, and other mental abilities. They were also told that some of the tasks were simple, while others were more difficult and may cause some frustration. Finally participants were told that they would be timed on certain tasks, but that they should ignore this and just try their best. If the participant felt comfortable with the study protocol and signed the consent form, the objective neuropsychological test (S-NAB) was completed. The S-NAB was completed before the structured clinical interview in order to reduce any effects of the MINI on the performance on the NAB.

Part 2. In Part 2, the structured clinical interview (MINI-Plus) was completed. The results were used to establish diagnoses and for classification of participants into the depressed and control groups.

Part 3. In Part 3, a medical and socio-demographic questionnaire (see Appendix M and N, respectively) was given to each participant, followed by a questionnaire package consisting of self-report measures. The measures in the package included the Patient Health Questionnaire (PHQ)-9, the Perceived Deficits Questionnaire (PDQ), the Perceived Cognitive Impairment Questionnaire (PCIQ), and the Sheehan Disability Scale (SDS). The order of the self-report measures was counterbalanced across participants such that any measure that was presented first to a participant would be re-sequenced to the bottom of the pile of measures for the next participant.

Part 4. Part 4 took place immediately after the participants filled out all the questionnaires. The participants at the START Clinic were debriefed by Dr. Katzman and provided with treatment where needed. The participants from the UTSC site were debriefed verbally by the current investigator (see Appendix O). Those who had significant psychological

distress as measured by the MINI were further assessed by Dr. Zakzanis and offered relevant treatment.

Results

Pre-analysis Issues

Missing data. The data was entered into the Statistical Package for the Social Sciences (SPSS) and was screened for missing items. For participants with a small number (less than 5%) of missing scale or subscale items, each missing item was replaced with the mean value for that particular group on that item (Tabachnick & Fidell, 2007).

Univariate and multivariate outliers. The data was also screened for univariate and multivariate outliers. Within group univariate outliers are cases within each group with extreme values on one variable that can distort results (Tabachnick & Fidell, 2007). To screen for univariate outliers, scores on all scale items were standardized into z-scores in SPSS. Once transformed, any cases with a z-score that exceeded ±3.29 were identified as univariate outliers (Tabachnick & Fidell, 2007). Each raw score for the outlier was moved to a raw score that was within plus or minus three standard deviations of the mean. This would make the case extreme with respect to the group that it is in, but would not have undue influence on the overall results.

Multivariate outliers are cases with unusual combinations of scores on two or more variables that can distort results (Tabachnick & Fidell, 2007). Multivariate outliers were assessed using Mahalanobis' distance and Cook's *D*. The Mahalanobis distance measures the distance between a case and its distribution. Cook's *D* measures the combined influence of a case being an outlier on *y* and on a set of predictors (Stevens, 2002). Influential outliers were defined as those with a Mahalanobis distance with χ^2 value that was significant at $p < .001$ and a

Cook's *D* that exceeded the value of one (Stevens, 2002). Using this method, no multivariate outliers were identified.

Multicollinearity. Analysis of the correlations among all variables for the total sample was conducted to test for multicollinearity (see Table 3 for the complete correlation matrix). Multicollinearity is present if two or more variables are highly correlated with one another (r = .90 or greater), which can cause redundancy (Tabachnick & Fidell, 2007). In the present analysis, correlations between subscales ranged from ranged from r = -.27 to r = .75. As there were no variables that reached the cut-off value of r = .90, multicollinearity was not present.

Further examination revealed that a number of variables were significantly correlated. The subjective measures were correlated with the functional impairment measures and ranged from .05 to .63. Severity of depression was significantly correlated with the objective language (r = -.25, p < .05) and visuospatial (r = -.24, p < .05) modules. Severity of depression was also significantly correlated with all subjective cognitive measures as well as all functional impairment subscales. The objective cognitive measures were not significantly correlated with any of the subjective cognitive measures or any of the functional impairment measures.

Comparison of groups. Analyses were undertaken to determine whether the UTSC depressed group and the START depressed group should be pooled together into one large depressed group. A one-way analysis of variance (ANOVA) revealed significant differences between the groups on severity of depression, $F(2, 71) = 4.20$, p = .02. Post hoc analyses using Tukey's honestly significant difference (HSD) revealed that the UTSC depressed group (M = 13.14, SD = 5.33) was more severely depressed than the control group (M = 7.10, SD = 5.87), p = .01, d = 1.08, but that there was no significant difference between the START depressed group

(M = 9.13, SD = 7.25) and the control group (M = 7.10, SD = 5.87), p = .44, d = 0.31, or between the two depressed groups, p = .13, d = 0.63.

Using a one-way ANOVA, significant differences were also found between the groups on age, $F(2, 71) = 54.14$, p = .00. Post hoc analyses using Tukey's HSD revealed that there was a significant difference between the START depressed (M = 42.35 years, SD = 13.45) and UTSC depressed groups (M = 18.64, SD = 1.78), p = .00, d = 2.47, and between the START depressed (M = 42.35 years, SD = 13.45) and control groups (M = 19.76 years, SD = 5.22), p = .00, d = 2.21. Based on Cohen's (1988) recommendations, the effect size between the groups can be considered large, further supporting the difference between the groups. No significant differences were found between the UTSC depressed and control groups, p = .93, d = 0.29. This result is not surprising, as both groups consisted of university students who were recruited from UTSC.

Differences between the three groups were also compared for gender. A chi-square test found no significant difference between the groups, χ^2 (2, N = 74) = 3.64, p = .16. Thus, the groups did not differ with respect to gender.

Since no significant differences were found between the START and UTSC depressed groups on severity of depression or gender, they were combined into one depressed group. An ANOVA was carried out to determine whether the combined depressed group and the control group differed on severity of depression. The results showed that the groups significantly on severity of depression, $F(1, 72) = 4.44$, p = 0.39, with the combined depressed group (M = 10.38, SD = 6.91) reporting more severe depressive symptoms than the control group (M = 7.10, SD = 5.87).

Anxiety. Anxiety is often found among individuals with depression (Lamers et al., 2011) and can interfere with test performance (Airaksinen, Larsson, & Forsell, 2005; Snyder, 2013), and influence self-report (Eysenck, 1997). Thus, the effects of anxiety may unduly influence the dependent variables. The effects of anxiety can be statistically controlled in covariate analysis. However, two criteria must be met: 1) the groups must differ on anxiety and 2) anxiety must be related to the dependent variables.

To determine if the depressed and control groups differed with respect to anxiety, a one-way ANOVA was conducted. A significant difference was found between the groups on anxiety, $F(1, 71) = 12.11$, $p = .001$, $d = 0.85$, with the depressed group ($M = 10.07$, $SD = 6.77$) having significantly higher anxiety than the control group ($M = 4.97$, $SD = 5.04$). Based on Cohen's (1988) recommendations, the effect size between the groups can be considered large, further supporting the difference between the groups.

To determine whether anxiety was related to the dependent variables, bivariate correlation analyses were carried out. It was found that anxiety was significantly correlated with the subjective subscales of attention ($r = .49$, $p < .01$), memory ($r = .39$, $p < .01$), and executive functioning ($r = .45$, $p < .01$). It was also significantly correlated with functional impairment in the domains associated with work ($r = .50$, $p < .01$), family ($r = .51$, $p < .01$), and social life ($r = .54$, $p < .01$). No other significant correlations were observed.

Given that the two aforementioned criteria were met only for the subjective self-report of cognitive functioning and impairment variables, anxiety was used as a covariate in the analyses involving these variables. Anxiety was not partialled out in analyses involving the objective psychometric neuropsychological test measures.

Main Analyses

Table 4 presents the mean and standard deviation of all dependent variables by group and total sample. Table 5 displays correlations among all the dependent variables for the depressed group only.

Group differences on objective psychometric neuropsychological test measures. A multivariate analysis of variance (MANOVA) was conducted to determine group differences on objective psychometric neuropsychological test measures in the domains of attention, memory, language, visuospatial functioning, and executing functioning. Using this method, a statistically significant difference was found, $F(5, 68) = 2.76$, $p = .025$, Wilk's $\lambda = .83$, partial $\eta^2 = .17$. Follow-up tests revealed that there was a significant group difference on the objective executive functioning subscale, $F(1, 72) = 6.48$, $p = .01$, partial $\eta^2 = .17$, $d = 0.60$, with the control ($M = 89.41$, $SD = 15.52$) group performing significantly worse than the depressed group ($M = 98.33$, $SD = 14.17$).

Group differences on subjective self-report of cognitive functioning. A multivariate analysis of covariance (MANCOVA) was conducted to determine the group differences on subjective self-report of cognitive functioning in the domains of attention, memory, language, visuospatial functioning, and executing functioning, with anxiety as the covariate. Using this method, a statistically significant difference was found, $F(5, 67) = 5.88$, $p = .00$, Wilk's $\lambda = .70$, partial $\eta^2 = .31$. Follow-up tests revealed that there was a significant group difference on the subjective visuospatial subscale, $F(1, 72) = 8.74$, $p = .00$, partial $\eta^2 = .11$, $d = 0.54$ with the depressed group ($M = 3.09$, $SD = 2.73$) reporting significantly fewer visuospatial functioning deficits than the control group ($M = 4.52$, $SD = 2.52$).

Group differences ups on functional impairment. A MANCOVA was also conducted to determine group differences on functional impairment in the domains of work, social, and family, with anxiety as the covariate. Using this method, a statistically significant difference was found, $F(3, 69) = 6.25$, $p = .00$, Wilk's $\lambda = .79$, partial $\eta^2 = .21$. Follow-up tests revealed that there was a significant group difference on all three of the subscales, with the depressed group reporting greater functional impairment than the control group in work, $F(1, 71) = 7.84$, $p = .01$, partial $\eta^2 = .10$, $d = 1.04$, social, $F(1, 71) = 15.21$, $p = .00$, partial $\eta^2 = .18$, $d = 1.31$, and family, $F(1, 71) = 14.24$, $p = .00$, partial $\eta^2 = .17$, $d = 1.31$, domains (see Table 4 for group means).

Depressed group: Relationship between severity of depression and cognitive measures. Bivariate correlation analyses were conducted to determine the relationship between severity of depression, and both the objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning in the depressed group (see Table 5). There was a significant correlation between the PHQ-9 and the following subjective domains: attention ($r = .46$, $p < .01$), memory ($r = .40$, $p < .01$), executive functioning ($r = .47$, $p < .01$), and language ($r = .45$, $p < .01$). No other significant correlations were found.

Depressed group: Relationship between severity of depression and functional impairment. There were significant correlations between the severity of depression and functional impairment in domains associated with work ($r = .42$, $p < .01$), social ($r = .43$, $p < .01$), and family ($r = .55$, $p < .01$).

Depressed group: Relationship between cognitive measures. Bivariate correlation analyses were conducted to determine the relationship between objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning in the domains of attention, language, memory, visuospatial functioning, and executive functioning

(see Table 5). Only three significant relationships were found: objective attention and subjective attention (r = -.44, p < .01), objective executive functioning and subjective executive functioning (r = -.30, p < .05), and objective executive functioning and subjective attention.

Depressed group: Relationship between objective psychometric neuropsychological test measures and functional impairment. Correlational analyses were conducted to determine the relationship between objective psychometric neuropsychological test measures (attention, language, memory, visuospatial functioning, executive functioning) and functional impairment (work, family, social). As can be seen from Table 5, significant relationships were found between objective attention and family functioning (r = -.37, p < .05), objective language and work (r = -.35, p < .05), and objective language and social functioning (r = -.30, p < .05).

Depressed group: Relationship between subjective self-report of cognitive functioning and functional impairment. Bivariate correlation analyses were conducted to determine the relationship between subjective self-report of cognitive functioning (attention, language, memory, visuospatial functioning, executive functioning) and functional impairment in the three domains (work, social, family). It was observed that subjective attention, memory, executive functioning, and language were all significantly correlated with greater self-reported functional impairments in all three domains (see Table 5).

In the work domain, the highest correlation was found for subjective attention (r = .53, p < .01) and the lowest correlation was found for subjective executive functioning (r = .38, p < .05). In the social domain, the highest correlation was found for subjective attention (r = .63, p < .01) and the lowest correlation was found for subjective memory (r = .47, p < .01). In the family domain, the highest correlation was found for subjective attention (r = .56, p < .01) and the

lowest correlation was found for subjective language ($r = .47$, $p < .01$). No other significant correlations were found.

Discussion

The objective of the present study was to investigate the concordance between objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning in depression and its relationship to functional impairment (work, social, family). The domains of cognitive functioning that were examined were attention, memory, language, visuospatial functioning, and executive functioning. Seven hypotheses were proposed. The first three addressed differences between the depressed and control groups, and the remaining four looked at associations among objective and subjective cognitive measures and functional impairment within the depressed group only.

Findings Regarding Group Differences

The first hypothesis, which stated that the depressed group would perform more poorly than the control group on objective psychometric neuropsychological test measures in the domains of attention, memory, visuospatial functioning, and executive functioning, was not supported. Contrary to the hypothesis, the control group was found to perform significantly worse than the depressed group on the executive functioning module. Based on Cohen's (1988) recommendations, analyses also revealed a medium to large effect size between the groups on the executive functioning module, further supporting the difference between the groups. Furthermore, the results showed that there was no significant difference between the groups in the domains of attention, memory, language, or visuospatial functioning.

These results are not consistent with previous research showing that individuals with depression score worse than nondepressed controls on tests of executive functioning (Henry &

Crawford, 2005; Naismith et al., 2003; Rogers et al., 2004; Zakzanis et al., 1998). However, a review shows that there have been inconsistent findings in the literature on performance-based cognitive deficits in depression (McClintock, Husain, Greer, & Cullum, 2010). It has been postulated that this could be due to differences across studies in sample characteristics and/or in methods used to assess cognitive dysfunction (Burt et al., 1995; Zakzanis et al., 1998).

In the present study, the screening module of the S-NAB was employed to measure objective performance-based cognitive functioning. The screening module is normally used to identify individuals who may benefit from further comprehensive neuropsychological assessment (Stern & White, 2003). It is possible that the screening module was not sensitive enough to detect cognitive differences between the depressed and control groups. Additionally, the specific characteristics of the samples used in this study may also have contributed to the absence of significant findings. At the time of the study, almost half (42.2%) of the depressed group was using psychiatric medication, some of which included selective serotonin reuptake inhibitors (SSRIs), selective norepinephrine reuptake inhibitors (SNRIs), norepinephrine dopamine reuptake inhibitors (NDRIs), and atypical antidepressants such as Vorioxetine (see Table 6). These classes of psychiatric medications have all been associated with improved cognitive functioning in depression (Greer, Sunderajan, Grannemann, Kurian, & Trivedi, 2011; Pehrson et al., 2015; Raskin et al., 2007; Rosenblat, Kakar, & McIntyre, 2015). Since none of the control participants were on psychiatric medications as expected, it is possible that group differences were not found on objective cognitive measures due to the effects of psychiatric medication.

The lack of a significant difference between the groups on objective psychometric neuropsychological test measures may also be explained by differences in motivation between

the two groups. The control group was recruited entirely from UTSC and were participating for the purposes of course credit. These individuals would have received course credit regardless of how much effort they put forth on the S-NAB. On the other hand, the majority of individuals in the depressed group were recruited from the START Clinic; these individuals were participating because information gained from the study would inform their treatment planning. Thus, it is possible that the control group may have been less motivated to try their hardest on the S-NAB than the depressed group. Supporting this notion, previous research has found that undergraduate university students may put forth suboptimal effort during neuropsychological testing (An, Zakzanis, & Joordens, 2012). This may also explain why the control group performed worse than the depressed group on the S-NAB executive functioning module. However, this must be interpreted with caution since this effect was only found for the executive functioning module of the S-NAB.

The resource-allocation hypothesis suggests that individuals with depression have a reduced cognitive capacity, which leads to deficits in cognitive functioning (Ellis & Ashbrrok, 1988). According to this view, individuals with depression allocate a significant amount of their attentional resources on ruminations (perseverating self-focused thoughts), a hallmark of depression, thereby preventing these resources from being allocated to the cognitive task at hand (Gotlib & Joorman, 2010; Levens, Muhtadie, Gotlib, 2009). In support of this, Hertel (1998) found a comparable memory recall deficit between dysphoric students who, between study and recall phases, were not given any instructions on what to do during the waiting period (unconstrained situation) and dysphoric students who were instructed to rate self-focused material designed to induce rumination. In contrast, no recall deficit was found for dysphoric students who were instructed to rate self-irrelevant and task-irrelevant material (constrained

condition). These results suggest that, at least with respect to memory deficits, individuals with depression have the ability to perform at the level of their nondepressed counterparts in structured/constrained situations but may not be able to function at this level on their own initiative in unconstrained situations. The participants in the present study completed the S-NAB under structured conditions, such that there was no point in which they would have had time to ruminate during the administration. Perhaps, completing the S-NAB in a structured environment that eliminated the opportunity for rumination to occur also eliminated impairment on the cognitive tasks, a result that might explain why there was no difference in objective psychometric neuropsychological test performance between the depressed and control groups, with the exception of the executive functioning module.

The second hypothesis, which stated that the depressed group would report greater impairment than the control group on subjective self-report of cognitive functioning in the domains of attention, memory, and executive functioning, was not supported. Results showed that the depressed and control groups did not differ on self-reported attention, memory or executive functioning. This could again be due to specific sample characteristics. As noted above, most of the individuals in the depressed group were on current medications and this may have improved their cognitive functioning. Another possibility is that these null results are due to the use of self-report measures. Self-report are subject to the influence of social desirability (Murphy & Davidshofer, 2005). Possibly, the depressed group did not want to report that they were experiencing cognitive difficulties, and could have inflated their self-report of cognitive functioning. However, this is not likely because there is a large body of research to indicate that depressed individuals have negative thinking particularly with respect to themselves and are more likely to self-report in a negative or pessimistic manner (Joormann et al., 2015). It is

possible that the depressed participants had a frame of reference that was different from the one used by the participants in the control group. If the depressed group had been having depressive symptoms for an extended period of time, they might have relied on their usual level of functioning (i.e., depressed) as the norm in their self-report, while the nondepressed control group could have used their usual euthymic states as the norm. Consequently, the depressed group might have reported their current functioning as no different from the control group because the two groups were using different standards of reference.

Interestingly, a significant difference between the groups was found on the subjective visuospatial subscale, with the control group reporting greater visuospatial functioning deficits than the depressed group. Based on Cohen's (1988) recommendations, analyses also revealed a medium effect size between the groups on the executive functioning module, further supporting the difference between the groups. No studies have looked at subjective cognitive complaints associated with depression in the visuospatial functioning domain. This is a novel and interesting finding, suggesting that individuals with depression report fewer visuospatial cognitive deficits than their nondepressed counterparts. This effect could be due to the use of the PCIQ, which was developed specifically for the purposes of this study. The PCIQ has not been validated and thus the extent to which it accurately measures the domains it purports to measure (visuospatial and language) is questionable.

The third hypotheses stated that the depressed group would report greater functional impairment than the control group in work, social, and family domains. This hypothesis was fully supported, as significant group differences were found on all three subscales of the SDS (work, social, family), with the depressed group reporting greater functional impairment than the control group. Based on Cohen's (1988) recommendations, analyses also revealed a large effect

size between the groups on all three functional impairment domains, further supporting the difference between the groups. This finding is consistent with previous literature that shows depression to be associated with impairment in the social and family domains (Coyne et al., 2002; Johnson et al., 2000; Kessler & Bromet, 2013; Mickelson, 2001; Nasser & Overholser, 2005; Windle, 1994), as well as the work domain (Adler et al., 2006; Gilmour and Patten, 2007).

Severity of Depression

The fourth hypothesis stated that within the depressed group, greater severity of depression symptoms would predict poorer performance in objective psychometric neuropsychological test measures in the domains of attention, memory, visuospatial functioning, and executive functioning and greater self-rated cognitive dysfunction in the domain of memory. This hypothesis was supported only for subjective memory. This is consistent with previous literature that shows that subjective self-reported memory complaints are directly related to the presence and severity of depressive symptoms (Naismith et al., 2007). Severity of depression was not related to any of the objective psychometric neuropsychological test measures. Although some research has found that severity of depression is associated with objective psychometric neuropsychological test measures (e.g. Naismith et al., 2003; Porter et al., 2003), contradictory results have also been reported and again have been attributed to variability in the samples and methodology used across studies (McDermott & Ebmeier, 2009).

Other significant relationships were found between severity of depression and subjective self-report of attention, executive functioning, and language in the depressed group. Severity of depression was also significantly correlated with all three functional impairment subscales in the depression group. When looking at the total sample (depressed and controls combined), a similar pattern emerged: significant relationships were found between severity of depression and

all subjective self-report of cognitive functioning as well as all functional impairment domains. Overall, these results suggest that individuals with more severe depression are more likely to self-report both greater cognitive deficits and functional impairment, but they may not display such cognitive deficits on objective psychometric neuropsychological test measures. This is consistent with previous research conducted by Svendsen et al. (2012), who found that severity of depression predicted subjective self-report of cognitive functioning but not objective psychometric neuropsychological test measures.

According to Beck's (1967) theory of depression, individuals with depression have negative thoughts about the self, the world, and the future. Individuals who have more severe depression would have more negative thoughts about themselves and may perceive themselves as performing more poorly on objective psychometric neuropsychological test measures, hence rating themselves as more cognitively impaired. This perception of cognitive impairment may not however be reflective of their actual behaviour on neuropsychological tests, reflected in the present study by the null association between the PHQ-9 and the S-NAB.

Concordance Between Cognitive Measures in Depression

Hypothesis five, which stated that there would be a positive relationship between subjective self-report of cognitive functioning and objective psychometric neuropsychological test measures in the domains of attention, memory, and executive functioning in the depressed group, was partially supported. Specifically, poorer objective psychometric neuropsychological test performance was significantly associated with greater self-reported cognitive impairment in the domains of attention and executive functioning, but not memory. There was also no significant relationship between objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning in the domains of memory, language, or

visuospatial functioning. This is the first study to investigate the concordance between objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning in depression using domains that map directly onto each other. These results suggest that individuals with depression might have greater insight into their functioning in the areas of attention and executive functioning and less insight with respect to the remaining areas of memory, language, and visuospatial functioning. Although some authors have postulated that the use of self-report with patients with depression is problematic because they are prone to cognitive biases in their thinking (Joormann et al., 2015), which can in turn affect their subjective reports, it seems that this might not be the case at least in the area of attention and executive functioning. Rather, the results of this study suggest that individuals with depression are aware of their objective performance-based cognitive deficits in these two domains and are able to accurately report such deficits, as their self-report of cognitive functioning match up with how they objectively performed on psychometric neuropsychological test measures. The implication from this finding is that subjective self-report of cognitive functioning could potentially be used with individuals with depression in place of more expensive and time-intensive objective psychometric neuropsychological test measures only in areas associated with attention and executive functioning in order to gauge their general level of cognitive functioning. However, if the objective of assessment is to establish the precise level of cognitive functioning, objective psychometric neuropsychological testing is always required. This is in part due to the fact that using objective psychometric neuropsychological test measures with individuals offers important behavioural information that subjective self-report does not.

Cognitive Functioning and Functional Impairment in Depression

Hypothesis six, which stated that poorer performance on objective psychometric neuropsychological test measures would predict greater functional impairment associated with work within the depressed group, was supported. The results showed that poorer performance on the S-NAB language module was associated with greater impairment in the work and social domains, and that poorer performance in the S-NAB attention module was linked to greater impairment in the family domain.

The seventh and final hypothesis, which stated that poorer subjective self-report of cognitive functioning would predict greater functional impairment in all domains (work, social, family), was also fully supported. Overall, these results are consistent with previous work showing that objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning are differentially related to different forms of impairment in depression (Naismith et al., 2007).

The results of this study show that objective language is associated with work impairment and objective attention is associated with family impairment. Subjective self-report of cognitive functioning in all five cognitive domains (attention, memory, language, visuospatial functioning, executive functioning) were correlated with functional impairment in all domains (work, family, social). Based on these results, it seems that self-report of cognitive functioning may be a better predictor of self-reported functional impairment overall, although some objective cognitive domains may predict impairment in certain areas of functioning.

It is possible, however, that the finding that subjective self-report of cognitive impairment were a better predictor of functional impairment overall may be due to the fact that the measure of functional impairment used (i.e. the SDS) was self-report in nature as well. It would be

expected that individuals who perceive themselves to be cognitively impaired would also perceive themselves to be functionally impaired. However, this perceived impairment might not be reflective of actual objective performance-based cognitive deficits.

Summary

Overall, when comparing the depressed and control groups, results showed that individuals with depression did not differ in either objective psychometric neuropsychological test measures or subjective self-report of cognitive functioning. There were two exceptions to this: the control group performed significantly worse on objective executive functioning and self-reported more visuospatial deficits than the depressed group. Results also suggest that those with depressed tended to report greater functional impairment in all domains than controls. However, when looking at depression from dimensional perspective by considering severity of depression, rather than looking only at group differences (i.e. depressed and nondepressed), a different pattern emerged. It appears that degree of self-reported impairment was related to severity of depression, such that those with more severe depression tended to self-report greater cognitive deficits and functional impairment. Severity of depression was however unrelated to objective psychometric neuropsychological test performance.

When considering the depressed group only, a concordance was found between objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning in the domains of attention, memory, and executive functioning. This suggests that individuals with depression are aware of their objective performance-based cognitive deficits in these domains and are able to accurately report such deficits, as their self-report of cognitive functioning match up with how they objectively performed on psychometric neuropsychological test measures.

Finally, both objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning were associated with functional impairment, albeit in different domains. Specifically, cognitive performance in two of the five objective domains was predictive of certain domains of functional impairment. Subjective self-report of cognitive functioning in all five domains (attention, memory, language, visuospatial functioning, executive functioning) were correlated with self-report of functional impairment in all three domains (work, family, social). Collectively, these results suggest that that subjective self-report of cognitive functioning may a better predictor of self-reported functional impairment overall, although performance on objective psychometric neuropsychological test measures in certain domains may predict impairment in certain areas of self-reported functional impairment.

Strengths and Limitations

The results must be viewed within the strengths and limitations of the present study. Although there have been a few studies conducted that investigate the relationship between objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning, none of these studies have used measures with cognitive domains that map directly onto each other (Naismith et al., 2007; Svendsen et al., 2011). Therefore, the extent to which a consensus about the concordance between these types of measures in depression can be drawn from these results is limited. Furthermore, no studies have looked at subjective self-reported cognitive functioning in visuospatial or executive functioning. Thus, a strength of the current study is that the results provide new information to the area of depression. Although some limitations exist, the present study has implications for future research and for the assessment of cognitive functioning in depression.

Another strength of the current study is the use of clinical sample. The majority of the depressed group was recruited from a mood and anxiety disorder clinic, which confirms that the primary complaint for these individuals was mood-related. This increases the generalizability of the findings from the present study to the depressed population.

It is also important to consider the limitations of the present study and how they may have contributed to the pattern of results. One limitation of the present study is that medication use, particularly antidepressant use, was not controlled for. Previous research has found that use of certain antidepressants is associated with cognitive improvement in depression (Greer et al., 2011; Pehrson et al., 2015; Raskin et al., 2007; Rosenblat et al., 2015). Thus, it is possible that cognitive impairment in the depressed group may have been improved by medication use, thus leading to the null result between the depressed and control group on objective cognitive performance, with the exception of the S-NAB executive functioning module.

Another limitation is that individuals were recruited from different sites, which may have led to significant differences between the groups. Participants from both sites were heterogeneous in the duration of their depression, depression severity, chronicity of depression, comorbid conditions, and treatment history. These clinical factors may have influenced their degree of cognitive and/or functional impairment (Austin et al. 2001; Baune, McAfoose, Leach, Quirk, & Mitchell, 2009; Elgamal, Denburg, Marriott, & MacQueen, 2010).

A third limitation of the present study is that the PCIQ was developed for the purposes of this study and has not been validated or used in other studies. Thus, the extent to which the PCIQ actually measures language and visuospatial functioning is questionable. The PCIQ was developed because no existing self-report measures of language or visuospatial functioning for use in depression were identified for use in the present study. However, the questions used on

the PCIQ were developed from an existing questionnaire for Alzheimer's disease (Masellis & Black, 2008). Furthermore, the questions have high face validity and thus subjectively appear to measure the constructs in question.

Conclusions and Future Directions

As a whole, the results of this study provide evidence of the concordance between objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning in depression in the domains of attention, memory, and executive functioning. The results also suggest that subjective self-report of cognitive functioning are a better predictor of self-reported functional impairment overall than are objective psychometric neuropsychological test measures and that severity of depression is associated with self-report measures of cognitive functioning and functional impairment, but not objective tests. The implication of these results is that self-report measures are reliable indicators of one's objective performance-based cognitive functioning in the domains of attention, memory, and executive functioning, and clinicians wishing to gauge cognitive functioning in these areas in those with depression may be able forgo lengthy and costly objective neuropsychological assessment.

There were a number of factors that may have affected the results of the present study. Particularly, antidepressant use, the presence of comorbid conditions, and the chronicity of depression have been found to impact the degree of cognitive impairment in depression (Austin et al. 2001; Baune et al., 2009; Elgamal et al., 2010; Pehrson, 2015). These three variables were not controlled for in the present study, thus the extent to which they may have contributed to the pattern of results is not known. Future research should seek to replicate the current research while controlling for these variables.

The cognitive domains examined in the present study included attention, memory, language, visuospatial functioning, and executive functioning. Others have argued that cognition may include other domains, such as motor function, involving psychomotor speed, and social cognition, which includes affective and emotional functioning (APA, 2013). As these domains were not specifically examined in the present study, future research should investigate the concordance between objective psychometric neuropsychological test measures and subjective self-report of cognitive functioning in these areas.

At the time of the study, there existed no established, validated self-report measures of cognitive functioning that directly mapped onto the cognitive domains assessed using the S-NAB. As a result, such a measure was created by the investigator for the purposes of the present study. Future research should address this limitation in the literature and results of this study should be replicated using a validated self-report measure of cognitive functioning.

Results of this study showed that subjective self-report of cognitive functioning were a better predictor of functional impairment overall than were objective psychometric neuropsychological test measures. It is possible that this effect may be due to the fact that the measure of functional impairment used in this study was subjective (i.e. self-report) in nature as well, and self-report measures used in depression are often influenced by negative bias (Joorman et al., 2015). Thus, a final suggestion is that future studies should utilize both self-report and objective or observer-rated measures of functional impairment in order to determine whether objective psychometric neuropsychological test measures or subjective self-report of cognitive functioning are better predictors of functional impairment.

References

Adler, D. A., McLaughlin, T. J., Rogers, W. H., Chang, H., Lapitsky, L., & Lerner, D. (2006). Job performance deficits due to depression. *American Journal of Psychiatry, 163*(9), 1569-1576. doi: 10.1176/appi.ajp.163.9.1569

Agarwal, A. K., Kalra, R., Natu, M. V., Dadhich, A. P., & Deswal, R. S. (2002). Psychomotor performance of psychiatric inpatients under therapy: Assessment by paper and pencil tests. *Human Psychopharmacology Clinical and Experimental Journal, 17*, 91-93. doi: 10.1002/hup.364

Airaksinen, E., Larsson, M., & Forsell, Y. (2005). Neuropsychological functions in anxiety disorders in population-based samples: Evidence of episodic memory dysfunction. *Journal of Psychiatric Research, 39*, 207-214. doi: 10.1016/j.jpsychires.2004.06.001

Alfridi, M. I., Hina, M., Qureshi, I. S., & Hussain, M. (2011). Cognitive disturbance comparison among drug-naïve depressed cases and healthy controls. *Journal of the College of Physicians and Surgeons Pakistan, 21*(6), 351-355. doi: 07.2011/JCPSP.351355

Allgöwer, A., Wardle, J., & Steptoe, A. (2001). Depressive symptoms, social support, and personal health behaviors in young men and women. *Health Psychology, 20*(3), 223-227. doi: 10.1037/0278-6133.20.3.223

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text revision). Washington, DC: Author.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

An. K. Y., Zakzanis, K. K., & Joordens, S. (2012). Conducting research with non-clinical healthy undergraduates: Does effort play a role in neuropsychological test performance?

Archives of Clinical Neuropsychology, 27(8), 849-857. doi: 10.1093/arclin/acs085

Antikainen, R., Hänninen, T., Honkalampi, K., Hintikka, J., Koivumaa-Honkanen, H., Tanskanen, A., & Vinamäki, H. (2001). Mood improvement reduces memory complaints in depressed patients. *European Archives of Psychiatry and Clinical Neuroscience, 251*(1), 6-11. doi: 10.1007/s004060170060

Arciniegas, D. B., McAllister, T. W., & Kaufer, D. I. (2007). Cognitive impairment. In C. E. Coffey, T. W. McAllister, & J. M. Silver (Eds.), *Guide to Neuropsychiatric Therapeutics* (pp. 24-78). Philadelphia: Lippincott Williams & Wilkins.

Asthana, H. S., Mandal, M. K., Khurana, H., & Haque-Nizamie, S. (1997). Visuospatial and affect recognition deficit in depression. *Journal of Affective Disorders, 48*, 57-62. doi: 10.1016/s0165-0327(97)00140-7

Austin, M. P., Mitchell, P., & Goodwin, G. M. (2001). Cognitive deficits in depression: Possible implications for functional neuropathy. *British Journal of Psychiatry, 178*, 200-206. doi: 10.1192/bjp.178.3.200

Bagby, R. M., Ryder, A. G., Schuller, D. R., & Marshall, M. B. (2005). The Hamilton Depression Rating Scale: Has the gold standard become a lead weight? *American Journal of Psychiatry, 161*, 2163-2177. doi: 10.1176/appi.ajp.161.12.2163

Bakkour, N., Samp, J., Akhras, K., Hammi, E. E., Soussi, I., Zahra,…Toumi, M. (2014). Systematic review of appropriate cognitive assessment instruments used in clinical trials of schizophrenia, major depressive disorder and bipolar disorder. *Psychiatry Research, 216*, 291-302. doi: 10.1016/j.psychres.2014.02.014

Baune, B. T., McAfoose, J., Leach, G., Quirk, F., & Mitchell, D. (2009). Impact of psychiatric and medication comorbidity on cognitive function in depression. *Psychiatry Clinical Neurosciences, 63,*(6), 392-400. doi: 10.1111/j.1440-1819.2009.01971.x.

Baune, B. T., Miller, R., McAfoose, J., Johnson, M., Quirk, F., & Mitchell, D. (2010). The role of cognitive impairment in general functioning in major depression. *Psychiatry Research, 176,* 183-189. doi: 10.1016/j.psychres.2008.12.00

Beblo, T., Baumann, B., Bogerts, B., Wallesch, C. W., & Herrmann, M. (1999). Neuropsychological correlates of major depression: A short-term follow-up. *Cognitive Neuropsychiatry, 4*(4), 333-341. doi: 10.1080/135468099395864

Beck, A. T. (1967). *Depression: Causes and treatment*. Philadelphia: University of Pennsylvania Press.

Behnken, A., Schöning, S., Gerβ, J., Konrad, C., de Jong-Meyer, R, Zwanzger, P., & Arolt, V. (2010). Persistent non-verbal memory impairment in remitted major depression – caused by encoding deficits? *Journal of Affective Disorders, 122*, 144-148. doi: 10.1016/j.jad.2009.07.010

Bowie, C. R., Twamley, E. W., Anderson, H., Halpern, B., Patterson, T. L., & Harvey, P. D. (2007). Self-assessment of functional status in schizophrenia. *Journal of Psychiatric Research, 41*(12), 1012-1018. doi: 10.1016/j.jpsychires.2006.08.003

Brand, A. N., Jolles, J., & Gispen-de Wied, C. (1992). Recall and recognition memory deficits in depression. *Journal of Affective Disorders, 25*, 77-86. doi: 10.1016/0165-0327(92)90095-n

Brenes, G. A. (2007). Anxiety, depression, and quality of life in primary care patients. *Primary Care Companion to the Journal of Clinical Psychiatry, 9*(6), 437-443. doi:

10.4088/pcc.v09n0606

Broadhead, W. E., Blazer, D. G., George, L. K., & Tse, C. K. (1990). Depression, disability days, and days lost from work in a prospective epidemiologic survey. *JAMA, 264*(19), 2524-2528. doi: 10.1001/jama.1990.03450190056028

Bromet, E., Andrande, L., H., Hwang, I., Sampson, N. A., Alonso, J., Girolamo, G… Kessler, R. C. (2011). Cross-national epidemiology of DSM-IV major depressive episode. *BMC Medicine, 9*(90). doi: 10.1186/1741-7015-9-90

Burdick, K. E., Endick, C. J., & Goldberg, J. F. (2005). Assessing cognitive deficits in bipolar disorder: Are self-reports valid? *Psychiatry Research, 136*, 43-50. doi: 10.1016/j.psychres.2004.12.009

Burt, D. B., Zembar, M. J. & Niederech, G. (1995). Depression and memory impairment: A meta-analysis of the association, its pattern, and specificity. *Psychological Bulletin, 117*(2), 285-305. doi: 10.1037//0033-2909.117.2.285

Cameron, I. M., Crawford, J. R., Lawton, K., & Reid, I. C. (2008). Psychometric comparison of PHQ-9 and HADS for measuring depression severity in primary care. *British Journal of General Practice*, *58*(546), 32-36. doi: 10.3399/bjgp08X263794

Coello, E., Ardila, A., & Rosselli, M. (1990). Is there a cognitive marker in major depression? *International Journal of Neuroscience, 50*(3-4), 137-145. doi: 10.3109/00207459008987167

Cohen, J. (1988), *Statistical Power Analysis for the Behavioral* Sciences (2nd ed). Hillsdale, N.J.: Lawrence Erlbaum.

Conradi, H. J., Ormel, J., & de Jonge, P. (2011). Presence of individual (residual) symptoms during depressive episodes and periods of remission: A 3-year prospective study.

Psychological Medicine, 41, 1165-1174. doi: 10.1017/S0033291710001911

Coyne, J. C., Thompson, R., & Palmer, S. C. (2002). Marital quality, coping with conflict, marital complaints, and affection in couples with a depressed wife. *Journal of Family Psychology, 16*(1), 26-37. doi: 10.1037/0893-3200.16.1.26

Cuellar, A. K., Johnson, S. L., & Winters, R. (2010). Distinctions between bipolar and unipolar depression. *Clinical Psychology Review, 25*(3), 307-339. doi: 10.1016/j.cpr.2004.12.002

Daly, E. J., Trivedi, M. H., Wisniewski, S. R., Nierenberg, A. A., Gaynes, B. N., Warden, D., … Rush, A. J., (2010). Health-related quality of life in depression: A STAR*D report. *Annals of Clinical Psychology, 22*(1), 43-55. Retrieved from: http://www.ncbi.nlm.nih.gov/pubmed/20196982

Deković, M., Janssens, J. M. A. M., & van As, N. M. C. (2003). Family predictors of antisocial behavior in adolescence. *Family Process, 42*(2), 223-235. doi:10.1111/j.1545-5300.2003.42203.x

Egerhazi, A., Balla, P., Ritzl, A., Varga, Z., Frecska, E., & Berecz, R. (2013). Automated neuropsychological test battery in depression – preliminary data. *Neuropsychopharmacol Hung, 15*(1), 5-11. Retrieved from: http://epa.niif.hu/02400/02454/00049/pdf/EPA02454_neurohun_2013_05-11.pdf

Elgamal, S., Denburg, S., Marriott, M., & MacQueen, G. (2010). Clinical factors that predict cognitive function in patients with major depression. *Canadian Journal of Psychiatry, 55*(10), 653-661. Retrieved from: http://www.ncbi.nlm.nih.gov/pubmed/20964944

Ellis, H. C., & Ashbrook, P. W. (1988). Resource allocation model of the effects of depressed mood states on memory. In K. Fiedler & J. P. Forgas (Eds.), *Affect, cognition and social behavior* (pp. 25-43). Toronto: Hogrefe.

Ellwart, T., Rinck, M., & Becker, E. S. (2003). Selective memory and memory deficits in depressed patients. *Depression and Anxiety, 17*, 197-206. doi: 10.1002/da.10102

Eysenck, M. W. (1997). Anxiety and cognitive processes. In C. Cooper & V. Varma (Eds.), *Processes in Individual Differences* (pp. 59-72). London: Routledge.

Farrin, L., Hull, L., Unwin, C., Wykes, T., & David, A. (2003). Effects of depressed mood on objective and subjective measures of attention. *Journal of Neuropsychiatry and Clinical Neurosciences, 15*(1), 98-104. doi: 10.1176/appi.neuropsych.15.1.98

Fava, M., Graves, L., Benazzi, F., Scalia, M.J., Iosifescu, D. V., Alpert, J. E., & Papakostas, G. I. (2006). A cross-sectional study of the prevalence of cognitive and physical symptoms during long-term antidepressant treatment. *Journal of Clinical Psychiatry, 67*, 1754-1759. doi: 10.4088/jcp.v67n1113

Fava, M., Iosifescu, D. V., Pedrelli, P., & Baer, L. (2009). Reliability and validity of the Massachusetts General Hospital Cognitive and Physical Functioning Questionnaire. *Psychotherapy and Psychosomatics, 78*, 91-97. doi: 10.1159/000201934

Fava, G. A., Ruini, C., & Belaise, C. (2007). The concept of recovery in major depression. *Psychological Medicine, 37*, 307-317. doi: 10.1017/S0033291706008981

Fossati, P., Amar, G., Raoux, N., Ergis, A. M., & Allilaire, J. F. (1999). Executive functioning and verbal memory in young patients with unipolar depression and schizophrenia. *Psychiatry Research, 89*, 171-187. doi: 10.1016/s0165-1781(99)00110-9

Fossati, P., Coyette, F., Ergis, A., & Allilaire, J. (2002). Influence of age and executive functioning on verbal memory of inpatients with depression. *Journal of Affective Disorders, 68*, 261-271. doi: 10.1016/S0165-0327(00)00362-1

Fray, P. J., Robbins, T. W., & Sahakian, B. J. (1996). Neuropsychiatric applications of

CANTAB. *International Journal of Geriatric Psychiatry, 11,* 329-336. doi: 10.1002/(sici)1099-1166(199604)11:4<329::aid-gps453>3.0.co;2-6

Friedman, N., P., Miyake, A., Young, S. E., DeFries, J. C., Corley, R. P., & Hewitt, J. K. (2008). Individual differences in executive functions are almost entirely genetic in origin. *Journal of Experimental Psychology: General, 137*(2), 201-225. doi: 10.1037/0096-3445.137.2.201

Gaynes, B. N., Rush, A. J., Trivedi, M. H., Wisniewski, S. R., Balasubramani, G. K., Spencer, D.C.,… Fava, M. (2007). Major depression symptoms in primary care and psychiatric care settings: A cross-sectional analysis. *Annals of Family Medicine, 5*(2), 126-134. doi: 10.1370/afm.641

Gazzaniga, M. S., Ivry, R. B., & Mangun, G. R. (2002). *Cognitive neuroscience: The biology of the mind.* New York: Norton.

Gilmour, H. & Patten, S. B. (2007). Depression and work impairment. *Health Reports, 18*(1), 9-22. Retrieved from: http://www.publications.gc.ca/Collection-R/Statcan/82-003-XIE/82-003-XIE2006003.pdf

Godard, J., Baruch, P., Grondin, S., & Lafluer, M. F. (2012). Psychosocial and neurocognitive functioning in unipolar and bipolar depression: A 12-month prospective study. *Psychiatry Research, 196*, 145-153. doi: 10.1016/j.psychres.2011.09.013

Gordon, W. A., Haddad, L., Brown, M., Hibbard, M., & Sliwinski, M. (2000). The sensitivity and specificity of self-reported symptoms in individuals with traumatic brain injury. *Brain Injury, 14*(1), 21-33. doi: 10.1080/026990500120907

Gorlyn, M., Keilp, J. G., Oquendo, M. A., Burke, A. K., Sackeim, H. A., & Mann, J. J. (2006). The WAIS-III and major depression: Absence of VIQ/PIQ differences. *Journal of*

Clinical and Experimental Neuropsychology, 28(7), 1145-1157. doi: 10.1080/13803390500246944

Gotlib, I. H. & Joorman, J (2010). Cognition and depression: Current status and future directions. *Annual Review of Clinical Psychology, 27*(6), 285-312. doi: 10.1146/annurev.clinpsy.121208.131305

Greer, T. L., Kurian, B. T., & Trivedi, M. H. (2010). Defining and measuring functional recovery from depression. *CNS Drugs, 24*, 267-284. doi: 10.2165/11530230-000000000-00000

Greer, T. L., Sunderajan, P., Grannemann, B. D., Kurian, B. T., & Trivedi, M. H. (2014). Does duloxetine improve cognitive functioning independently of its antidepressant effect in patients with major depressive disorder and subjective reports of cognitive dysfunction? *Depression Research and Treatment, 4*, 1-13. d*oi:* 10.1155/2014/627863

Grohman, K. & Fals-Stewart, W. (2004). The detection of cognitive impairment among substance-abusing patients: The accuracy of the Neuropsychological Assessment Battery-Screening module. *Experimental and Clinical Psychopharmacology, 12*(3), 200-207. doi: 10.1037/1064-1297.12.3.200

Gualtieri, C. T., Johnson, L. G., Benedict, K. B. (2006). Neurocognition in depression: Patients on and off medication versus healthy control subjects. *Journal of Neuropsychiatry & Clinical Neurosciences, 18*(2), 217-225. doi: 10.1176/appi.neuropsych.18.2.217

Hammar, Å., Isaksen, L., Schmid, M., Årdal, G., & Strand, M. (2011). Patients with major depression show intact memory performance – given optimal conditions. *Applied Neuropsychology, 18*, 191-196. doi: 10.1080/09084282.2011.595445

Hammar, Å. & Schmid, M. (2013). Visual memory performance in patients with major

depression: A 9-month follow-up. *Applied Neuropsychology: Adult, 20*(3), 192-196. doi: 10.1080/09084282.2012.670170

Harada, C. N., Natelson, M. C., & Triebel, K. (2013). Normal cognitive aging. *Clinics in Geriatric Medicine, 29*(4), 737-752. doi: 10.1016/j.cger.2013.07.002

Harmer, C. J., O'Sullivan, U., Favaron, E., Massey-Chase, R., Ayres, R., Reinecke, A.,… Cowen, P. (2009). Effect of acute antidepressant administration on negative affective bias in depressed patients. *American Journal of Psychiatry, 166,* 1178-1184: doi: 10.1176/appi.ajp.2009.09020149

Harvey, P. D. (2012). Clinical applications of neuropsychological assessment. *Dialogues in Clinical Neuroscience, 14*, 91-99. Retrieved from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3341654/

Hasin, D. S., Goodwin, R. D., Stinson, F. S., & Grant, B. F. (2005). Epidemiology of major depressive disorder: Results from the National Epidemiologic Survey on Alcoholism and Related Conditions. *Archives of General Psychiatry, 62*(10), 1097-1106. doi: 10.1001/archpsyc.62.10.1097

Hasselbalch, B. J., Knorr, U., Hasselbalch, S. G., Gade, A., & Kessing, L.V. (2012). Cognitive deficits in the remitted state of unipolar depressive disorder. *Neuropsychology, 26,* 642-651. doi: 10.1037/a0029301

Henry, J. D. & Crawford, J. R. (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. *British Journal of Clinical Psychology, 44*, 227-239. doi: 10.1348/014466505X29657

Hermens, D. F., Naismith, S. L., Hodge, M., A., R., Scott, E. M., & Hickie, I. B. (2010). Impaired verbal memory in young adults with unipolar and bipolar depression. *Early Intervention in Psychiatry, 3*, 227-233. doi: 10.1111/j.1751-7893.2010.00194.x

Hertel, P. T. (1998). Relation between rumination and impaired memory in dysphoric moods. *Journal of Abnormal Psychology, 107*(1), 166-172. doi: 10.1037/0021-843x.107.1.166

Horner, M. D., Harvey, R. T., & Denier, C. A. (1999). Self-report and objective measures of cognitive deficit in patients entering substance abuse treatment. *Psychiatry Research, 86*, 155-161. doi: 10.1016/s0165-1781(99)00031-1

Hueng, T. T., Lee, H., Guog, Y. J., Chen, K. C., Chen, S. S., Chuang, S. P.,… Yang, Y. K. (2011). Is a patient-administered depression rating scale valid for detecting cognitive deficits in patients with major depressive disorder? *Psychiatry and Clinical Neurosciences, 65*, 70-76. doi: 10.1111/j.1440-1819.2010.02166.x

Ilsley, J. E., Moffoot, A. P. R., & O'Carroll, R. E. (1995). An analysis of memory dysfunction in depression. *Journal of Affective Disorders, 35*, 1-9. Retrieved from: http://www.sciencedirect.com/science/article/pii/016503279500032I

IsHak, W. W., Greenberg, J. M., Balayan, K., Kapitanski, N., Jeffery, J., Fathy, H.,… Rapaport, M. H. (2011). Quality of life: The ultimate outcome measure of interventions in major depressive disorder. *Harvard Review of Psychiatry, 19*, 229-239. doi: 10.3109/10673229.2011.614099

Jaeger, J., Berns, S., Uzelac, S., & Davis-Conway, S., (2006). Neurocognitive deficits and disability in major depressive disorder. *Psychiatry Research, 145*, 39-48. doi: 10.1016/j.psychres.2005.11.011

Johnson, S. L., Meyer, B., Winett, C., & Small, J. (2000). Social support and self-esteem predict

changes in bipolar depression but not mania. *Journal of Affective Disorders, 58*(1), 79-86. doi: 10.1016/s0165-0327(99)00133-0

Joorman, J. & Gotlib, I. H. (2007). Selective attention to emotional faces following recovery from depression. *Journal of Abnormal Psychology, 116*(1), 80-85. doi: 10.1037/0021-843X.116.1.80

Joormann, J., Waugh, W. E., & Gotlib, I. H. (2015). Cognitive bias modifications for interpretation in major depression: Effects on memory and stress reactivity. *Clinical Psychological Science, 3*(1), 126-139. doi: 10.1177/2167702614560748

Julian, L., Merluzzi, N. M., & Mohr, D. C. (2007). The relationship among depression, subjective cognitive impairment, and neuropsychological performance in multiple sclerosis. *Multiple Sclerosis, 13*, 81-86. doi: 10.1177/1352458506070255

Keller, J., Nitschke, J. B., Bhargava, T., Deldin, P. J., Gergen, J. A., Miller, G. A., & Heller, W. (2000). Neuropsychological differentiation of depression and anxiety. *Journal of Abnormal Psychology, 109*(1), 3-10. doi: 10.1037/0021-843X.109.1.3

Kessing, L. V. (1998). Cognitive impairment in the euthymic phase of affective disorder. *Psychological Medicine, 28*, 1027-1038. doi: 10.1017/s0033291798006862

Kessler, R. C., Aguilar-Gaxiola, S., Alonso, J., Chatterij, S., Lee, S., Ormel, J.,…Wang, P. S. (2009). The global burden of mental disorders: An update from the WHO World Mental Health (WMH) Surveys. *Epidemiologia e Psichiatria Sociale, 18*(1), 23-33. doi: 10.1017/s1121189x00001421

Kessler, R. C. & Bromet, E. J. (2013). The epidemiology of depression across cultures. *Annual Review of Public Health, 34,* 119-138. doi: 10.1146/annurev-publhealth-031912-114409

Kessler, R. C., Petukhova, M., Sampson, N. A., Zaslavsky, A. M., & Wittchen, H. (2012).

Twelve-month and lifetime prevalence and lifetime morbid risk of anxiety and mood disorders in the United States. *International Journal of Methods in Psychiatric Research, 21*(3), 169-184. doi: 10.1002/mpr.1359

Kessler, R. C., & Üstün, T. B. (2008). *The WHO World Mental Health Surveys: Global perspectives on the epidemiology of mental disorders*. New York: Cambridge University Press. Retrieved from: http://assets.cambridge.org/97805218/84198/frontmatter/9780521884198_frontmatter.pdf

Koster, E. H. W., Raedt, R. D., Goeleven, E., Franck, E., & Crombez, G. (2005). Mood-congruent attentional bias in dysphoria: Maintained attention to and impaired disengagement from negative information. *Emotion, 5*(4), 446-455. doi: 10.1037/1528-3542.5.4.446

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9. *Journal of General Internal Medicine*, *16*(9), 606-613. Retrieved from: http://onlinelibrary.wiley.com/doi/10.1046/j.1525-1497.2001.016009606.x/epdf

Kuehner, C. & Buerger, C. (2005). Determinants of subjective quality of life in depressed patients: The role of self-esteem, response styles, and social support. *Journal of Affective Disorders, 86*(2-3), 205-213. doi: 10.1016/j.jad.2005.01.014

Kummer, A., Cardoso, F., & Teixeira, A. L. (2010). Generalized anxiety disorder and the Hamilton Anxiety Rating Scale in Parkinson's disease. *Arquivos de Neuro-psiquiatria*, *68*(4), 495-501. doi: 10.1590/s0004-282x2010000400005

Lam, R. W., Kennedy, S. H., McIntryre, R. S., & Khullar, A. (2014). Cognitive dysfunction in MDD: Effects on psychosocial functioning and implications for treatment. *Canadian*

Journal of Psychiatry, 59(12), 649-654. Retrieved from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4304584/

Lam, R. W., Michalak, E. E., Bond, D. J., Tam, E. M., Axler, A. & Yatham, L. N. (2012). Which depressive symptoms and medication side effects are perceived by patients as interfering most with occupational functioning? *Depression Research and Treatment, 2012,* 1-6. doi: 10.1155/2012/630206

Lamers, F., van Oppen, P., Comijs, H. C., Smit, J. H., Spinhoven, P., Van Balkom, A. J., ... Penninx, B. W. (2011). Comorbidity patterns of anxiety and depressive disorders in a large cohort study: The Netherlands Study of Depression and Anxiety (NESDA) *The Journal of Clinical Psychiatry*, *72*(3), 341-348. doi: 10.4088/jcp.10m06176blu

Larochette, A. C., Harrison, A. G., Rosenblum, Y., & Bowie, C. R. (2011). Additive neurocognitive deficits in adults with attention-deficit/hyperactivity disorder and depressive symptoms. *Archives of Clinical Neuropsychology, 26*(5), 385-395. doi: 10.1093/arclin/acr03

Lavie, N. (2005). Distracted and confused? Selective attention under load. *TRENDS in Cognitive Sciences, 9*(2), 75-82. doi: 10.1016/j.tics.2004.12.004

Lawrence, C., Roy, A., Harikrishnan, V., Yu, S. & Dabbous, O. (2013). Association between severity of depression and self-perceived cognitive difficulties among full-time employees. *Primary Care Companion for CNS Disorders, 15*(3). doi: 10.4088/PCC.12m0146

Leon, A. C., Olfson, M., Portera, L., Farber, L., & Sheehan, D. V. (1997). Assessing psychiatric impairment in primary care with the Sheehan Disability Scale. *The International Journal of Psychiatry in Medicine*, *27*(2), 93-105. doi: 10.2190/t8em-c8yh-373n-1uwd

Levens, S. M., Muhtadie, L., Gotlib, I. H. (2009). Rumination and impaired resource allocation in depression. *Journal of Abnormal Psychology, 118*(4), 757-766. doi: 10.1037/a0017206

Lezak, M. D., Howieson, D. B., & Loring, D. W. (2004). *Neuropsychological assessment*. New York, NY: Oxford University Press.

Lim, K. L., Jacobs, P., Ohinmaa, A., Schopflocher, D., & Dewa, C. S. (2008). A new population-based measure of the economic burden of mental illness in Canada. *Chronic Diseases and Injuries in Canada, 28*(3), 92-98. Retrieved from: http://www.ncbi.nlm.nih.gov/pubmed/18341763

Lim, J., Oh, I. K., Han, C., Huh, Y. J., Jung, I, K., Patkar, A. A., … Jang, B. H. (2013). Sensitivity of cognitive tests in four cognitive domains in discriminating MDD patients from healthy controls: A meta-analysis. *International Pyschogeriatrics, 25(*9), 1543-1557. doi: 10.1017/s1041610213000689

Luciano, J. V., Bertsch, J., Salvador-Carulla, L., Tomás, J. M., Fernández, A., Pinto-Meza, A.,… Serrano-Blanco, A. (2010). Factor structure, internal consistency and construct validity of the Sheehan Disability Scale in a Spanish primary care sample. *Journal of Evaluation and Clinical Practice, 16*(5), 895-901. doi: 10.1111/j.1365-2753.2009.01211.x

Mackin, R. S., Delucchi, K. L., Bennett, R. W., & Areán, P. A. (2011). The effect of cognitive impairment on mental healthcare costs for individuals with severe psychiatric illness. *American Journal of Geriatric Psychiatry, 19*(2), 176-184. doi: 10.1097/JGP.0b013e3181e56cfa

Madden, J. J., Luban, J. A., Kaplan, L. A., & Manfredi, H. M. (1952). Non-dementing psychoses in older persons. *Journal of the American Medical Association, 150*, 1567-1572. doi: 10.1001/jama.1952.03680160017004

Majer, M., Ising, M., Kunzel, H., Binder, E. B., Holsboer, F., Modell, S.,… Zihl, J. (2004). Impaired divided attention predicts delayed response and risk to relapse in subjects with depressive disorders. *Psychological Medicine, 34*, 1453-1463. doi: 10.1017/s0033291704002697

Mapou, R. L. (1995). Cognitive framework for neuropsychological assessment. In R. L. Mapou & J. Spector (Eds.), *Neuropsychological Assessment: A cognitive approach,* (pp. 295-332). New York: Plenum Press.

Marrie, R. A., Miller, D. M., Chelune, G. J., & Cohen, J. A. (2003). Validity and reliability of the MSQLI in cognitively impaired patients with multiple sclerosis. *Multiple Sclerosis, 9*(6), 621-626. doi: 10.1191/1352458503ms971oa

Martin, D. J., Oren, Z., & Boone, K. (1991). Major depressives' and dysthymics' performance on the Wisconsin card sorting test. *Journal of Clinical Psychology, 47*(5), 684-690. doi: 10.1002/1097-4679(199109)47:5<684::aid-jclp2270470509>3.0.co;2-g

Marvel, C.L., & Paradisø, S. (2004). Cognitive and neurological impairment in mood disorders. *Psychiatry Clinics of North America, 27*, 19-36. doi: 10.1016/S0193-953X(03)00106-0

Masellis, M. & Black, S. (2008). Assessing patients complaining of memory impairment. *Geriatrics and Aging, 11*(3). Retrieved from: http://www.alzheimer.ca/~/media/Files/national/Tip-sheets/tipsheet_Questions_to_ask_e.pdf

Mathews, A., Ridgeway, V., & Williamson, D. A. (1996). Evidence for attention to threatening stimuli in depression. *Behaviour, Research, Therapy, 34*(9), 695-705. doi: 10.1016/0005-7967(96)00046-0

McClintock, S. M., Husain, M. M., Greer, T. L., & Cullum, C. M. (2010). Association between

depression severity and neurocognitive function in major depressive disorder: A review and synthesis. *Neuropsychology, 24*(1), 9-34. doi: 0.1037/a0017336

McDermott, L. M. & Ebmeier, K. P. (2009). A meta-analysis of depression severity and cognitive function. *Journal of Affective Disorders, 119*(1-3), 1-8. doi: 10.1016/j.jad.2009.04.022.

McGlynn, S. M., & Schacter, D. L. (1989). Unawareness of deficits in neuropsychological syndromes. *Journal of Clinical and Experimental Neuropsychology*, *11*(2), 143-205. doi: 10.1080/01688638908400882

McIntyre, R. S., Cha, D. S., Soczynska, J. K., Woldeyohannes, H. O., Gallaugher, L. A., Kudlow, P,… Baskaran, A. (2013). Cognitive deficits and functional outcomes in major depressive disorder: Determinants, substrates, and treatment interventions. *Depression and Anxiety, 30*(6), 515-527. doi: 10.1002/da.22063

Mialet, J. P., Pope, H. G., & Yurgelun-Todd, D. (1996). Impaired attention in depressive states: a non-specific deficit? *Psychological Medicine*, *26*, 1009-1020. doi: 10.1017/s0033291700035339

Mickelson, K. D. (2001). Perceived stigma, social support, and depression. *Personality and Social Psychology Bulletin, 27*(8), 1046-1056. doi: 10.1177/0146167201278011

Miskowiak, K., Vinberg, M., Christensen, M. E., & Kessing, L. V. (2012). Is there a difference in subjective experience of cognitive function in patients with unipolar disorder versus bipolar disorder? *Nordic Journal of Psychiatry, 66*(6), 389-395. doi: 10.3109/08039488.2012.658862

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., & Howerter, A. (2000). The unity and diversity of executive functions and their contributions to complex “frontal lobe”

tasks: A latent variable analysis. *Cognitive Psychology, 41*, 49-100. doi: 10.1006/cogp.1999.0734

Mohanty, A., & Heller, W. (2002). The neuropsychology of depression: Affect, cognition, and neural circuitry. In H. D'haenen, J. A. den Boer, H. Westenberg, & P. Willner (Eds.), *Textbook of biological psychiatry,* (pp. 791–802). Chichester, West Sussex: Wiley.

Murphy, K. R. & Davidshofer, D. O. (2005). *Psychological testing: Principles and applications* (6th ed.). Upper Saddle River, NJ: Prentiss Hall.

Murray, C. J., & Lopez, A. D. (1997). Alternative projections of mortality and disability by cause 1990–2020: Global burden of disease study. *The Lancet*, *349*(9064), 1498-1504. doi: 10.1016/s0140-6736(96)07492-2

Naismith, S. L., Hickie, I. B., Turner, K., Little, C. L., Winter, V., Ward, P. B.,… Parker, G. (2003). Neuropsychological performance in patients with depression is associated with clinical, etiological and genetic risk factors. *Journal of Clinical and Experimental Neuropsychology, 25*(6), 866-877. doi: 10.1076/jcen.25.6.866.16472

Naismith, S. L., Longlet, W. A., Scott, E. M. & Hickie, I, B. (2007). Disability in major depression related to self-rated and objectively-measured cognitive deficits: A preliminary study. *BMC Psychiatry, 7*(32). doi: 10.1186/1471-244X-7-32

Nasser, E. H. & Overholser, J. C. (2005). Recovery from major depression: The role of support from family, friends, and spiritual beliefs. *Acta Psychiatrica Scandinavica, 111*(2), 125-132. doi: 10.1111/j.1600-0447.2004.00423.x

Nierenberg, A. A., Husain, M. M., Trivedi, M. H., Fava, M., Warden, D., Wisniewski, S. R., … & Rush, A.J. Residual symptoms after remission of major depressive disorder with citalopram and risk of relapse: a STAR*D report. *Psychological Medicine, 40*(1), 41-50.

doi: 10.1097/JCP.0b013e31820ebd2c

Nissen, C., Holz, J., Blechert, J., Feige, B., Rieman, D., Voderholzer, U., & Normann, C. (2010). Learning as a model for neural plasticity in major depression. *Biological Psychiatry, 68*(6), 544-522. doi: 10.1016/j.biopsych.2010.05.026

Olchanski, N., Myers, M. M., Halseth, M., Cyr, P. L., Bockstedt, L., Goss, T. F., & Howland, R. H. (2013). The economic burden of treatment-resistant depression. *Clinical Therapeutics, 35*(4), 512-522 doi: 10.1016/j.clinthera.2012.09.001

Ottowitz, W. E., Dougherty, D. D., & Savage, C. R. (2002). The neural network basis for abnormalities of attention and executive function in major depressive disorder: Implications for application of the medical disease model to psychiatric disorders. *Harvard Review Psychiatry, 10,* 86-99. doi: 10.1093/hrp/10.2.86

Papakostas, G. I. (2014). Cognitive symptoms in patients with major depressive disorder and their clinical implications for clinical practice. *Journal of Clinical Psychiatry, 75*(1), 8-14. doi: 10.4088/jcp.13r08710

Patten, S. B. (2009). Accumulation of major depressive episodes over time in a prospective study indicates that retrospectively assessed lifetime prevalence estimates are too low. *BMC Psychiatry, 9*(19). doi:10.1186/1471-244X-9-19

Patten, S. B., Wang, J. L., Williams, J. V., Currie, S., Beck, C. A., Maxwell, C. J., & El-Guebaly, N. (2006). Descriptive epidemiology of major depression in Canada. *Canadian Journal of Psychiatry, 51*(2), 84-90. Retreived from: https://ww1.cpa-apc.org/Publications/Archives/CJP/2006/february/patten-OR.asp

Paulhus, D. L. & Vazire, S. (2009). The self-report method. In R. W. Robins, R. C. Franley, & R. F. Krueger (Eds.), *Handbook of research methods in personality psychology* (pp. 224-239). New York, NY: Guilford.

Paykel, E. S. (2008). Partial remission, residual symptoms and relapse in depression. *Dialogues in Clinical Neuroscience, 10*(4), 431-437. Retrieved from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3181895/

Pehrson, A. L., Leiser, S. C., Gulinello, M., Dale, E., Li, Y., Waller, J. A., & Sanchez, C. (2015). Treatment of cognitive dysfunction in major depressive disorder: A review of the preclinical evidence for efficacy of selective serotonin reuptake inhibitors, serotonin-norepinephrine reuptake inhibitors and the multimodal-acting antidepressant vortioxetine. *European Journal of Pharmacology, 753*, 19-31. doi:10.1016/j.ejphar.2014.07.044

Porter, R. J., Gallagher, P., Thompson, J. M., & Young, A. H. (2003). Neurocognitive impairment in drug-free patients with major depressive disorder. *British Journal of Psychiatry, 182*, 214-220. doi: 10.1192/bjp.182.3.214

Potter, G. G., Kittinger, J. D., Wagner, H. R., Steffens, D. C., & Kristnan, K. R. R. (2004). Prefrontal neuropsychological predictors of treatment remission in late-life depression. *Neuropsychopharmacology, 29*, 2266–2271. doi: 10.1038/sj.npp.1300551

Priddy, D. A., Mattes, D., & Lam, C. S. (1988). Reliability of self report among non-oriented head-injured adults. *Brain Injury, 2*, 249-253. doi: 10.3109/02699058809150949

Purdon S. (2005). *The screen for cognitive impairment in psychiatry: Administration and psychometric properties.* Alberta: PNL Inc.

Quraishi, S. & Frangou, S. (2002). Neuropsychology of bipolar disorder: A review. *Journal of Affective Disorders, 72*, 209-226. doi: 10.1016/s0165-0327(02)00091-5

Rapport, M. H., Clary, C., Fayyad, R., & Endicott, J. (2005). Quality-of-life impairment in depressive and anxiety disorders. *American Journal of Psychiatry, 162*(6), 1171-1178. doi: 10.1007/978-1-4020-5779-3_14

Raskin, J., Wiltse, C.G., Siegal, A., Sheikh, J., Xu, J., Dinkel, J. J., … & Mohs, R. C. (2007). Efficacy of duloxetine on cognition, depression, and pain in elderly patients with major depressive disorder: an 8-week, double-blind, placebo-controlled trial. *American Journal of Psychiatry, 164*(6), 900-909. doi: 10.1176/appi.ajp.164.6.900

Rinck, M. & Becker, E. S. (2005). A comparison of attentional biases and memory biases in women with social phobia and major depression. *Journal of Abnormal Psychology, 114*(1), 62-74. doi: 10.1037/0021-843X.114.1.62

Rock, P. L., Roiser, J. P., Riedel, W. J., & Blackwell, A. D. (2014). Cognitive impairment in depression: A systematic review and meta-analysis. *Psychological Medicine, 44,* 2029–2040. doi:10.1017/S0033291713002535

Rogers, M. A., Kasai, K., Koji, M., Fukuda, R., Iwanami, A. Nakagome, K.,… Kato, N. (2004). Executive and prefrontal dysfunction in unipolar depression: A review of neuropsychological and imaging evidence. *Neuroscience Research, 50*, 1-11. doi: 10.1016/j.neures.2004.05.003

Rosenblat, J. D., Kakar, R., McIntyre, R. S., (2015). The cognitive effects of antidepressant in major depressive disorder: A systematic review and meta-analysis of randomized clinical trials. *International Journal of Neuropsychopharmacology, 19*(2), 1-13. doi: 10.1093/ijnp/pyv082

Rossi, A., Stratta, P., Nistico, R., Sabatini, M. D., Michele, V. Di., & Casacchia, M. (1990). Visuovisuospatial impairment in depression: A controlled ECT study. *Acta Psychiatrica Scandinavica, 81,* 245-249. doi: 10.1111/j.1600-0447.1990.tb06489.x

Russo, M., Mahon, K., & Burdick, K. E. (2014). Measuring cognitive function in MDD: Emerging assessment tools. *Depression and Anxiety, 00*, 1-8. doi: 10.1002/da.22297

Sahakian, B. J., Morris, R. G., Evenden, J. L., Heald, A., Levy, R., Philpot, M., & Robbins, T. W. (1988). A comparative study of visuospatial memory and learning in Alzheimer-type dementia and Parkinson's disease. *Brain, 111*(3), 695–718. doi:10.1093/brain/111.3.695. PMID 3382917.

Salthouse, T. (2012). Consequences of age-related cognitive declines. *Annual Review of Psychology, 63*, 201-226. doi: 10.1146/annurev-psych-120710-100328

Shallice, T. (1982). Specific impairments of planning. *Philosophical Transactions of the Royal Society B: Biological Sciences, 298,* 199-209. doi: 10.1098/rstb.1982.0082

Sheehan, D. V. (1983). *The anxiety disease*. New York, NY: Scribner.

Sheehan, D.V., Lecrubier, Y., Sheehan, K.H., Janavs, J., Weiller, E.,Keskiner, A., Schinka, J.,.. Dunbar, G. C. (1997). The validity of the Mini International Neuropsyciatric Interview (MINI) according to the SCID-P and its reliability. *European Psychiatry, 12,* 232-241. doi: 10.1016/s0924-9338(97)83297-x

Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Amorim, P., Janavs, J., Weiller, E., ... & Dunbar, G. C. (1998). The Mini-International Neuropsychiatric Interview (MINI): The development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *Journal of Clinical Psychiatry*, *59*, 22-33. Retrieved from: http://www.ncbi.nlm.nih.gov/pubmed/9881538

Stevens, J. P. (2002). *Applied multivariate statistics for the social sciences* (4th ed.*)*. New Jersey: Lawrence Erlbaum Associates, Inc.

Snyder, H. R. (2013). Major depressive disorder is associated with broad impairments on neuropsychological measures of executive function: A meta-analysis and review. *Psychological Bulletin, 139*(1), 81-132. doi: 10.1037/a0028727

Squire, L. R. & Knowlton, B. J. (2000).The medial temporal lobe, the hippocampus, and the memory systems of the brain. In M. Gazzaniga (Ed.), *The new cognitive neurosciences (2nd Ed.)* (pp. 765-779). Cambridge, MA: MIT Press.

Sohlberg, M. M. & Mateer, C. A. (2000). *Cognitive rehabilitation: An integrative neuropsychological approach*. New York, NY: Guilford.

Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Lowe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine, 166*, 1092-1097. doi: 10.1001/archinte.166.10.1092

Stern, R. A., & White, T. (2003). *Neuropsychological Assessment Battery*. Lutz, FL: Psychological Assessment Resources.

Stordal, K. I., Lunderwold, A. J., Egeland, J., Mykletun, A., Asbjørnsen, A., Landrø, N. I.,… Lund, A. (2004). Impairment across executive functions in recurrent major depression. *Nordic Journal of Psychiatry, 58*(1), 41-47. doi: 10.1080/08039480310000789

Svenden, A. M., Kessing, L. V., Munkholm, K., Vinberg, M., & Miskowiak, K. W. (2012). Is there an association between subjective and objective measures of cognitive function in patients with affective disorders? *Nordic Journal of Psychiatry, 66, 248-253.* doi: 10.3109/08039488.2011.626870

Sullivan, J. J. L., Edgley, K., & Dehoux, E. (1999). A survey of multiple sclerosis Part 1:

Perceived cognitive problems and compensatory strategy use. *Canadian Journal of Rehabilitation, 4,* 99-105.

Surguladze, S., Brammer, M. J., Keedwell, P., Giamoietro, V., Young, A. W., Travis, M. J., …Phillips, M. L. (2005). A differential pattern of neural response toward sad versus happy facial expressions in major depressive disorder. *Biological Psychiatry, 57*, 201-209. doi: 10.1016/j.biopsych.2004.10.028

Tabachnick, B. G. & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston, MC: Pearson Education, Inc.

Tanaka-Matsumi, J. & Kameoka, V. A. (1986). Reliabilities and concurrent validities of popular self-report measures of depression, anxiety, and social desirability. *Journal of Consulting and Clinical Psychology, 54*(3), 328-333. doi: 10.1037//0022-006x.54.3.328

Titov, N., Dear, B. F., McMillan, D., Anderson, T., Zou, J., & Sunderland, M. (2011). Psychometric comparison of the PHQ-9 and BDI-II for measuring response during treatment of depression. *Cognitive Behavior Therapy*, *40*(2), 126-136. doi: 10.1080/16506073.2010.550059

Tomida, K., Takahashi, N., Saito, S., Maeno, N., Iwamoto, K., Yoshida, K.,… Ozaki, N. (2010). Relationship of psychopathological symptoms and cognitive function to subjective quality of life in patients with chronic schizophrenia. *Psychiatry and Clinical Neurosciences, 64,* 62-69. doi: 0.1111/j.1440-1819.2009.02033.x

Üstün, T. B., Ayuso-Mateos, J. L., Chatterji, S., Mathers, C., & Murray. C. J. L. (2004). Global burden of depressive disorders in the year 2002. *British Journal of Psychiatry, 184*(5), 386-392. doi: 10.1192/bjp.184.5.386

Üstün, B. & Kennedy, C. (2009). What is "functional impairment"? Disentangling disability

from clinical significance. *World Psychiatry, 8*(2), 82-85. doi: 10.1002/j.2051-5545.2009.tb00219.x

van der Werf-Eldering, M. J., Burger, H., Jabben, N., Holthausen, E. A. E., Aleman, A., & Nolen, W. A. (2011). Is the lack of association between cognitive complaints and objective cognitive functioning in patients with bipolar disorder moderated by depressive symptoms? *Journal of Affective Disorders, 130*(1-2), 306-311. doi: 10.1016/j.jad.2010.10.005

Veiel, H. O. F. (1997). A preliminary profile of neuropsychological deficits associated with major depression. *Journal of Clinical and Experimental Neuropsychology, 19*(4), 587-602. doi: 10.1080/01688639708403745

Wagner, M. T., & Cushman, L. A. (1994). Neuroanatomic and neuropsychological predictors of unawareness of cognitive deficit in the vascular population. *Archives of Clinical Neuropsychology*, *9*(1), 57-69. doi: 10.1093/arclin/9.1.57

Waraich, P., Goldner, E. M., Somers, J. M., & Hsu, L. (2004). Prevalence and incidence studies of mood disorders: a systematic review of the literature. *Canadian Journal of Psychiatry, 49*(2), 124-138. Retrieved from: https://ww1.cpa-apc.org/Publications/Archives/CJP/2004/february/waraich.pdf

Watts, F. N. & Cooper, Z. (1989). The effects of depression on structural aspects of the recall of prose. *Journal of Abnormal Psychology, 98*(2), 150-153. doi: 10.1037/0021-843x.98.2.150

Weinstock, L. M., Keitner, G. I., Ryan, C. E., Solomon, D. A., & Miller, I., W. (2006). Family functioning and mood disorders: A comparison between patients with major depressive disorder and bipolar I disorder. *Journal of Consulting and Clinical Psychology, 74*, 1192-

1202. doi: 10.1037/0022-006x.74.6.1192

Windle, M. (1994). A study of friendship characteristics and problem behavior among middle adolescents. *Child Development, 65*, 1764-1777. doi: 10.1111/j.1467-8624.1994.tb00847.x

Woo, J., Kim, W., Hwang, T., Frick, K. D., Choi, B. H., Seo,… Park, Y., L. (2011). Impact of depression on work productivity and its improvement after outpatient treatment with antidepressants. *Value in Health, 14*, 475-482. doi: 10.1016/j.jval.2010.11.006

Xiang, X. & An, R. (2015). The impact of cognitive impairment and comorbid depression on disability, health care utilization, and costs. *Psychiatric Services, 66*(11), 1245-1248. doi: 10.1176/appi.ps.201400511

Zakazanis, K. K., Leach, L., & Kaplan, E. (1998). On the nature and pattern of neurocognitive function in major depressive disorder. *Neuropsychiatry, Neuropsychology, and Behavioral Neurology, 11*(3), 111-119. Retrieved from: http://journals.lww.com/cogbehavneurol/Abstract/1998/07000/On_the_Nature_and_Pattern_of_Neurocognitive.1.aspx

Zgaljardic, D. J. & Temple, R. O. (2010). Reliability and validity of the Neuropsychological Assessment Battery-Screening Module (NAB-SM) in a sample of patients with moderate-to-severe acquired brain injury. *Applied Neuropsychology, 17*, 27-36. doi: 10.1080/09084280903297909

Table 1

Demographic Characteristics by Group and Total Sample

	Group				
Demographic characteristics	START depressed *n* = 31	UTSC depressed *n* = 14	Depressed combined *n* = 45	Control *n* = 29	Total Sample *n* = 74
Gender					
Female	16 (51.6%)	11 (78.6%)	27 (60.0%)	20 (69.0%)	47 (63.5%)
Male	15 (48.4%)	3 (21.4%)	18 (40.0%)	9 (31.0%)	27 (36.5%)
Age (years)	42.36 (*SD* = 13.45)	18.64 (*SD* = 1.78)	34.98 (*SD* = 15.73)	19.76 (*SD* = 5.22)	29.01 (*SD* = 14.68)
Currently on medication	29 (93.5%)	7 (50.0%)	36 (80.0%)	5 (17.2%)	41 (55.4%)
Handedness					
Right	28 (90.3%)	13 (92.9%)	41 (91.1%)	26 (89.7%)	67 (90.5%)
Left	2 (6.5%)	1 (7.1%)	3 (6.7%)	2 (6.9%)	5 (6.8%)
Ambidextrous	1 (3.2%)	0	1 (2.2%)	1 (3.4%)	2 (2.7%)
Marital status					
Single	9 (29.0%)	11 (78.6%)	20 (44.4%)	22 (75.9%)	42 (56.8%)
Cohabiting	5 (16.1%)	0	5 (11.1%)	0	5 (6.8%)
Married	8 (25.8%)	0	8 (17.8%)	1 (3.4%)	9 (12.2%)
Separated	1 (3.2%)	0	1 (2.2%)	0	1 (1.4%)
Divorced	2 (6.5%)	0	2 (4.4%)	0	2 (2.7%)
Dating	5 (16.1%)	3 (21.4%)	8 (17.8%)	6 (20.7%)	14 (18.9%)
Did not report	1 (3.2%)	0	1 (2.2%)	0	1 (1.4%)
Highest degree earned					
Less than high school	1 (3.2%)		1 (2.2%)		1 (1.4%)
High school or GED	15 (48.4%)	14 (100.0%)	29 (64.4%)	27 (93.1%)	56 (75.7%)
College degree	2 (6.5%)		2 (4.4%)		2 (2.7%)
Bachelor degree	6 (19.4%)		6 (13.3%)	2 (6.9%)	8 (10.8%)
Master's degree	3 (9.7%)		3 (6.7%)		3 (4.1%)
PhD degree	1 (3.2%)		1 (2.2%)		1 (1.4%)
Professional degree	1 (3.2%)		1 (2.2%)		1 (1.4%)
Other	1 (3.2%)		1 (2.2%)		1 (1.4%)
Did not report	1 (3.2%)		1 (2.2%)		1 (1.4%)
Annual family income					

Less than $5,000	1 (3.2%)	0	1 (2.2%)	0	1 (1.4%)
$5,000-$11,999	2 (6.5%)	0	2 (4.4%)	0	2 (2.7%)
$16,000-$24,999	1 (3.2%)	3 (21.4%)	4 (8.9%)	1 (3.4%)	5 (6.8%)
$25,000-$34,999	2 (6.5%)	0	2 (4.4%)	2 (6.9%)	4 (5.4%)
$35,000-$49,999	3 (9.7%)	2 (14.3%)	5 (11.1%)	2 (6.9%)	7 (9.5%)
$50,000-$74,999	4 (12.9%)	1 (7.1%)	5 (11.1%)	3 (10.3%)	8 (10.8%)
$75,000-$99,999	3 (9.7%)	0	3 (6.7%)	2 (96.9%)	5 (6.8%)
$100,000 or greater	11 (35.5%)	3 (21.4%)	14 (31.1%)	1 (3.4%)	15 (20.3%)
Don't know	1 (3.2%)	4 (28.6%)	5 (11.1%)	17 (58.6%)	22 (29.7%)
No response	3 (9.7%)	1 (7.1%)	4 (8.9%)	1 (3.4%)	5 (6.8%)
Ethnicity					
Caucasian	23 (74.2%)	2 (14.3%)	25 (55.6%)	4 (13.8%)	29 (39.2%)
Asian	5 (16.1%)	8 (57.1%)	12 (28.9%)	12 (48.3%)	27 (36.5%)
African American	1 (3.2%)	0	1 (2.2%)	7 (24.1%)	8 (10.8%)
Other	1 (3.2%)	4 (28.6%)	5 (11.1%)	4 (13.8%)	9 (12.2%)
Did not identify	1 (3.2%)	0	1 (2.2%)	0	1 (1.4%)
Religion					
Protestant	5 (16.1%)	0	5 (11.1%)	6 (20.7)	11 (14.9%)
Jewish	5 (16.1%)	0	5 (11.1%)	0	5 (6.8%)
Catholic	4 (12.9%)	2 (14.3%)	6 (13.3%)	2 (6.9%)	8 (10.8%)
Buddhist	0	0	0	2 (6.9%)	2 (2.7%)
Hindu	0	6 (42.9%)	6 (13.3%)	3 (10.3%)	9 (12.2%)
Muslim	0	1 (7.1%)	1 (2.2%)	6 (20.7%)	7 (9.5%)
Other	8 (25.8%)	3 (21.4%)	11 (24.4%)	9 (31.0%)	20 (27.0%)
None	9 (29.0%)	0	10 (22.2%)	1 (3.4%)	10 (13.5%)
Did not report		1 (7.1%)	1 (2.2%)		

Table 2

Frequency of Psychiatric Diagnoses as Assessed by the M.I.N.I.

	Group				
Psychiatric diagnoses	START depressed *n* = 31	UTSC depressed *n* = 14	Depressed combined *n* = 45	Control *n* = 29	Total Sample *n* = 74
Mood disorders					
Major depressive episode (current)	11 (35.5%)	6 (42.9%)	17 (37.8%)	0	17 (22.4%)
Major depressive episode (past)	31 (100%)	14 (100%)	45 (100%)	0	45 (59.2%)
Major depressive episode (recurrent)	25 (80.6%)	9 (64.3%)	34 (75.6%)	0	34 (44.7%)
Major depressive disorder	20 (64.5%)	10 (71.4%)	30 (66.7%)	0	30 (39.5%)
Manic episode (current)	0	0	0	0	0
Manic episode (past)	3 (9.7%)	1 (7.1%)	4 (8.9%)	0	4 (5.3%)
Manic episode (recurrent)	3 (9.7%)	1 (7.1%)	4 (8.9%)	0	4 (5.3%)
Hypomanic episode (current)	1 (3.2%)	0	1 (2.2%)	0	1 (1.3%)
Hypomanic episode (past)	8 (25.8%)	3 (21.4%)	11 (24.4%)	0	11 (14.5%)
Hypomanic episode recurrent	6 (19.4%)	1 (1.7%)	7 (15.6%)	0	7 (9.2%)
Hypomanic symptoms (current)	0	0	0	0	0
Hypomanic symptoms (past)	0	0	0	0	0
Hypomanic symptoms (recurrent)	0	0	0	0	0
Bipolar I	3 (9.7%)	1 (7.1%)	4 (8.9%)	0	4 (5.3%)
Bipolar II	8 (25.8%)	3 (21.4%)	11 (24.4%)	0	11 (14.5%)
Bipolar NOS	0	0	0	0	0
Mood disorder + psychotic features (lifetime)	0	0	0	0	0
Mood disorder + psychotic features (current)	0	0	0	0	0
Psychotic disorders					
Psychotic disorder (current)	0	0	0	0	0
Psychotic disorder (lifetime)	0	0	0	0	0
Anxiety disorders					
Panic disorder (lifetime)	15 (48.4%)	1 (7.1%)	16 (35.6%)	1 (3.4%)	17 (22.4%)
Panic disorder (current)	3 (9.7%)	0	3 (6.7%)	0	3 (3.9%)
Panic disorder (limited symptoms)	5 (16.1%)	3 (21.4%)	8 (17.8%)	0	8 (10.5%)
Agoraphobia (current)	11 (35.5%)	1 (7.1%)	12 (26.7%)	0	12 (15.8%)

Social phobia (generalized)	14 (45.2%)	2 (14.3%)	16 (35.6%)	0	16 (21.1%)
Social phobia (non-generalized)	4 (12.9%)	0	4 (8.9%)	0	4 (5.3%)
Specific phobia	5 (16.1%)	1 (7.1%)	6 (13.3%)	0	6 (7.9%)
Obsessive compulsive disorder	6 (19.4%)	1 (7.1%)	7 (15.6%)	1 (3.4%)	8 (10.5)
Post-traumatic stress disorder	4 (12.9%)	3 (21.4%)	7 (15.6%)	0	7 (9.2%)
Generalized anxiety disorder	25 (80.6%)	5 (35.7%)	30 (66.7%)	0	30 (39.5%)
Substance-related disorders					
Alcohol dependence (current)	4 (12.9%)	0	4 (8.9%)	1 (3.4%)	5 (6.6%)
Alcohol abuse (current)	4 (12.9%)	0	4 (8.9%)	1 (3.4%)	5 (6.6%)
Substance dependence (current)	3 (9.7%)	0	3 (6.7%)	0	3 (3.9%)
Substance abuse (current)	3 (9.7%)	0	3 (6.7%)	2 (6.9%)	5 (6.6%)
Eating disorders					
Anorexia	0	0	0	0	0
Bulimia	0	0	0	0	0
Suicidal risk					
Low risk	14 (45.2%)	3 (21.4%)	17 (37.8%)	0	17 (22.4%)
Moderate risk	2 (6.5%)	0	2 (4.4%)	0	2 (2.6%)
High risk	1 (3.2%)	0	1 (2.2%)	0	1 (1.3%)
No risk	14 (45.2%)	11 (78.6%)	25 (55.6%)	29 (100%)	53 (69.7%)
Attention Deficit Hyperactivity Disorder	0	0	0	0	0

Table 3

Bivariate Correlations Among Variables in the Total Sample (N = 74)

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. S-NAB (A)	–														
2. S-NAB (L)	.17	–													
3. S-NAB (M)	.32**	.19	–												
4. S-NAB (V)	.35**	.27*	.25*	–											
5. S-NAB (EF)	.55**	.30**	.59**	.45**	–										
6. PDQ (A)	-.30**	-.12	-.13	-.22	-.17	–									
7. PDQ (M)	.00	.09	.15	-.01	.04	.69**	–								
8. PDQ (EF)	-.13	-.01	.02	-.14	-.04	.70**	.63**	–							
9. PCIQ (L)	-.08	-.28*	-.02	-.01	-.18	.50**	.57**	.37**	–						
10. PCIQ (V)	-.07	-.27*	-.00	-.06	-.25*	.24*	.36**	.27**	.42**	–					
11. SDS (W)	-.04	-.25*	.09	-.05	.10	.54**	.43**	.55**	.29*	.05	–				
12. SDS (S)	-.11	-.04	-.01	-.12	.05	.63**	.51**	.53**	.31**	-.17	.66**	–			
13. SDS (F)	-.27*	.03	-.03	-.06	-.03	.52**	.48**	.50**	.22	-.15	.61**	.75**	–		
14. PHQ-9	-.11	-.25*	-.10	-.24*	-.70	.50**	.45**	.46**	.37**	.24*	.48**	.49**	.52**	–	
15. GAD-7	-.16	-.07	-.11	-.15	.03	.49**	.39**	.45**	.17	.12	.50**	.51**	.54**	.77**	–

Note. S-NAB (A) = Neuropsychological Assessment Battery Screening module attention subscale; S-NAB (L) = Neuropsychological Assessment Battery Screening module language subscale; S-NAB (M) = Neuropsychological Assessment Battery Screening module memory subscale; S-NAB (V) = Neuropsychological Assessment Battery Screening module visuospatial subscale; S-NAB (EF) = Neuropsychological Assessment Battery Screening module executive functioning subscale; PDQ (A) = Perceived Deficits Questionnaire attention subscale; PDQ (M) = Perceived Deficits Questionnaire memory subscale; PDQ (EF) = Perceived Deficits Questionnaire executive functioning subscale; PCIQ (L) = Perceived Cognitive Impairment Questionnaire language subscale; PCIQ (V) = Perceived Cognitive Impairment Questionnaire visuospatial subscale; SDS (W) = Sheehan Disability Scale work subscale; SDS (S) = Sheehan Disability Scale social subscale; SDS (F) = Sheehan Disability Scale family subscale; PHQ-9 = Patient Health Questionnaire; GAD-7 = Generalized Anxiety Disorder Scale.

*$p < .05$.

**$p < .01$.

Table 4

Mean (Standard Deviation) of Scores for Variables by Group and Total Sample

	Group		
Variable	Depressed *n* = 45	Control *n* = 29	Total Sample *n* = 74
Objective cognitive			
S-NAB attention	95.20 (17.91)	95.00 (17.22)	95.12 (17.53)
S-NAB language	112.84 (13.27)	106.90 (25.79)	110.51 (19.23)
S-NAB memory	93.53 (11.38)	91.17 (13.25)	92.61 (12.11)
S-NAB visuospatial	104.58 (14.56)	106.03 (12.82)	105.15 (13.83)
S-NAB executive functioning	98.33 (14.17)	89.41 (15.52)	94.84 (15.25)
Subjective cognitive			
PDQ attention	10.31 (4.45)	7.66 (2.72)	9.27 (4.06)
PDQ memory	7.74 (3.77)	5.28 (2.97)	3.88 (2.23)
PDQ executive functioning	10.40 (4.20)	7.59 (2.92)	9.30 (3.98)
PCIQ language	3.73 (2.32)	4.10 (2.09)	3.88 (2.23)
PCIQ visuospatial	3.09 (2.73)	4.52 (2.52)	3.65 (2.72)
Functional impairment			
SDS work	4.42 (3.20)	1.66 (1.95)	3.34 (3.08)
SDS social	5.51 (3.13)	2.00 (2.16)	4.14 (3.27)
SDS family	4.56 (2.85)	1.52 (1.64)	3.36 (2.86)
PHQ-9	10.38 (6.91)	7.10 (5.87)	9.09 (6.68)
GAD-7	10.07 (6.77)	4.97 (5.04)	8.07 (6.61)

Note. Objective cognitive = objective psychometric neuropsychological test measures; S-NAB = Neuropsychological Assessment Battery Screening module; Subjective cognitive = subjective self-report of cognitive functioning; PDQ = Perceived Deficits Questionnaire; PCIQ = Perceived Cognitive Impairment Questionnaire; PHQ-9 = Patient Health Questionnaire; GAD-7 = Generalized Anxiety Disorder Scale.

Table 5

Bivariate Correlations Among Variables in the Depressed Group (N = 45)

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. S-NAB (A)	–														
2. S-NAB (L)	.21	–													
3. S-NAB (M)	.31*	.24	–												
4. S-NAB (V)	.30*	.42**	.45*	–											
5. S-NAB (EF)	.54**	.19	.62**	.48**	–										
6. PDQ (A)	-.44**	-.19	-.18	-.19	-.37*	–									
7. PDQ (M)	-.12	.10	.13	.10	-.13	.71**	–								
8. PDQ (EF)	-.31*	-.08	-.12	-.14	-.30*	.74**	.65**	–							
9. PCIQ (L)	-.15	-.07	.13	.02	-.11	.68**	.75**	.50**	–						
10. PCIQ (V)	-.07	.18	.10	-.05	-.16	.35*	.60**	.46**	.38*	–					
11. SDS (W)	-.14	-.35*	-.00	-.01	-.03	.53**	.38*	.46**	.40**	.58	–				
12. SDS (S)	-.20	-.30*	-.13	-.14	-.12	.63**	.47**	.54**	.54**	.00	.65**	–			
13. SDS (F)	-.37*	-.15	-.18	-.06	-.28	.56**	.48**	.54**	.47**	.05	.60**	.68**	–		
14. PHQ-9	.18	-.19	-.24	-.28	-.12	.46**	.40**	.47**	.45**	.24	.42**	.43**	.55**	–	
15. GAD-7	-.20	-.01	-.25	-.14	-.11	.40**	.33*	.38*	.17	.17	.36*	.31*	.44**	.74**	–

Note. S-NAB (A) = Neuropsychological Assessment Battery Screening module attention subscale; S-NAB (L) = Neuropsychological Assessment Battery Screening module language subscale; S-NAB (M) = Neuropsychological Assessment Battery Screening module memory subscale; S-NAB (V) = Neuropsychological Assessment Battery Screening module visuospatial subscale; S-NAB (EF) = Neuropsychological Assessment Battery Screening module executive functioning subscale; PDQ (A) = Perceived Deficits Questionnaire attention subscale; PDQ (M) = Perceived Deficits Questionnaire memory subscale; PDQ (EF) = Perceived Deficits Questionnaire executive functioning subscale; PCIQ (L) = Perceived Cognitive Impairment Questionnaire language subscale; PCIQ (V) = Perceived Cognitive Impairment Questionnaire visuospatial subscale; SDS (W) = Sheehan Disability Scale work subscale; SDS (S) = Sheehan Disability Scale social subscale; SDS (F) = Sheehan Disability Scale family subscale; PHQ-9 = Patient Health Questionnaire; GAD-7 = Generalized Anxiety Disorder Scale.

*$p < .05$.

**$p < .01$.

Table 6

Frequency of current psychiatric medication use by group

	Group	
	Depressed (*n* = 45)	Control (*n* = 29)
Currently on psychiatric medications	19 (42.2%)	0
Type of psychiatric medication		
SSRIs	11 (24.4%)	0
SNRIs	6 (13.3%)	0
NDRIs	4 (8.9%)	0
NaSSAs	4 (8.9%)	0
Atypical antidepressants	2 (4.4%)	0
Mood stabilizers	5 (11.1%)	0
Antipsychotics	7 (15.6%)	0
Benzodiazepines	12 (26.7%)	0
Stimulants	6 (13.3%)	0

Note. SSRIs = selective serotonin reuptake inhibitors; SNRIs = selective norepinephrine reuptake inhibitors; NDRIs = norepinephrine dopamine reuptake inhibitors; NaSSAs = noradrenaline serotonin specific antidepressants.

Appendix A: DSM-5 Diagnostic Criteria for Major Depressive Episode

DSM-5 Diagnostic Criteria for Major Depressive Disorder and Major Depressive Episode

A. Five (or more) of the following symptoms have been present during the same 2 week period and represent a change from previous functioning: at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure.

   Note: Do not include symptoms that are clearly attributable to another medical condition.

1. Depressed mood most of the day, nearly every day, as indicated by either subjective report (e.g. feels sad, empty, hopeless) or observation made by others (e.g. appears tearful). (**Note:** in children and adolescents, can be irritable mood.)
2. Marked diminished interest or pleasure in all, or almost all activities most of the day, nearly every day (as indicated by either subjective account or observation).
3. Significant weight loss when not dieting or weight gain (e.g. a change of more than 5% of body weight in a month), or decrease or increase in appetite nearly every day (**Note:** in children, consider failure to make expected weight gain.)
4. Insomnia or hypersomnia nearly every day.
5. Psychomotor agitation or retardation nearly every day (observable by others, not merely subjective of restlessness or being slowed down).
6. Fatigue or loss of energy nearly every day.
7. Feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick).
8. Diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others).
9. Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide.

B. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.

C. The episode is not attributable to the physiological effects a substance or to another medical condition.

Note: Responses to a significant loss (e.g. bereavement, financial ruin, losses form a natural disaster, a serious medical illness or disability) may include the feelings of intense sadness, rumination about the loss, insomnia, poor appetite, and weight loss noted in Criterion A, which may resemble a depressive episode. Although such symptoms may be understandable or considered appropriate to the loss, the presence of a major depressive episode in addition to the normal response to a significant loss should also be carefully considered. This decision inevitably requires the exercise of clinical judgment based on the individual's history and the cultural norms for the expression of distress in the context of loss.

D. The occurrence of the major depressive episode is not better explained by schizoaffective disorder, schizophrenia, schizophreniform disorder, delusional disorder, or other specific and unspecified schizophrenia spectrum and psychotic disorders.

E. There has never been a manic episode or a hypomanic episode.

Note: This exclusion does not apply if all of the manic-like or hypomanic-like episodes are substance-induced or are attributable to the physiological effects of another medical condition.

Appendix B: Optimum Ethics Review Board Approval Letters

OPTIMUM
CLINICAL RESEARCH INC

December 3, 2014

Attn: Leena Anand
c/o Dr. Martin A. Katzman
START Clinic for Mood and Anxiety Disorders
32 Park Road
Toronto, Ontario
M4W 2N4
Fax: 416-598-8198

RE DATABASE PACKAGE CHANGES

Dear Dr. Katzman:

At the meeting held on December 3, 2014, the Board reviewed your letter dated November 21, 2014 notifying the Board of the closure of your current database package, and amendment of the package with the replacement of alternative scales. The Board had no concerns with the changes and addition of these scales.

Thank you.

Sincerely,

Paul Macneil
Co-Chair - Ethics Review Board

PM/pgh

Appendix C: UTSC Ethics Board Approval Letter

FW: Thesis in Psychology Ethics Protocol Submission Inbox x
Gausiha Rathitharan 21 Sep (1 day ago)
to me

From: epulickeel@utsc.utoronto.ca
Subject: Re: Thesis in Psychology Ethics Protocol Submission
Date: Thu, 10 Sep 2015 09:34:20 -0400
To: gausi@live.com

Good morning Gausiha,

I have received approval for your protocol and the protocol number 2015-2 has been assigned. Your protocol will expire on September 10, 2016.

Best,
Liz

Elizabeth Pulickeel
Assistant to the Chair
Department of Psychology
University of Toronto Scarborough
1265 Military Trail, Room S427!B
Toronto, ON, M1C 1A4
Tel: 416-287-7400
Emailepulickeel@utsc.utoronto.ca

Appendix D: List of Disorders Assessed by the M.I.N.I.

List of Disorders Assessed by the M.I.N.I.

Disorder	Past	Current	Lifetime
Major depressive episode	X	X	
Suicidality		X	X
Manic and hypomanic episodes	X	X	
Panic disorder		X	X
Agoraphobia		X	
Social phobia		X	
Specific phobia		X	
Obsessive compulsive disorder		X	
Post traumatic stress disorder		X	
Alcohol dependence/abuse		X	
Substance dependence/abuse		X	
Psychotic disorders and mood disorder with psychotic features		X	X
Anorexia nervosa		X	
Bulimia nervosa		X	
General anxiety disorder			
Adult deficit/hyperactivity disorder			X

Appendix E: Patient Health Questionnaire (PHQ-9)

PHQ-9

Over the last 2 weeks, how often have you been bothered by any of the following problems? (Use "✔" to indicate your answer)	Not at all	Several days	More than half of the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself — or that you are a failure or have let yourself or your family	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3
FOR OFFICE CODING	0	+ _____	+ _____	+ _____ = Total Score: _____

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult

Appendix F: Generalized Anxiety Disorder Scale (GAD-7)

GAD-7

Over the last 2 weeks, how often have you been bothered by any of the following problems?	Not at all sure	Several days	Over half of the days	Nearly every day
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it's hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid as if something awful might happen	0	1	2	3
Add the score for each column	____ +	____ +	____ +	____
Total Score (add your column scores) =				

If you checked off any problems, how difficult have these made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all _____
Somewhat difficult _____
Very difficult _____
Extremely difficult _____

Appendix G: Perceived Deficits Questionnaire (PDQ)

PDQ

INSTRUCTIONS

Please select the appropriate response based on your cognitive functioning during the *past 4 weeks, including today*. If you are not sure which answer to select, please choose the one that comes closest to describing you.

During the past 4 weeks, how often did you…

Never	Rarely	Sometimes	Often	Almost Always
0	1	2	3	4

_____ Lose your train of thought when speaking?
_____ Have difficulty remembering the names of people, even ones you have met several times?
_____ Forget what you came into the room for?
_____ Have trouble getting things organized?
_____ Have trouble concentrating on what people are saying during a conversation?
_____ Forget if you had already done something?
_____ Miss appointments and meetings you had scheduled?
_____ Have difficulty planning what to do in a day?
_____ Have trouble concentrating on things like watching a television program or reading a book?
_____ Forget what you did the night before?
_____ Forget the date unless you looked it up?
_____ Have trouble getting started, even if you had a lot of things to do?
_____ Find your mind drifting?
_____ Forget what you talked about after a phone conversation?
_____ Forget to do things like turn off the stove or turn on your alarm clock?
_____ Feel like your mind went totally blank?
_____ Have trouble holding phone numbers in your head, even for a few seconds?
_____ Forget what you did last weekend?
_____ Forget to take your medication?
_____ Have trouble making decisions?

Appendix H: Perceived Cognitive Impairment Questionnaire (PCIQ)

PCIQ

INSTRUCTIONS

Everyone at some point experiences problems with memory, attention, or concentration, but these problems may occur more frequently for some individuals. The following questions describe several situations in which a person may encounter such problems.

Please select the appropriate response based on your cognitive functioning during the *past 4 weeks, including today*. If you are not sure which answer to select, please choose the one that comes closest to describing you.

During the past 4 weeks, how often did you…

Never	Rarely	Sometimes	Often	Almost Always
0	1	2	3	4

_____ Become easily distracted?

_____ Lose your train of thought?

_____ Have difficulties understanding simple verbal instructions?

_____ Have trouble finding words for people's names or things?

_____ Forget where you leave things?

_____ Find it difficult to follow and instruction that only has pictures of what you needed to do?

_____ Find it hard to learn when someone showed you how to do something visually, rather than telling you verbally?

_____ Forget things that people tell you?

_____ Have trouble remembering stories?

_____ Become clumsy?

_____ Have a hard time putting things together with your hands (and not because of pain or physical limitations)?

_____ When you reach for things, feel your accuracy is off?

_____ Have problems with recognizing common objects, familiar scenes, or faces of people you know?

_____ Have difficulties recognizing common objects (e.g. a car) if they were seen from different angles (e.g. front, side, rear)?

_____ Experience problems with writing or drawing because you were not able to mentally put together the lines and curves to produce what you wanted to write or draw?

_____ Have difficulty with planning or organizing daily activities?

_____ Find yourself talking more slowly?

Appendix I: Sheehan Disability Scale (SDS)

SDS

Circle a number that describes your situation now

W Work

Because of my problems my work is impaired

0	1	2	3	4	5	6	7	8	9	10
Not at all		Mildly			Moderately			Markedly		Very severe

S Social life/leisure activities

(with other people at parties, socializing, visiting, dating, outings, clubs, entertaining)

Because of my problems my social life is impaired

0	1	2	3	4	5	6	7	8	9	10
Not at all		Mildly			Moderately			Markedly		Very severe

F Family life/home responsibilities

(relating to family members, paying bills, managing home, shopping and cleaning)

Because of my problems my family life/home responsibilities are impaired

0	1	2	3	4	5	6	7	8	9	10
Not at all		Mildly			Moderately			Markedly		Very severe

Appendix J: START Clinic Consent Form

Dear Patients of the START Clinic,

Just before your first visit to the START Clinic, you are asked to complete a series of questionnaires which allow us the opportunity to assess you and your mental health. The information gathered from the packages is used individually to aid in your assessment. In addition, it may be added together with the information from other people to examine generally what people are like when they arrive in the clinic.
This information is very important for us and other therapists of patients with anxiety disorders in order to study and develop new treatment options that we can in turn offer our patients.
Please be aware that all of the information you provide us with is kept with strict confidentiality, and also be aware that your name will not be used in any publications.
If you have any further questions regarding the questionnaires used or the research we are conducting please do not hesitate to ask.
Thank you,

Dr. Martin Katzman B.Sc., MD, FRCP(C)
Clinic Director

I _____understand and am comfortable with the above.
Patient Name (PLEASE PRINT)

_____ _____
Signature Date

Appendix K: UTSC Consent Form

INFORMED CONSENT

Title of Study: On the Predictive Validity of Neuropsychological Testing and Real World Function

Supervisor: Konstantine Zakzanis, Ph.D, C.Psych.
zakzanis@utsc.utoronto.ca
Investigator: Gausiha Rathitharan
Gausiha.rathitharan@mail.utoronto.ca

Overview:

You are invited to participate in a study that aims to investigate the predictive validity of neuropsychological testing and real world function.

This study is not part of any treatment. It is expected that 150 participants will be enrolled.

It is important to know about the potentials risks and benefits of the study in order to make an informed decision to participate or not. This consent form gives you detailed information about the research study. Once you understand the study, you will be asked if you wish to participate; if so, you will be asked to check yes at the bottom of this form.

Voluntary Participation:

Your participation in this study is entirely voluntary. You can choose to not participate, or to withdraw from the study at any time, and this will not have any foreseen undesirable consequences. If you withdraw from the study, all information collected to that point will be retained within the study records.

Benefits:

The benefit of participation in this study is an opportunity to contribute to scientific research in clinical neuropsychology which will provide insight into the validity of neuropsychological testing.

Student participants enrolled in TAPS will be rewarded with a time completion on the TAPS system leading to a course credit. Participants will be reimbursed for their participation on a pro-rated basis, in increments of 30 minutes.

Description of Procedures:

During this study you will be asked some questions related to any medical history, and to complete a series of computerized tasks. Afterwards, you will complete some self-report questionnaires about your daily activities and emotional experiences. You have the right to refuse to answer questions or withdraw from the study if you wish.

This study is expected to take 3 hours.

Risks:

During the study you may feel mild fatigue or discomfort when completing some of the tasks. If needed you may take breaks during the study.

Exclusion from the Study:

You will not be eligible for participation in this study if you are under 17 years of age or lack fluency in English.

Confidentiality:

All information collected about you during this study will be kept confidential and your identity will not be revealed when the results of this study are reported in presentations and publications. Your confidentiality will be protected.

As part of continuing review of the research, your study records may be assessed on behalf of the Research Ethics Board. A person from the research ethics team may contact you, if your contact information is available to ask you questions about the research study and your consent to participate. The person assessing your file or contacting you must maintain your confidentiality to the extent permitted by law.

New Information:

If new information becomes available that is relevant to your participation or continuation in this study, you will be informed in a timely manner.

Contacts:

If you have any further questions about the study, you may contact Dr. Konstantine Zakzanis at zakzanis@utsc.utoronto.ca or Gausiha Rathitharan at Gausiha.rathitharan@mail.utoronto.ca. If you have any questions about your rights as a study participant, you may contact the Research Ethics Office at ethics.review@utoronto.ca, at 416-946-3273.

Conflicts of Interest

There are no foreseen conflicts of interest with respect to this study.

Consent:

I, _____(name of study participant) have read the information form for the study named "On the predictive validity of neuropsychological testing and real world function". I understand that my role is that of a participant in this study. I have been given an opportunity to ask questions about this study. Any questions that I have had have been answered to my satisfaction, so that I now understand the study procedures, the potential risks of participating, and my right to the confidential treatment of the information that is collected about me. I also understand that my participation in this study is entirely voluntary, and that I may refuse to participate or withdraw from the study at any time, without any foreseen consequences.

_____	_____
Participant's Printed Name	Signature & Date
_____	_____
Research Assistant's Name	Signature & Date
_____	_____
Principal Investigators Name	Signature & Date

Appendix L: Medical Questionnaire

Medical Information Questionnaire

Please check YES or NO to each of the following. When you are in contact with the clinic, please mention any health problems for which you checked YES.

1. Have you ever suffered from (or are you currently being treated for) any of the following?

YES	NO	
___	___	a. Heart Disease
___	___	b. Cardiac arrhythmias (irregular heart rhythm)
___	___	c. Angina or chest pain (aside from panic attacks)
___	___	d. High or low blood pressure (which?_____)
___	___	e. Neurological disorder, e.g. epilepsy (specify:_____)
___	___	f. Migraine Headaches
___	___	g. Asthma
___	___	h. Other respiratory or chest disease
___	___	i. Thyroid Abnormalities
___	___	j. Diabetes
___	___	k. Mitral valve prolapse
___	___	l. Vestibular or inner ear disorder (specify:_____)
___	___	m. Contagious blood condition, e.g. hepatitis, HIV/AIDS (specify:_____)

2. Height:_____ Weight:_____

3. Date of last physical exam (month/day/year):_____ any abnormalities?_____

4. Do you have any reason to believe you are pregnant? YES_____ NO_____

5. Have you ever had a concussion or head injury resulting in loss of consciousness, or which produced any symptoms following the injury? YES_____ NO_____

6. Have you ever had any operations/surgery? YES_____ NO_____

7. Please list all prescription medications that you are currently taking (including medications takes "as needed"). Include the dosage taken per day, and the reason for taking the medication.

_____
_____
_____
_____

8. Please list all prescription medications that you have taken in the past (including medications takes "as needed"). Include the dosage taken per day, and the reason for taking the medication.

_____
_____
_____
_____

Appendix M: Socio-demographic Questionnaire

Sociodemographic Questionnaire

Sex: female____ male____ **Date of birth (dd/mm/yy):** ____ **Age:**____

Marital Status:

Single ____ (please enter date as: dd/mm/yy)
Married ____ (date) _____
Cohabiting ____ (date) _____
Separated ____ (date) _____
Divorced ____ (date) _____
Widowed ____ (date) _____

Religion:

____ Protestant ____ Jewish ____ Buddhist ____ Hindu
____ Catholic ____ Muslim ____ Other (Please specify)

Ethnic Background

____ White ____ Asian ____ Hispanic ____ Black
____ Native American ____ Other (Please specify)

Question 1.

Think of this ladder as representing where people stand in their communities.

People define community in different ways: please define it in whatever way is most meaningful to you. At the **top** of the ladder are the people who have the highest standing in their community. At the **bottom** are the people who have the lowest standing in their community.

Where would you place yourself on this ladder?

Please place a large "X" on the rung where you think you stand at this time in your life, relative to other people in your community.

Question 2.

Think of this ladder as representing where people stand in Canada.

At the **top** of the ladder are the people who are the best off – those who have the most money, the most education and the most respected jobs. At the **bottom** are the people who are the worst off – who have the least money, least education, and the least respected jobs or no job. The higher up you are on this ladder, the closer you are to the people who are at the very top; the lower you are, the closer you are to the people at the very bottom.

Where would you place yourself on this ladder?

Please place a large "X" on the rung where you think you stand at this time in your life, relative to other people in Canada.

Question 3. What is the highest grade (or year) of regular school you have completed? (Check one.)

Elementary School	High School	College	Graduate School
01 ____	09 ____	14 ____	18 ____
02 ____	10 ____	15 ____	19 ____
03 ____	11 ____	16 ____	20 ____
04 ____	12 ____	17 ____	21+ ____
05 ____	13 (OAC) ____		
06 ____			
07 ____			
08 ____			

Question 4. What is the highest degree you earned?

____ High school diploma or equivalency (GED)
____ Associate degree (junior college)
____ Bachelor's degree
____ Master's degree
____ Doctorate
____ Professional (MD, JD, DDS, etc.)
____ Other (specify)
____ None of the above (less than high school)

Question 5. Which of the following best describes your current main daily activities and/or responsibilities?

____ Working full-time
____ Working part-time
____ Unemployed or laid off
____ Looking for work
____ Keeping house or raising children full-time
____ Retired
____ Student

Question 6. With regard to your current or most recent job activity:

a. In what kind of business or industry do (did) you work?

_____

(For example: hospital, newspaper publishing, mail order house, auto engine manufacturing, breakfast cereal manufacturing.)

b. What kind of work do (did) you do? (Job Title)

_____

(For example: registered nurse, personnel manager, supervisor of order department, gasoline engine assembler, grinder operator.)

c. How much did you earn, before taxes and other deductions, during the past 12 months?

____ Less than $5,000
____ $5,000 through $11,999
____ $12,000 through $15,999
____ $16,000 through $24,999
____ $25,000 through $34,999
____ $35,000 through $49,999
____ $50,000 through $74,999
____ $75,000 through $99,999
____ $100,000 and greater
____ Don't know
____ No response

Question 7. How many people are currently living in your household, including yourself?

____ Number of people
____ Of these people, how many are children?
____ Of these people, how many are adults?
____ Of the adults, how many bring income into the household?

Question 8. Is the home where you live:

____ Owned or being bought by you (or someone in the household)?
____ Rented for money?
____ Occupied without payment of money or rent?
____ Other (specify) _____

[Some might try to get a "market value" estimate of the value of owned homes and an estimate of how much principal was outstanding on the mortgage.]

Question 9. Which of these categories best describes your total combined family income for the past 12 months? This should include income (before taxes) from all sources, wages, rent from properties, social security, disability and/or veteran's benefits, unemployment benefits, workman's compensation, help from relatives (including child payments and alimony), and so on.

____ Less than $5,000
____ $5,000 through $11,999
____ $12,000 through $15,999
____ $16,000 through $24,999
____ $25,000 through $34,999
____ $35,000 through $49,999
____ $50,000 through $74,999
____ $75,000 through $99,999
____ $100,000 and greater
____ Don't know
____ No response

Question 10. If you lost all your current source(s) of household income (your paycheck, public assistance, or other forms of income), how long could you continue to live at your current address and standard of living?

____ Less than 1 month
____ 1 to 2 months
____ 3 to 6 months
____ 7 to 12 months
____ More than 1 year

Question 11. Suppose you needed money quickly, and you cashed in all of your (and your spouse's) checking and savings accounts, and any stocks and bonds. If you added up what you would get, about how much would this amount to?

____ Less than $500
____ $500 through $4,999
____ $5,000 through $9,999
____ $10,000 through $19,999
____ $20,000 through $49,999
____ $50,000 through $99,999
____ $100,000 through $199,999
____ $200,000 through $499,999
____ $500,000 and greater
____ Don't know
____ No response

If you now subtracted out any debt that you have (credit card debt, unpaid loans including car loans, home mortgage), about how much would you have left?

____ Less than $500
____ $500 through $4,999
____ $5,000 through $9,999
____ $10,000 through $19,999
____ $20,000 through $49,999
____ $50,000 through $99,999
____ $100,000 through $199,999
____ $200,000 through $499,999
____ $500,000 and greater
____ Don't know
____ No response

Appendix N: UTSC Debriefing Form

Debriefing Form

Thank you for your participation in the study "On the predictive validity of neuropsychological testing and real world function."

Historically, Clinical Neuropsychology was developed to assist with the diagnosis of brain pathology and neuropsychological assessments were successful in doing so. However, results obtained from neuropsychological assessments may not always correspond to everyday functioning. Ecological validity is the degree to which test performance corresponds to real world functioning. It is important to demonstrate that neuropsychological tests have ecological validity as the recommendations made by neuropsychologists depending on these measures can have dire consequences if the results are not applicable.

In this study, you were asked to perform some neuropsychological tasks, questionnaires and a computerized task. These will allow us to measure your activities of daily living and we hypothesize that results from the neuropsychological measurements will correlate with those from the Activities of Daily Living measures.

We ask that you do not disclose any information about this experiment, especially anything on this debriefing form, to any of your peers or colleagues, as we do not want any prior knowledge of our participants to bias the results of our study. This can ultimately lead to the publication of non-credible data. We thank you in advance for your cooperation.

This research is being supervised by a board certified and licensed clinical psychologist (i.e. Dr. Zakzanis). To begin, results will be reviewed by the psychologist. Should you express any concern as a result of completing any of the measures, the psychologist will review your responses with you and assess (informally) whether you might want to seek aid for a more formal matter (i.e. mental health issue) by way of Health and Wellness at UTSC."

If you have any further questions about the study, you may contact Dr. Konstantine Zakzanis at zakzanis@utsc.utoronto.ca or Gausiha Rathitharan at Gausiha.rathitharan@mail.utoronto.ca.