Summer 7-15-2024

A Comparison of Cognitive Impairment in Health Anxiety, Generalized Anxiety Disorder, and Posttraumatic Stress Disorder and the Moderating Role of Social Connectedness

Kaitlyn B. Schodt
University of New Mexico - Main Campus

Kaitlyn Schodt
Candidate

Psychology
Department

This dissertation is approved, and it is acceptable in quality and form for publication:

Approved by the Dissertation Committee:

Bruce W. Smith, Chairperson

Lynette Abrams-Silva

Jeremy Hogeveen

Kristin Mickelson

A COMPARISON OF COGNITIVE IMPAIRMENT IN HEALTH ANXIETY, GENERALIZED ANXIETY DISORDER, AND POSTTRAUMATIC STRESS DISORDER AND THE MODERATING ROLE OF SOCIAL CONNECTEDNESS

by

KAITLYN SCHODT

B.A., Psychology, University of New Mexico, 2015
M.S., Psychology, Arizona State University, 2019

DISSERTATION

Submitted in Partial Fulfillment of the
Requirements for the Degree of
Doctor of Philosophy

Psychology

The University of New Mexico
Albuquerque, New Mexico

July 2024

DEDICATION

To my dad, Jim. Although you were unable to witness my graduate school journey, I know that you would be so proud.

ACKNOWLEDGMENTS

There are several individuals I would like to acknowledge for their endless support and always reminding me that I am capable of more than I think.

I would like to express utmost gratitude to my advisor, Dr. Bruce W. Smith, who has served as a mentor throughout my undergraduate and graduate career. His guidance and ongoing support, both academically and personally, have been invaluable.

I owe much of where I am today to Dr. Lynette Abrams-Silva, who served as my primary clinical supervisor during doctoral training and to whom I credit my discovery of my true passion within psychology – neuropsychology. Her mentorship and constant encouragement to strive for the highest quality of training has contributed significantly to my professional and personal growth.

I would also like to thank Dr. Kristin Mickelson, who served as my advisor at Arizona State University for my master's studies and as a committee member for my dissertation, and who has provided me with guidance throughout my graduate career.

I would also like to extend thanks to my ASU and UNM lab mates and fellow interns at Rush University Medical Center for their friendship, collaboration, and support.

I would like to express gratitude to my mom, Patti, for her ongoing support and encouragement throughout my doctoral studies. Thank you also to my dad who, although no longer with us, would be so proud of this accomplishment. Thank you to my brother, David, who was always willing to take a break from his own doctoral studies for hiking and beers with me. I would also like to thank my best friend, Marissa, who has been cheering me on since middle school and has always supported me unconditionally.

I would not have gotten through a doctoral program in the height of the COVID-19 pandemic if it weren't for the emotional support of my cat, Vanta. Thanks for being the cuddliest and silliest cat around, and undoubtedly the favorite cat in all my Zoom meetings.

Last but certainly not least, I would like to thank my fiancé, Luca. Grazie mille per avermi sempre sostenuto, avermi mostrato amore incondizionato, e illuminato le mie giornate. Ti amo tanto, amore mio.

A COMPARISON OF COGNITIVE IMPAIRMENT IN HEALTH ANXIETY, GENERALIZED ANXIETY DISORDER, AND POSTTRAUMATIC STRESS DISORDER AND THE MODERATING ROLE OF SOCIAL CONNECTEDNESS

by

Kaitlyn Schodt

B.A., Psychology, University of New Mexico, 2015
M.S., Psychology, Arizona State University, 2019
Ph.D., Psychology, University of New Mexico, 2024

ABSTRACT

The current study examined the associations between 1) health anxiety, generalized anxiety disorder (GAD), and posttraumatic stress disorder (PTSD) symptomatology and cognitive functioning, and between 2) social connectedness and cognitive functioning, as well as the moderating roles of 3) social connectedness and 4) biological sex and race/ethnicity in the association between symptomatology and cognitive functioning. Results showed that PTSD was associated with greater deficits in several cognitive domains relative to GAD and health anxiety, while health anxiety was not associated with any of the cognitive domains. Social connectedness was positively associated with several cognitive domains, and there was evidence it mitigated the effects of PTSD on some cognitive domains. Exploratory analyses suggested that the impact of PTSD on cognitive functioning may differ by sex, and that health anxiety may have different impacts on the cognition of White versus non-White individuals.

TABLE OF CONTENTS

LIST OF TABLES

Chapter 1

Introduction

Research has consistently demonstrated the negative impact of mental illness on cognitive functioning (e.g., Abramovitch et al., 2021). However, most research has focused on more common mental illnesses such as generalized anxiety disorder (e.g., Robinson et al., 2013) and depression (e.g., Rock et al., 2014) with little attention paid to less common disorders such as health anxiety. Illness anxiety disorder (IAD) involves "a preoccupation with having or acquiring a serious, undiagnosed medical illness" while somatic symptom disorder (SSD) involves pervasive somatic symptoms that result in significant distress and/or disruption to daily life (American Psychiatric Association, 2013). Colloquially, IAD and SSD may also be referred to as health anxiety and may include those who experience some of the symptoms associated with each disorder, though not necessarily enough to meet diagnostic criteria. Research suggests that rates of health anxiety are increasing, possibly due to changes in diagnostic criteria as well as to increased internet accessibility and use, which may fuel rumination and checking behaviors (Tyrer et al., 2016). Though prevalence of health anxiety has not yet been established since the start of the COVID-19 pandemic, it is likely that rates have further increased due to additional fears, anxiety, and uncertainty arising from the pandemic (Rettie & Daniels, 2021) and the pandemic's impact on mental health more broadly (World Health Organization, 2022). Despite increased rates of health anxiety and related disorders, there remains a lack of consistent research on health anxiety (e.g., Tyrer et al., 2016) especially since the COVID-19 pandemic (Tyrer et al., 2020). Further, little is known about the potential impact of health anxiety on cognitive functioning.

Although mental illness can have a detrimental impact on cognitive functioning, there are factors that may mitigate these negative effects. One prime candidate is social connectedness, which has been found to be associated with greater cognitive functioning and may act as a protective factor (e.g., Paiva et al., 2021) whereas deficits (i.e., loneliness, social isolation) have been associated with worse cognitive functioning (e.g., Lara et al., 2019) and may act as a vulnerability factor. However, no research to date has examined whether social connectedness might act as a protective factor between mental illness and cognitive functioning.

The current study sought to address these gaps by examining and comparing the cognitive functioning of individuals experiencing symptoms of health anxiety to those experiencing symptoms of generalized anxiety disorder (GAD) or posttraumatic stress disorder (PTSD). Additionally, the potential protective value of social connectedness was examined in the association between health anxiety, GAD, and PTSD symptomatology and cognitive functioning. Examining the role of social connectedness is particularly important given evidence of increased social isolation and loneliness during the COVID-19 pandemic (e.g., Hajek & Konig, 2022), which may have exacerbated mental health difficulties and, in turn, negatively impacted cognitive functioning. Data collection for the current study took place during the COVID-19 pandemic (i.e., began in October 2021 and concluded in February 2023), and therefore will likely reflect increased levels of health anxiety and social isolation. The current research was used to better delineate the cognitive profiles of individuals with symptoms of health anxiety, highlight functional differences between health anxiety and other anxiety disorders, and explore the important role social connectedness may play in protecting against cognitive decline associated with each disorder. Doing so will

allow for a better understanding of the impact of health anxiety on cognitive functioning, as well as provide insights into possible targets for treatment.

Chapter 2

Review of Relevant Literature

Health Anxiety

Illness anxiety disorder (IAD) involves a preoccupation with having or contracting a serious illness, while somatic symptom disorder (SSD) involves one or more somatic symptoms that cause distress and/or significant disruption in daily life (American Psychiatric Association, 2013). IAD and SSD were previously referred to as hypochondriasis or simply as health anxiety, though hypochondriasis was reconceptualized in the DSM-V. Although IAD and SSD share overlapping features, there are several key differences detailed in the DSM-V. First, individuals with IAD experience anxiety and distress primarily in relation to their own thoughts about the suspected illness (e.g., the cause or significance of the illness) rather than from a physical sensation or sign of illness as in somatic symptom disorder. Further, unlike SSD, which primarily involves somatic symptoms, such symptoms are not always present in IAD and, if they are, are mild in intensity (American Psychiatric Association, 2013). Second, IAD may occur when the individual has a physical illness, though the level of anxiety and preoccupation is considered disproportionate to the severity of the condition. Additionally, to meet diagnostic criteria for IAD, individuals must engage in excessive health-related behaviors, such as checking their body for signs of illness, or maladaptive avoidance, such as avoiding regular medical check-ups.

As described previously, health anxiety is often used colloquially to refer to both IAD and SSD, and there remains a lack of definition of health anxiety – does it refer to either IAD or SSD, or does it capture both disorders? One recent study (Rask et al., 2020) argues that health anxiety has been “consistently identified as excessive concern about one’s health or a

preoccupation with the notion that one has or will get a serious disease including some degree of bodily symptoms that are interpreted as signs of disease or illness." They also argue that a key aspect of health anxiety is illness rumination (i.e., obsessive thoughts surrounding the illness). Further, they suggest that memories of prior illnesses can lead to the development and reinforcement of health anxiety. Given the potential role of memory in health anxiety, Rask et al. (2020) called for additional research exploring the processes that lead to and are associated with health anxiety, including memory as well as other cognitive factors. Based on Rask et al.'s (2020) definition, health anxiety as it is currently used colloquially appears to refer to aspects of both IAD and SSD.

Other research suggests that health anxiety is pervasive and often comorbid, and may result from having experienced a physical illness. Utilizing a sample of treatment-seeking individuals with health anxiety, Newby et al. (2017) observed that most patients in their sample reported experiencing more than seven episodes of health anxiety in their lifetime, with each episode lasting two or more weeks. Further, approximately half the sample reported experiencing health anxiety for four or more years. Newby et al. (2017) also observed that approximately half of the patients reported that their health anxiety was limited to a single illness, such as cancer, whereas 44.9% reported more diffuse fears. Taken together, these findings suggest that individuals may experience health anxiety in response to a single or multiple illnesses, some of which the individual may truly be at risk for, and that symptoms of health anxiety can persist for extended periods of time, especially without proper treatment. The possibility that health anxiety may occur in response to a real physical illness is especially interesting in light of the COVID-19 pandemic, as individuals may experience greater health anxiety either as a result of the pandemic overall (e.g., fear of

contracting the virus; seeing others fall ill with COVID-19), having contracted COVID-19 themselves, and/or the long-term symptoms and illnesses associated with having had COVID-19 (i.e., "long" COVID symptoms such as heart palpitations, neurological symptoms, or respiratory symptoms; CDC, 2022), resulting in overall higher rates of health anxiety. Of interest to the current study, it will also be important to understand the cross-sectional associations between health anxiety and cognitive functioning as an initial exploration of the cognitive sequalae of health anxiety. For example, it may be that experiencing greater health anxiety may negatively impact cognitive functioning. Alternatively, there is evidence that critical thinking skills and disposition are associated with better mental health (e.g., Liu et al., 2021), which suggests that experiencing cognitive difficulties may result in decreased ability to critically consider factors such as disease prevalence and the likelihood of oneself contracting an illness, the meaning of one's symptoms, and so on.

Anxiety Disorders and Cognitive Functioning

Though little is known about health anxiety and cognitive functioning, there is considerable research examining the cognitive functioning of individuals with other anxiety disorders. In a review of the literature on cognitive impairment among young adults with depressive and anxiety disorders, Castaneda et al. (2018) observed variability between subtypes of anxiety disorders, rather than general deficits across anxiety disorders. For example, they found that obsessive-compulsive disorder (OCD) was most strongly associated with executive functioning and short- and long-term visual memory deficits, whereas PTSD was most strongly associated with deficits in attention, short- and long-term verbal and visual memory, and executive functioning. There were fewer studies examining the cognitive

functioning of individuals with other anxiety disorders such as panic disorder and social phobia, and thus consistent findings were not observed. However, this may be due in part to the review's focus on young adults, as the authors reference some studies using adult samples that observed consistent findings for these disorders. Specifically, in studies of older adults, Castaneda et al. (2018) observed that panic disorder was most strongly associated with deficits in visual memory and long-term verbal memory, as well as learning deficits. Interestingly, executive functioning and concentration were found to be intact among those with panic disorder. Social phobia was found to be most associated with deficits in attention, executive functioning, visuospatial functions, and verbal memory. An overview of these findings, as well as those of the following studies reviewed, can be found in Table 1.

Table 1

Deficits in Cognitive Functioning by Domain for Generalized Anxiety Disorder, Posttraumatic Stress Disorder, Obsessive-compulsive Disorder, Social Phobia, and Panic Disorder.

	GAD	PTSD	OCD	Panic Disorder	Social Phobia
Executive Functioning	X(1)	X*$^{+}$(1)	X*		X*
Working Memory	X^{+}(3)	X^{+}			
Processing Speed		X^{+}(1)			
Attention	X(1)	X*			X*
Visuospatial Abilities		X^{+}			X*
Visual Memory	X(1)	X*	X*	X*	
Verbal Memory		X*$^{+}$		X*	X*
General Intelligence		X^{+}			

Note. $^{+}$ indicates meta-analytic findings and * indicates review findings. Single studies are denoted in parentheses.

Generalized Anxiety Disorder

Consistent findings have been observed for generalized anxiety disorder (GAD) and cognitive functioning. In a study by Tempesta et al. (2013), the neuropsychological functioning of individuals with GAD being treated with pharmacotherapy was compared to those with GAD not being treated with pharmacotherapy and controls. They found that, in general, those with GAD experienced greater difficulties in attention, non-verbal memory, and executive functioning as compared to controls. Additionally, those with GAD (both with and without pharmacotherapy) had greater total errors, perseverative errors, and non-perseverative errors on the Wisconsin Card Sorting Test (WCST), which measures a variety of executive functions. Another more recent study (Kim et al., 2018) compared cognitive performances among youth with GAD, OCD, and healthy controls. They found that those with OCD and GAD displayed deficits in planning ability and efficiency, cognitive flexibility, and visual processing. Additionally, those with OCD showed worse planning relative to those with GAD, whereas those with GAD displayed more difficulty with cognitive flexibility. These findings suggest that while there may be some consistent deficits across anxiety disorders, there also appear to be specific deficits for each disorder, particularly in regard to executive functioning.

Research has long suggested an association between anxiety and working memory. Early studies suggested that greater levels of anxiety are associated with worse storage and processing capacity of working memory (Drake, 1988) as well as the interactive effect of situational stress and trait anxiety in predicting working memory capacity (Sorg & Whitney, 1992). A meta-analysis of 177 studies (Moran, 2016) observed a significant association between self-reported anxiety and worse working memory performances. More recent

research has further supported the association between anxiety and impaired working memory. For example, Held et al. (2020) examined working memory performance across four groups: GAD group, clinical group (i.e., other anxiety or mood disorder), subclinical group (i.e., excessive worry), and a control group. They found that clinical status (i.e., the GAD, clinical, and subclinical groups) was associated with working memory impairments. Further, on the working memory task, the GAD group was found to have the lowest accuracy and had a slower reaction time than the control and subclinical group. This finding suggests that although other mood and anxiety disorders may be associated with working memory difficulties, those with GAD may display greater difficulties relative to those with other mood and anxiety disorders. In a large, non-depressed sample, Lukasik et al. (2019) also found that anxiety was associated with poorer working memory performance. Finally, one recent study (Fellman et al., 2020) observed a significant association between COVID-19-elicited anxiety and poorer working memory performance. Thus, there appears to be a consistent link between GAD and poorer working memory performance, including when controlling for depression.

In sum, it appears there are general and specific deficits across anxiety disorders regarding cognitive functioning. Of interest to the current study, GAD appears to be most often associated with deficits in working memory, executive functioning, non-verbal memory, and attention and not as strongly associated with verbal memory, processing speed, and visuospatial abilities. Given evidence of distinct differences in cognitive functioning across anxiety disorders and lack of research on health anxiety, examining potential differences in cognitive functioning between those with health anxiety and other disorders may be beneficial for diagnosis and treatment.

Posttraumatic Stress Disorder

Though posttraumatic stress disorder (PTSD) is currently classified as a trauma disorder in the DSM-V-TR, it was previously considered an anxiety disorder and still shares overlapping symptoms with anxiety disorders (Pai et al., 2017). One key difference between PTSD and anxiety disorders is that in the DSM-V-TR, to be diagnosed with PTSD one must experience a Criterion A event, which involves exposure to "actual or threatened death, serious injury, or sexual violence" either by directly experiencing the traumatic event(s), witnessing the event(s) happen to others, learning that a close other has experience such an event(s), or repeated exposure or experiencing of details of traumatic events (e.g., exposure to details of abuse as part of one's job) (American Psychological Association, 2013). Though anxiety disorders do not require exposure to a Criterion A event as does PTSD, health anxiety may occur in response to a real illness or threat of illness, such as COVID-19. Experiencing a life-threatening illness or repeatedly witnessing others falling seriously ill and/or die as a result of an illness such as COVID-19 could be considered a Criterion A event. Further, health anxiety may lead individuals to exhibit avoidance behaviors, distressing thoughts about the illness, or have reexperiencing symptoms (e.g., nightmares, flashbacks) similar to the experience of those with PTSD. Given these overlapping features of PTSD and health anxiety, the current study examined and compared the cognitive functioning of those with health anxiety symptomatology with PTSD symptomatology.

Of the mental health disorders, the impact of PTSD on cognitive functioning has possibly been the most examined. An early study (Zalewski et al., 1994) compared the cognitive functioning of Vietnam War veterans with either PTSD or GAD to those with neither disorder. They failed to observe differences for the tests utilized (i.e., WAIS-R Block

Design, California Verbal Learning Test, Rey-Osterrieth, Complex Figure Drawing Test, Paced Auditory Serial Addition Test). However, there were several limitations in their study which may have impacted their null findings including lack of a true control group, small sample size, and power issues. Despite these early null findings, more recent studies have observed more consistent deficits and differences. As previously described, review findings on studies utilizing young adult samples observed specific deficits in attention and short- and long-term visual and verbal memory among those with PTSD (Castaneda et al., 2018). In a meta-analysis (Johnsen & Asbjornsen, 2008) of 28 studies examining the association between PTSD and verbal memory, verbal memory was found to be consistently significantly impaired among those with PTSD. Further, this finding held across various groups who experienced different types of trauma (i.e., war combat vs. sexual/physical abuse), though those who experienced war combat trauma were found to display greater impairments relative to those who experienced sexual/physical abuse. Regarding specific measures of verbal memory used across studies, the Wechsler Memory Scale (WMS) and the Auditory Verbal Learning Test (AVLT) showed large effect sizes, whereas the California Verbal Learning Test (CVLT) showed moderate effect sizes. In other words, the WMS and AVLT appeared to be the most sensitive to group differences, suggesting their utility in examining the impact of PTSD on cognitive functioning.

Other studies have shown that veterans with PTSD also display significantly worse performance in information processing speed and executive functions relative to non-veteran controls (Wrocklage et al., 2016). However, in Wrocklage et al.'s (2016) study, they failed to observe significant differences in attention and working memory, which conflicts with meta-analytic findings. In a more recent meta-analysis (Scott et al., 2015) of 60 studies (N = 4108)

on PTSD and neuropsychological functioning, large effect sizes were observed for verbal learning, speed of information processing, attention/working memory, and verbal memory, consistent with other meta-analytic findings.

Another recent meta-analysis (Malarbi et al., 2017) of 27 quantitative and qualitative studies (N = 1526) examined neuropsychological functioning among those who had experienced childhood trauma who went on to develop PTSD and those who did not develop PTSD. Of note, this meta-analysis was limited to children, which provided a different sample than the other meta-analyses reviewed here. Malarbi et al. (2017) found that trauma-exposed children with unknown PTSD status displayed overall lower cognitive functioning compared to healthy controls. Additionally, they displayed significant difficulties in language/verbal skills and some difficulty in general intelligence, perceptual/visual skills, and some aspects of executive functioning. However, they did not observe significant differences in learning and memory. When comparing those with PTSD to those with trauma exposure but no PTSD, they found that those with PTSD displayed moderate deficits in overall cognitive functioning. Additionally, the greatest deficits were in general intelligence, with moderate deficits in language/verbal skills, perceptual/visuospatial abilities, information processing, verbal and visual learning and memory, and overall executive functioning. For executive functioning specifically, Malarbi et al. (2017) found that the largest deficits were in goal setting, with moderate deficits in attentional control and cognitive flexibility, though they noted these findings may be limited due to only 2 to 3 studies being analyzed for each. Interestingly, no consistent differences were observed between those with trauma exposure and no PTSD as compared to controls in regard to general intelligence. This finding suggests that lower IQ may be unique to PTSD rather than broadly related to trauma exposure.

Additionally, those with trauma exposure and PTSD displayed worse perceptual/visuospatial deficits than those with trauma exposure with no PTSD, which suggests right hemisphere development disruption.

As described, some research suggests low IQ may be specific to PTSD (e.g., Malarbi et al., 2017). Interestingly, there is some research suggesting that low IQ may be a predictor of PTSD, rather than an outcome, though findings are limited and variable. For example, in a study by Vasterling et al. (2002), veterans with combat-related PTSD were found to have a lower estimated premilitary IQ (EPIQ) as compared to veterans without psychopathology. Additionally, those with PTSD were found to perform worse on tasks of working memory, attention, and learning, consistent with other research findings. They also observed that current cognitive functioning was impaired among those with PTSD even when controlling for EPIQ. While Vasterling et al.'s (2002) findings are limited due to small sample size and a focus on combat-exposed veterans, their findings nonetheless suggest the bidirectional association between PTSD and IQ. Other studies have also observed an association between pretrauma IQ and the development of PTSD (e.g., Macklin et al., 1998); however, more recent research has suggested that low IQ does not predict PTSD (Shura et al., 2020). Specifically, Shura et al. (2020) found that the differences in IQ observed between those with and without PTSD in their study did not hold when accounting for multiple comparisons and when including symptom/performance validity measures. This finding suggests that the IQ-PTSD link may be accounted for by other factors, such as performance validity and/or demographic factors (e.g., education). Taken together, existing research appears to suggest a stronger causal association between PTSD and cognitive functioning, rather than IQ predicting PTSD.

In sum, PTSD appears to be most strongly associated with deficits in verbal memory, executive functioning, processing speed, and working memory. There is also evidence that PTSD impacts attention, visuospatial abilities, and visual memory, as well as general intelligence. Though some of these features overlap with GAD, such as executive functioning and working memory, there are key differences, such as in the areas of executive functioning most impacted and in what aspects of memory are impacted. For example, PTSD appears to be more strongly associated with deficits in verbal memory and processing speed, whereas GAD appears to be more strongly associated with deficits in non-verbal memory and attention. Additionally, individuals with PTSD appear to display more global deficits in cognitive functioning relative to those with GAD. Based on these differences, it is feasible that distinct differences would appear for those experiencing health anxiety. For example, we may predict that health anxiety is associated with more global deficits, given its overlapping features with both GAD and PTSD. Further, few studies to date have directly compared the cognitive profiles of individuals with GAD to PTSD. Although each disorder shares overlapping deficits, there may be additional ways of distinguishing between the disorders based on the domains most strongly associated with each.

COVID-19 and Health Anxiety

The COVID-19 pandemic has undoubtedly impacted the mental and physical well-being of many individuals. For example, the World Health Organization (WHO) estimated a 25% increase in the worldwide prevalence of anxiety and depression just during the first year of the COVID-19 pandemic. Further, the WHO argued that the greatest contributing factors were likely increased social isolation and associated stress; fear of infection; suffering and/or death associated with the virus; witnessing others fall ill or experiencing the virus oneself;

grief; and financial stressors. Additionally, they cite evidence that women and young people experienced greater negative impacts on mental health.

Similar findings have been observed in other studies. In one study, data was collected nation-wide in China to provide information on psychological distress experienced in the early days of the COVID-19 pandemic (Qiu et al., 2020). In their study, the COVID-19 Peritraumatic Distress Index (CPDI), which asks about the frequency of anxiety, depression, specific phobias, cognitive change, avoidance and compulsive behavior, physical symptoms, and loss of social functioning in the past week, was used. They found that approximately 35% of the sample reported experiencing psychological distress as measured by the CPDI. Additionally, they observed that females experienced significantly greater psychological distress than males, while individuals between ages 18 and 30 and those above 60 had the highest CPDI scores. Other studies have also observed differences in psychological distress during the COVID-19 pandemic based on demographic factors. In one study (Singh Chauhan et al., 2020), 31.9% of participants reported experiencing significant anxiety as a result of the COVID-19 pandemic and lockdowns. Further, Singh Chauhan et al. (2020) observed that younger age, student-status, being currently employed, male gender, and lower income were significantly correlated with anxiety scores.

Given the impact of COVID-19 on overall mental health, it is likely that rates of healthy anxiety have also increased. Most of the research thus far on COVID-19 has examined its impact on common mental health disorders such as anxiety and depression, though some studies have also examined health anxiety. In one qualitative study (Kibbey et al., 2021), the impact of COVID-19 on mental health was examined in a sample of undergraduates living in a COVID “hotspot.” Using an online narrative writing task in which

participants were asked to write about the impact of COVID-19 and their distress, Kibbey et al. (2021) identified nine themes: viral outbreak distress, fear of virus contraction/transmission, proximity to virus, dissatisfaction with public response, physical distancing distress, social distancing distress, academic and school-related distress, disruptive changes in health behavior and routines, financial strain/unemployment, worsening of pre-existing mental health problems, and social referencing that minimizes distress. Of interest to the current study, some of the identified themes are consistent with symptoms and signs of healthy anxiety, such as fear of virus contraction/transmission, which suggests that health anxiety may have been exacerbated by the COVID-19 pandemic, perhaps even more so for those living in COVID-19 hotspots. In another study examining psychological well-being among university students in a COVID-19 hotspot (Kibbey et al., 2021), further evidence for increased rates of mental illness, including health anxiety, was observed. Specifically, they found that 30.3% of their sample reported clinically elevated health anxiety as well as elevated depression (25.4%) and generalized anxiety (22.3%). As discussed by the authors, these rates appear higher than pre-pandemic prevalence rates suggesting an increased risk of each disorder during the pandemic.

Several studies have examined the impact of COVID-19 on health anxiety specifically, and some researchers early in the pandemic called for additional examination of health anxiety and COVID-19 (Tyrer 2020). Specifically, Tyrer (2020) argued that many individuals were likely to experience non-pathological levels of health anxiety as a result of the pandemic noting, however, that some increased health anxiety could be considered reasonable given the known risks of COVID-19. Tyrer (2020) also argued that many individuals would likely reach diagnosable levels of health anxiety, which poses a unique

challenge as it is unclear how to distinguish between pathological and non-pathological health anxiety regarding COVID-19, as some of the fears are within reason. Given that distress is likely to occur regardless of whether one meets diagnostic criteria for health anxiety, it is important to examine the impact of health anxiety more broadly, rather than only examining pathological health anxiety (i.e., SSD or IAD), to better understand its impact on cognitive functioning.

Despite research suggesting increased rates of health anxiety as a result of COVID-19, there is at least one study that failed to find support for this occurrence. In Sauer et al.'s (2022) study, health anxiety related to COVID-19 was compared to health anxiety related to other severe illnesses (e.g., cancer). They found that COVID-19 health anxiety was, on average, significantly lower than health anxiety associated with other severe illnesses. Further, they found that COVID-19 health anxiety was not significantly associated with pre-COVID-19 health anxiety or anxiety associated with other severe illnesses. However, it is important to note that their sample was very small (N = 12) and was limited to individuals who were diagnosed with pathological health anxiety during the "first wave" of the COVID-19 pandemic, thus limiting the generalizability of their findings. Overall, the existing literature suggests that the prevalence of health anxiety, both at the clinical and sub-clinical level, has likely increased due to the COVID-19 pandemic. However, there remains a dearth of research examining the impact of health anxiety on cognitive functioning.

Social Connectedness

Much research has examined the role of positive psychological variables on mental health, with many studies highlighting the protective effects of having high levels of such variables. Of interest to the current study is social connectedness, given that rates of social

isolation and loneliness increased during the COVID-19 pandemic (e.g., Hajek & Konig, 2022) and evidence that each is associated with poorer cognitive functioning (e.g., Lara et al., 2019). In a review of social connectedness research, Cacioppo and Cacioppo (2014) discuss findings suggesting that loneliness is associated with increased morbidity and mortality, depression, poorer health outcomes (e.g., hypertension, poor sleep), and executive functioning. In one recent study (Saeri et al., 2018) social connectedness predicted mental health, more strongly than mental health predicted social connectedness, suggesting that increased levels of social connectedness may act as a protective factor for mental health. Thus, it appears that social isolation or loneliness has deleterious effects on overall mental and physical well-being; in contrast, social connectedness may act as a protective factor for mental health and other factors.

Social Connectedness and COVID-19

The role of social connectedness during COVID-19 has also been examined. In one study on the impact of COVID-19 on social connectedness across age groups, loneliness was found to be associated with negative mental health outcomes across all age groups (Gregory et al., 2021). Important differences were observed between age groups, however. Specifically, older adults (i.e., ages 65 and older) reported greater perceived social support and less loneliness and worsening of mental health since the start of the pandemic relative to other age groups. Further, anxiety, psychological stress, and depression were each found to decrease with increasing age. Lastly, higher levels of perceived social support were associated with better mental health for some age groups (i.e., 25-34, 55-64, 65-69) but not others (i.e., 17-24, 35-44, 45-54). Taken together, these findings highlight the impact of COVID-19 on loneliness and mental health, as well as the protective value of social

connectedness on each. Additionally, findings suggest that older adults may be more resilient to the effects of COVID-19 on loneliness and mental health, relative to younger individuals.

In another study, social connectedness during an early COVID-19 lockdown was examined in relation to distress and fatigue (Nitschke et al., 2020). They found that greater social connectedness was associated with lower levels of general and COVID-19-specific worries and perceived stress. Further, they observed that distress mediated the association between social connectedness and fatigue, suggesting that social connectedness may act as a resilience factor for somatic symptoms, such as fatigue, that are associated with distress. This finding is particularly important for the current study, as it suggests that social connectedness may similarly buffer the impact of health anxiety on cognitive functioning.

Social Connectedness and Cognitive Functioning

In addition to its protective role for mental and physical health, social connectedness also appears to play an important role in maintaining cognitive functioning and protecting against cognitive decline. For example, in a sample of individuals with Alzheimer's disease and other dementias, social connectedness was found to buffer the negative effects of brain atrophy on cognitive functioning (Perry et al., 2021). Other studies have demonstrated the protective value of social connectedness in cognition. In a large sample (N = 66,504), Paiva et al. (2021) found that both greater social connectedness and social engagement were associated with improved cognition. Further, the positive effects of each on cognition held when controlling for the other, demonstrating the important protective role each plays. Some recent studies have also examined this association in relation to the COVID-19 pandemic. For example, one study found that greater levels of loneliness among older adults (age 60 and older) were associated with worse cognitive performance (Souza-Talarico et al., 2021). In a

longitudinal study, higher levels of loneliness and anxiety were associated with worse reported cognition among middle-aged and older adults (Koboyashi et al., 2022). Taken together, these findings suggest that loneliness during the COVID-19 pandemic was associated with worse cognitive functioning in adult samples.

Several theories might help to explain the association between social connectedness (or lack thereof) and cognitive functioning. For example, Vygotsky's (1978) sociocultural theory argues that social interaction plays an integral role in cognitive development, in that our early interactions with others guide and influence our learning. Similarly, the social intelligence hypothesis posits that the complexity of human social networks drives human brain development, particularly for areas associated with executive functioning (Byrne 1994). Given the demonstrated role of social relationships in cognitive development, it is feasible that similar mechanisms may be at play when considering the protective value of social connectedness in preserving cognitive functioning. It may be that a greater number of social connections requires greater use of brain areas such as those associated with executive functioning; for example, someone with an active social network may require more frequent use of problem-solving skills to resolve conflict, better working memory abilities to aid in conversation, and so on. In contrast, those experiencing social isolation or loneliness may have fewer opportunities to use these skills and the associated parts of the brain, which may result in atrophy over time. With this in mind, it is also feasible that some areas of cognitive functioning may be more impacted by social connectedness than are others.

Regarding specific domains of cognitive functioning impacted by social connectedness, in a systematic review of the role of various social relationships variables on cognitive functioning in healthy adults over age 50, Kelly et al. (2017) found that greater

social activity was associated with greater overall cognition, executive functioning, working memory, visuospatial abilities, and processing speed. Additionally, they observed that a greater number of social networks was associated with better global cognition, while social support was associated with global cognition and episodic memory. Overall, these findings suggest that increased levels of social connectedness in the form of social activity, number of networks, and level of support, may be most associated with overall cognitive functioning, as well as several other specific cognitive domains depending on the type of social domain examined.

In another systematic review of studies examining cognitive functioning and loneliness in adults over the age of 60 (Boss et al., 2015), higher levels of loneliness were broadly associated with worse cognitive functioning. Regarding specific domains, they found that loneliness was most associated with lower intelligence quotient (IQ), processing speed, and immediate and delayed recall of information. Taken together, the findings from each of these reviews suggest that social connectedness plays a role in maintaining cognitive functioning. Regarding areas of overlap, it appears processing speed may be impacted by both, though other areas of cognitive functioning are less clear. Other areas of research suggest executive functioning is developed in part through social interactions (see Perry et al., 2019 for review and recent developments), thus executive functioning may also be particularly impacted by social connectedness.

Regarding the specific aspects of social relationships that may be relevant to cognitive functioning, it may be important to consider both the more subjective assessment of how close or connected one is with other people and more objective measures such as whether a person is in a relationship, living with others, and/or employed. Prior research has

frequently distinguished between social embeddedness (also referred to as structural measures of support) and perceived social support (also referred to as functional measures of support) (Cohen & Syme, 1985). Social embeddedness captures an individual's connections with others within social environments and may include factors such as marital/relationship status, number of social relationships, involvement in community organizations, and so forth (Barrera 1986). In contrast, perceived support captures an individual's subjective feelings of social support – i.e., the adequacy of support, feelings of belonging, and so forth (Barrera 1986; Cohen & Syme, 1985). Research has generally found that perceived support has a greater positive impact on factors such as depressive symptoms (Eagle et al., 2019) and adjustment to illness (Helgeson, 1993) than does social embeddedness. Additionally, systematic review findings (e.g., Kelly et al., 2017) suggest that involvement in social activities impacts a broader range of cognitive domains than does the number of one's social networks. As such, it may also be that the more subjective perception of social connectedness and more objective proximity to other people may influence and affect cognitive functioning in different ways.

In sum, research suggests that social connectedness often acts a protective factor, and that it may buffer the impact of stress on mental and physical well-being. Additionally, there is some evidence to suggest that social connectedness may also buffer the impact of COVID-19 distress on somatic symptoms and mental health. Existing research also highlights the important role social connectedness plays in preserving cognitive functioning and potentially protecting against cognitive decline. Of interest to the current study is whether social connectedness may similarly buffer against the negative effects of health anxiety, GAD, and PTSD symptomatology on cognitive functioning. Additionally, much existing research has

focused on social connectedness and cognitive functioning in later adulthood, with little research examining this association in younger and middle-aged adults. Given evidence that younger adults were less resilient to the negative impacts of the COVID-19 pandemic on well-being (e.g., Gregory et al., 2021) it will be important to also examine how social connectedness may impact associations between mental health and cognitive functioning in younger and middle-aged adults. To address this gap, the current study examined this association in adults aged 20 to 69. Lastly, given evidence that subjective versus objective aspects of social support differentially impact both mental health and cognitive functioning, the current study focused especially on subjective aspects of social support while also exploring the potential impact of objective aspects of social support on cognitive functioning. Subjective social support will be conceptualized as "social connectedness" in the current study, while objective social support will be conceptualized as "social capital."

Current Study

Despite evidence of increasing rates of health anxiety, especially since the start of the COVID-19 pandemic, very little research exists on health anxiety. Additionally, rates of social isolation have likely increased as a result of the COVID-19 pandemic. However, little is known about the impact of health anxiety on cognitive functioning and how social connectedness might impact this association, especially in younger and middle-aged adults. The current dissertation sought to address these gaps by 1) examining and comparing differences in cognitive functioning across health anxiety, GAD, and PTSD, 2) examining the associations between social connectedness and cognitive functioning, and 3) examining the potential protective role of social connectedness in the association between health anxiety, GAD, and PTSD symptomatology and cognitive functioning. Although the impact

of COVID-19 on each of these associations specifically was not examined, the COVID-19 pandemic has made research on health anxiety and social connectedness (or lack thereof) particularly important.

The cognitive domains that were examined included: general cognitive functioning, verbal comprehension, processing speed, perceptual reasoning, working memory, verbal memory retrieval for structured and unstructured information, visual memory retrieval, attention, and executive functioning related to set-shifting, response inhibition, and problem-solving and non-verbal abstract reasoning. These cognitive domains were chosen for examination based on prior research suggesting the association between each with health anxiety, GAD, and/or PTSD. Additionally, each of these cognitive domains are typically assessed during a comprehensive neuropsychological assessment, therefore providing a comprehensive picture of how each disorder may impact overall cognitive functioning as well as specific areas of functioning. Memory was conceptualized as retrieval (rather than initial learning) and examined using recognition scores for each of the memory domains in analyses. Encoding is believed to take place primarily in hippocampal and parietal brain regions, whereas retrieval is believed to take place primarily in frontotemporal brain regions (Nyberg et al., 1996). Successful retrieval suggests that an individual has the ability to efficiently encode new information.

Given overlapping symptomatology between IAD and SSD, and the colloquial use of health anxiety in referencing both disorders, health anxiety was examined more broadly and at potentially sub-clinical levels, rather than focusing only on diagnosable IAD or SSD. The measure used to examine health anxiety (i.e., Health Anxiety Inventory, short form; Salkovskis et al., 2002) captures aspects of both disorders.

Aims

Aim 1 sought to delineate differences in cognitive functioning between health anxiety, GAD, and PTSD to better understand how symptoms of each disorder are associated with cognitive functioning and may contribute to functional impairment. Further, better understanding such differences can lead to improved treatment planning and treatment recommendations for each disorder, particularly for health anxiety as it is currently less understood. In line with prior research, PTSD was predicted to be associated with greater deficits in general cognitive functioning relative to GAD (*Hypothesis 1*). Additionally, PTSD was predicted to be associated with greater deficits in verbal memory retrieval and processing speed relative to GAD, whereas GAD would be associated with greater deficits in visual memory retrieval (*Hypothesis 2*). Health anxiety was predicted to be associated with deficits in cognitive functioning (*Hypothesis 3*); however, because little is known of the impact of health anxiety on cognitive functioning, no specific hypotheses about which domains would be most impacted were made and analyses pertaining to health anxiety were exploratory in nature.

Aim 2 examined the associations between social connectedness and each of the cognitive domains to determine which are most strongly associated with social connectedness. Given evidence that social connectedness appears to be most associated with general cognitive functioning, executive functioning, and processing speed, higher levels of social connectedness were predicted to be associated with higher functioning in each of the cognitive domains (*Hypothesis 4*). A set of exploratory analyses examining the potential role of social capital was also conducted.

Aim 3 examined the potential protective value of social connectedness by examining whether social connectedness moderated the association between health anxiety, GAD, and PTSD and cognitive functioning. Social connectedness was predicted to moderate the association between health anxiety, GAD, and PTSD symptomatology and cognitive functioning, such that higher levels of social connectedness would be associated with a weaker association between each of the mental health variables (i.e., health anxiety, GAD, and PTSD) and cognitive functioning, while lower levels of social connectedness would be associated with a stronger association (*Hypothesis 5*). A set of exploratory analyses examining the potential role of social capital as a moderator between each of the mental health variables and each of the cognitive domains was also conducted.

Lastly, for Aim 4, a series of exploratory analyses was conducted to examine the potential roles of biological sex and race/ethnicity in the association between each mental disorder and cognitive functioning. Specifically, biological sex and race/ethnicity were examined as moderators in this association.

Chapter 3

Method

Participants

Participants were patients seen for comprehensive neuropsychological evaluations at a private practice in a medium-sized Southwestern city to assess their current cognitive functioning. Most patients were referred due to reported memory difficulties or suspected mild cognitive impairment. The target sample size was calculated using G*Power (Faul, Erdfelder, Buchner, & Lang, 2009) and yielded a target sample size between 264 and 395. The a priori power analysis was based on the proposed moderation analyses for the Aim 3 and 4 (described in *Overview of Analyses* section), as these were the most complex analyses, with an estimated effect size (f^2) between .02 and .03 (for a small effect), an alpha of .05, power of .80, one tested predictor (i.e., the interaction), and five total predictors (i.e., each independent variable, one moderator, and two covariates). Individuals who failed more than one performance validity measure (i.e., TOMM; WAIS ERDS) were excluded from the final sample, resulting in a final sample size of 157. The sample was roughly equal in terms of biological sex (53.1% female) and most patients reported living with at least one other person (83.1%) and as being in a relationship (56.9%). The mean age of patients was 48.92 years (SD = 13.67) and most of the sample identified as white (52.5%) or Hispanic (33.1%). The sample was diverse in regard to years of education. Nearly one third (32.5%) of the sample had contracted COVID-19 and 13.4% had lost someone they knew to COVID-19 (see Table 2 for additional sample characteristics).

Table 2.
Complete Participant Demographics (N = 157)

	M	*SD*	*Range*
Age	48.62	13.61	19-68
Education	14.58	2.74	5-20
	N	*%*	
Education (Cat.)			
<12 years	10	6.4%	
12 years	33	15.9%	
13-15 years	53	15.9%	
16 years	30	19.1%	
17-18 years	16	10.2%	
19+ years	15	9.6%	
Biological Sex*			
Male	73	46.5%	
Female	84	53.5%	
Living Arrangement			
Alone	25	15.9%	
With >1 Other	130	82.8%	
Missing	2	1.3%	
Relationship Status			
Single	24	15.3%	
Partnered	89	56.7%	
Missing	44	28.0%	
Currently Employed			
Yes	70	44.6%	
No	85	54.1%	
Missing	2	1.3%	
Race/Ethnicity			
White	83	52.9%	
Hispanic	52	33.1%	
Black/African American	5	3.2%	
Asian	1	0.6%	
American Indian/Alaska Native	1	0.6%	
Multiethnic/racial	12	7.6%	
Other	3	1.9%	
Contracted COVID-19			
Yes	51	32.5%	
No	98	62.4%	
Missing	8	5.1%	
Lost Someone to COVID-19			
Yes	21	13.4%	
No	126	80.3%	
Missing	10	6.4%	

**Note*. The sample included 3 trans-identifying individuals, for whom biological sex at birth was used in analyses.

Procedure

Patient charts were reviewed by a trained psychometrician, and a de-identified data set including patient demographics and test data was created. The de-identified data set only included total scores and not individual items for the measures utilized. As such, measures of internal consistency and reliability (e.g., Cronbach's alpha) were unable to be calculated for the measures. Patients were evaluated between October 2021 and February 2023 using a test battery developed as part of a larger study on COVID-19 and neuropsychological functioning. Individuals between the ages of 18 and 69 were included in the current study, given the focus of the current study on young to middle aged adults. Additionally, those older than 69 years old were administered a different test battery and there was some concern for the impact of older age on cognitive functioning and impact of COVID-19. All parts of the study were reviewed by the University of New Mexico's Institutional Review Board (IRB) following data collection, and the study was determined to not require full IRB review as it involved retrospective chart review only.

Measures

Sociodemographics

Demographic variables believed to be associated with one or more of the study variables were assessed, including biological sex, age, years of education, relationship/marital status, employment status, living arrangements (i.e., alone or with others), and race/ethnicity (see Appendix A for Demographic Questionnaire). Biological sex was coded as Male or Female. Age and years of education were included as continuous variables. Relationship/marital status was categorized as either "yes" or "no." Race/ethnicity was open-ended and coded into the following categories: White, Hispanic, Native American,

African American/Black, 4 = Asian, 5 = Multi-ethnic, and Other. For moderation analyses, race/ethnicity was coded as White and non-White. Employment status was categorized as currently employed and/or enrolled as a student and currently unemployed (for any reason). Living arrangement was categorized as living alone and living with others.

COVID-19 Measures

Participants were asked if they had ever been diagnosed with COVID-19, as well as if they had lost anyone to COVID-19. For those who answered "yes" to having lost someone to COVID-19, they were then asked to detail their relationship to that person (see Appendix B for COVID-19 Questionnaire).

Mental Health Measures

Depression. The Patient Health Questionnaire (PHQ-9; Kroenke & Spitzer, 2001) was used to measure current symptoms of depression. The PHQ-9 is a well-validated, self-report measure that includes nine items based on DSM-IV criteria for major depressive disorder. Patients are asked to indicate how often they have been bothered by each symptom in the past two weeks on a 4-point scale (0 = not at all, 1 = several days, 2 = more than half the days, 3 = nearly every day). A total score was obtained by summing all items. Total scores between 0 and 4 indicate minimal to no depressive symptoms, scores of 5 to 9 indicate mild depressive symptoms, scores of 10 to 14 indicate moderate depressive symptoms, scores of 15 to 19 indicate moderately-severe depressive symptoms, and scores of 20 to 27 indicate severe depressive symptoms (see Appendix C for all mental health measures).

Generalized Anxiety Disorder (GAD). The Generalized Anxiety Disorder 7-Item Scale (GAD-7; Spitzer et al., 2006) was used to measure generalized anxiety symptomatology. The GAD-7 is a well-validated, self-report measure based on diagnostic

criteria for DSM-IV (e.g., Lowe et al., 2008). Patients are asked to indicate how often they have been bothered by each symptom in the past two weeks on a 4-point scale (0 = not at all, 1 = several days, 2 = more than half the days, 3 = nearly every day). A total score was obtained by summing all items. Total scores between 0 and 4 indicate minimal anxiety symptoms, scores of 5 to 9 indicate mild anxiety symptoms, scores of 10 to 14 indicate moderate anxiety symptoms, and scores greater than 15 indicate severe anxiety symptoms.

Health Anxiety. The Health Anxiety Inventory, short form (HAI; Salkovskis et al., 2002) was used to measure health anxiety symptomatology. The HAI is a brief screening measure used to assess health anxiety and includes groups of statements that assess degree of health anxiety. Participants are asked to circle one of the four statements within each group that best describes their feelings over the prior sixth months (e.g., (a) I do not worry about my health. (b) I occasionally worry about my health. (c) I spend much of my time worrying about my health. (d) I spend most of my time worrying about my health). There is currently not a recommended cut-off score for this scale. However, the initial validation study (Salkovskis et al., 2002) found that those experiencing health anxiety had an average HAI score of 37.9 (*SD* = 6.8) while those with anxiety had an average score of 18.5 (*SD* = 7.3) and controls had an average score of 12.2 (*SD* = 6.2).

Post-Traumatic Stress Disorder (PTSD). The PTSD checklist for DSM-5 (PCL-5; Blevins et al., 2015) was used to measure PTSD symptomatology. The PCL-5 is a widely used and validated 20-item, self-report measure assessing the presence and severity of PTSD symptoms using DSM-5 criteria. Patients are asked to rate each of 20 symptoms on a 5-point scale (i.e., 0 = not at all, 1 = a little bit, 2 = moderately, 3 = quite a bit, 4 = extremely). A total score was calculated by summing all items. The recommended total symptom score cut-

off for probable PTSD is between 31 and 33. Alternatively, a provisional diagnosis can be made by summing the number of items within each cluster rated as "moderately" or higher. The PCL-5 includes an assessment of major traumatic events (i.e., Criterion A) as well as assessment of symptom clusters (i.e., Clusters B, D, and D). Criterion A was not measured in the current study. Cluster B (items 1-5) assesses re-experiencing symptoms, cluster C (items 6-7) assesses avoidance, cluster D items 8-14) assesses negative alterations in cognition and mood, and cluster E (items 15-20) assesses hyper-arousal. To meet DSM-V-TR diagnostic criteria based on number of symptoms endorsed, an individual must endorse at least 1 cluster B item, at least 1 cluster C item, at least 2 cluster D items, and at least 2 cluster E items to meet diagnostic criteria for PTSD at "moderately" or higher.

Performance Validity Measures.

Test of Memory Malingering (TOMM). The TOMM (Tombaugh, 1997) was used to assess for variable effort and/or frank malingering. The TOMM is a 50-item visual recognition task that helps distinguish genuine memory impairments from malingering. Scores between 26 and 44 on Trial 1 are suggestive of poor motivation and/or effort. Scores of less than 45 on Trial 2 are considered frank malingering. A cut-off score of 45 on Trial 2 was used to determine sufficient effort.

WAIS-IV Enhanced Reliable Digit Span (ERDS). The WAIS-IV ERDS (Reese et al., 2012) was calculated by summing the longest digits-forward, digits-backward, and digits-sequencing from the WAIS-IV Digit Span subtest. Both trials must be completed correctly to count. Scores less than 11 indicates probable malingering and/or poor effort; as such, a cut-off score of 11 was used to determine sufficient effort.

Estimated Premorbid Cognitive Functioning.

Premorbid Cognitive Functioning. The Test of Premorbid Functioning (TOPF) is a 70-item word-reading measure that provides an estimate of premorbid cognitive functioning (Wechsler, 2009b). A standardized score was calculated for each participant and used in analyses.

Cognitive and Neuropsychological Measures.

The following measures were used to assess each of the cognitive domains of interest. Table 3 summarizes which measures and subtests were used to assess each domain.

Attention. The Trail Making Test Part A (Trails A; Reitan, 1956) was used to measure attention. The standard score for Trails A was used in analyses.

Executive Functioning – Problem-solving and Non-verbal Abstract Reasoning. The Wisconsin Card Sorting Test, 128-card version (WCST) was used to measure executive functioning related to problem-solving and non-verbal abstract reasoning. The WCST is a widely used and validated measure of executive functioning that is sensitive to frontal lobe dysfunction (Heaton et al., 1993). Three scores were utilized in analyses: percent of perseverative errors (standard score), number of failures to maintain set (percentile range), and number of categories completed (percentile range). The percentile ranges were coded as follows: <=1% = 0, 2-5% = 1, 6-10% = 2, 11-16% = 3, >16% = 4. In the Results and Discussion sections, this cognitive domain will be referred to by the specific subtest used since three scores were utilized for this cognitive domain.

Table 3.
Cognitive Domains of Interest and Associated Neuropsychological Tests and Scores Used in Analyses

Cognitive Domain	Neuropsychological Test	Score Used from Test
Attention	Trail Making Test - Part A (Trails A)	Trails A T-Score
Executive Functioning		
Problem Solving and Non-verbal Abstract Reasoning	Wisconsin Card Sorting Test (WCST)	WCST Perseverative Errors Standard Score (SS); Number of Categories Completed Percentile Range Score; Number of Failures to Maintain Set Percentile Range Score
Response Inhibition	Stroop Color Word Test (SCWT)	SCWT T-Score
Set-Shifting	Trail Making Test - Part B (Trails B)	Trails B T-Score
General Intelligence	Wechsler Adult Intelligence Scale, 4th Edition, Full Scale Intelligence Quotient (WAIS-IV FSIQ)	FSIQ Standard Score (SS)
Memory		
Verbal Memory Retrieval (Unstructured Information)	California Verbal Learning Test, 3rd Edition	CVLT-3 Discrimability Scaled Score (ss)
Verbal Memory Retrieval (Structured Information)	Wechsler Memory Scale, 4th Edition, Logical Memory subtest (WMS-IV LM)	WMS-IV Logical Memory Recognition Percentile Range Score
Visual Memory Retrieval	Wechsler Memory Scale, 4th Edition, Visual Reproduction subtest (WMS-IV VR)	WMS-IV Visual Reproduction Recognition Percentile Range Score
Perceptual Reasoning	Wechsler Adult Intelligence Scale, 4th Edition, Perceptual Reasoning Index (WAIS-IV PRI)	PRI Standard Score (SS)
Processing Speed	Wechsler Adult Intelligence Scale, 4th Edition, Processing Speed Index (WAIS-IV PSI)	PSI Standard Score (SS)
Verbal Comprehension	Wechsler Adult Intelligence Scale, 4th Edition, Verbal Comprehension Index (WAIS-IV VCI)	VCI Standard Score (SS)
Working Memory	Wechsler Adult Intelligence Scale, 4th Edition, Working Memory Index (WAIS-IV WMI)	WMI Standard Score (SS)

Note. Standard scores (SS) have a mean of 100 and SD of 15, scaled scores (ss) have a mean of 10 and SD of 3. T-scores have a mean of 50 and SD of 10.

Executive Functioning – Response Inhibition. The color-word score from the Stroop Color Word Test (SCWT; Stroop, 1935) was used as a measure of executive functioning related to response inhibition. The Stroop measures the ability to inhibit cognitive interference (i.e., response inhibition). The standard color-word score was used in analyses as a measure of executive functioning related to response inhibition.

Executive Functioning – Set-shifting. The Trail Making Test Part B (Trails B; Reitan, 1956) was used to measure executive functioning related to set-shifting. The standard score for Trails B was used in analyses.

General Cognitive Functioning. The Wechsler Adult Intelligence Scale, Fourth Edition (WAIS-IV; Wechsler, 2008) Full-Scale Intelligence Quotient (FSIQ) was used as a measure of general cognitive functioning. The WAIS-IV is a widely used and validated psychological instrument for the assessment of cognitive abilities. A standard score based on demographics was calculated, and a Full Scale Intelligence Quotient (FSIQ) was obtained for each participant.

Perceptual Reasoning. The WAIS-IV Perceptual Reasoning Index (WAIS IV PRI; Wechsler, 2008) was used as a measure perceptual reasoning. A standard score based on demographics was calculated and used in analyses.

Processing Speed. The WAIS-IV Processing Speed Index (WAIS IV PSI; Wechsler, 2008) was used as a measure processing speed. A standard score based on demographics was calculated and used in analyses.

Verbal Comprehension. The WAIS-IV Verbal Comprehension Index (WAIS IV VCI; Wechsler, 2008) was used as a measure verbal comprehension. A standard score based on demographics was calculated and used in analyses.

Verbal Memory Retrieval (structured). The Wechsler Memory Scale, Fourth Edition Logical Memory subtest (WMS-IV Logical Memory; Wechsler, 2009a) was used to measure verbal memory retrieval for structured verbal information. The percentile score for verbal memory recognition was used in analyses. Percentiles were coded as follows: <=2% = 0, 3-9% = 1, 10-16% = 2, 17-25% = 3, 26-50% = 4, 51-75% = 5, >75% = 6.

Verbal Memory Retrieval (unstructured information). Learning and memory for unstructured verbal information was measured using the California Verbal Learning Test, Third Edition (CVLT-3; Delis et al., 2017). Standard scores were calculated for the following: total immediate memory, short free recall, short cued recall, long free recall, long cued recall, hits, false positives, and discriminability. The standard score for discriminability (i.e., recognition) was used in analyses as a measure of verbal memory retrieval.

Visual Memory Retrieval. The Wechsler Memory Scale, Fourth Edition Visual Reproduction subtest (WMS-IV Visual Reproduction; Wechsler, 2009a) was used to measure visual memory retrieval. The percentile score for visual memory recognition was used in analyses. Percentiles were coded as follows: <=2% = 0, 3-9% = 1, 10-16% = 2, 17-25% = 3, 26-50% = 4, 51-75% = 5, >75% = 6.

Working Memory. The WAIS-IV Verbal Comprehension Index (WAIS IV WMI; Wechsler, 2008) was used as a measure working memory. A standard score based on demographics was calculated and used in analyses.

Social Support Measures.

Social Connectedness. Social connectedness was measured using the UCLA Loneliness Scale (UCLA LS; Russell, 1996). The UCLA LS a 20-item self-report measure assessing subjective feelings of loneliness and feelings of isolation. The scale includes both

positively valanced items (e.g., “How often do you feel that you have a lot in common with the people around you?”) and negatively valanced items (e.g., “How often do you feel that there is no one you can turn to?”). Patients were asked to indicated on a 4-point scale (1 = never, 2 = rarely, 3 = sometimes, 4 = always) how often they felt the way described in each statement. Items 1, 5, 6, 9, 10, 15, 16, 19, and 20 were reverse coded. Since nine of the 20 items are positively valenced and the scale assesses a continuum from social isolation to social connection, the scores were reversed so that higher scores indicated greater social connection and the scale will be referred to as “social connectedness.”

Social Capital. In addition to the measure of social connectedness, a composite measure of social capital was created that included: 1) whether the participant lived alone, 2) was currently employed, and 3) were married or in a relationship. This data was gathered from review of a patient demographic form on which each patient listed their living arrangement (including with whom they lived), employment history, and whether they were accompanied by someone to the appointment. This measure was created to provide an additional way of assessing the potential effects of the social domain on cognitive functioning alone and in interaction between each mental health disorder and each cognitive domain. A score of 1 was given for a “no” response for question 1, and for a “yes” response for questions 2 and 3. A higher composite score indicated a greater level of social capital. This measure will be referred to as “social capital” and was used in exploratory analyses only.

Overview of Analyses

Preliminary examination of the data revealed that all assumptions of regression (e.g., multivariate normality, no significant skewness or kurtosis) were met in the current dataset.

Additionally, there were minimal issues with multicollinearity. Though there was some concern for multicollinearity between some of the mental health variables (i.e., PTSD, GAD, depression), these variables were not combined into a composite variable due to conceptual differences between the mental health disorders and because the primary study aims focused on examination of each separately. As such, each of the mental health variables were either controlled for or omitted from respective analyses as detailed. Additionally, collinearity statistics provided in each regression analysis that included some combination of these variables did not suggest significant problems with multicollinearity. Similarly, there was a strong correlation between general cognitive functioning (WAIS-IV FSIQ) and each major domain of the WAIS-IV (i.e., Verbal Comprehension, Perceptual Reasoning, Processing Speed, Working Memory); however, this was expected as the WAIS-IV FSIQ is calculated based on each of these domains and each domain is purported to measure related but distinct aspects of cognitive functioning.

As the amount of missing data varied widely across major study variables (i.e., between 0.01% and 31.9%) though was generally well below 10% (i.e., all but 2 variables were missing less than 8.9% of data), pairwise deletion was utilized to maximize available sample size without introducing bias through use of other readily available methods (e.g., mean imputation) for addressing missing data. As discussed by Bennett (2001), when more than 10% of data are missing estimates are likely to be biased; therefore, for the current study, most variables were within acceptable range for missing data. Of note, a significant percentage of data was missing for the UCLA Loneliness scale (31.9%) and the Health Anxiety Inventory (30.6%) as these tests were frequently omitted from the test battery, which resulted in a smaller sample size for many analyses. Given the smaller sample size (which

was below that suggested in the a priori power analysis) and potentially biased estimates, results should be interpreted with some caution.

For the Results and Discussion sections, the name of the cognitive domains will used rather than the name of the test used to assess each domain, except for executive functioning related to problem-solving and non-verbal abstract reasoning which will also include the subtest name as it was assessed by more than one subtest from the WCST (as detailed in Table 3). Depression and premorbid cognitive functioning were included as covariates in all analyses.

To examine the association between health anxiety, GAD, and PTSD symptomatology and cognitive functioning (Aim 1), a series of multiple linear regression analyses were conducted. Covariates and each of the mental health variables were entered as continuous predictors of each of the cognitive domains of interest (i.e., executive functioning, verbal memory, visual memory, attention, general intellectual functioning, working memory, processing speed, perceptual reasoning, and verbal comprehension).

To examine the association between social connectedness and cognitive functioning (Aim 2), a series of multiple linear regression analyses were conducted. Covariates and social connectedness were entered as continuous predictors of each of the cognitive domains of interest. Additionally, a second set of analyses was conducted using social capital rather than the social connectedness measure.

Aim 3 utilized a series of moderation analyses to examine the potential protective value of social connectedness. Specifically, social connectedness was included as a moderator between health anxiety, GAD, and PTSD symptomatology and each of the cognitive domains. Moderation analyses were conducted using the Hayes PROCESS Macro

in SPSS (Hayes, 2013). Given concern for multicollinearity between PTSD and GAD, PTSD was not included in the analyses with GAD predicting each cognitive domain and GAD was not included in the analyses with PTSD predicting each cognitive domain. Additionally, a set of exploratory analyses was conducted using the social capital measure for comparison with the results for social connectedness. Continuous predictors were mean-centered prior to the calculation of interaction terms, and significant interactions were probed at 1 SD below the mean, at the mean, and at 1 SD above the mean and further investigated using the Johnson-Neyman floodlight technique (Johnson & Neyman, 1936) in the PROCESS macro.

For Aim 4, a series of exploratory moderation analyses were conducted to examine the potential roles of biological sex and race/ethnicity in the association between PTSD, GAD, and health anxiety symptomatology and cognitive functioning. Sex (0 = male, 1 = female) and race/ethnicity (0 = White, 1 = non-White) were entered as moderators between each mental health variable (health anxiety, GAD, PTSD) and each cognitive domain). Significant interactions were probed at 1 SD below the mean, the mean, and 1 SD above the mean and further investigated using the Johnson-Neyman floodlight technique (Johnson & Neyman, 1936) in the PROCESS macro.

Chapter 4

Results

Descriptive statistics for all major study variables are provided in Table 4. Of the 157 participants included in the final sample, most (81.9%) endorsed at least mild depressive symptomatology (i.e., total PHQ-9 score of 5-9) with 13.8% endorsing severe depressive symptomatology (i.e., total PHQ-9 score of 20 or greater), most (79%) endorsed at least mild anxiety symptomatology (i.e., total GAD-7 score of 5-9) with 20% endorsing severe anxiety symptomatology (i.e., total GAD-7 score of 15 or greater), and 40% endorsed clinically significant levels of PTSD based on the recommended cutoff score of 33 on the PCL-5. As described in the Method section, there is not a recommended clinical cut-off score for the Health Anxiety Inventory (HAI), though in the initial validation study (Salkovskis et al., 2002), those experiencing health anxiety had an average HAI score of 37.9 (*SD* = 6.8), those with general anxiety had an average score of 18.5 (*SD* = 7.3), and controls had an average score of 12.2 (*SD* = 6.2). Participants in the current study had an average HAI score of 17.33 (*SD* = 9.32), which is most consistent with those with general anxiety based on the scores from the validation study.

Bivariate correlations between all major study variables are presented in Table 5. Most cognitive domains were positively associated with one another. Older age and being in a relationship were significantly positively associated with social connectedness. Social connectedness was significantly negatively associated with PTSD, GAD, depression, and health anxiety, and was most strongly positively associated with visual memory retrieval and perceptual reasoning. Social capital was most strongly positively associated with attention and visual memory retrieval. Of the cognitive domains, PTSD was most strongly negatively

associated with verbal memory retrieval (structured), general cognitive functioning, and verbal comprehension. GAD was negatively associated with verbal memory retrieval (structured) only. Health anxiety was most strongly negatively correlated with general cognitive functioning and verbal comprehension.

Table 4.
Descriptive Statistics of Major Study Variables

	M (SS)	*SD*	*Range*
General Cognitive Functioning	94.94	16.23	55-147
Verbal Comprehension	99.85	16.56	52-143
Perceptual Reasoning	96.74	15.75	59-140
Working Memory	92.44	16.78	53-150
Processing Speed	91.62	15.05	50-146
Premorbid Cognitive Functioning	104.06	12.67	76-127
Exec. Functioning (WCST Perseverative Errors)	95.34	14.60	55-144
	M (T)	*SD*	*Range*
Attention	42.37	12.00	2-68
Exec. Functioning - Set-Shifting	42.44	12.18	5-67
Exec. Functioning - Response Inhibition	42.49	11.93	10-69
	M (ss)	*SD*	*Range*
Verbal Memory Retrieval (unstructured)	9.25	3.70	1-15
	M (raw)	*SD*	*Range*
PTSD	30.31	20.49	1-80
Depression	11.48	6.97	0-27
Generalized Anxiety	9.51	6.03	0-21
Health Anxiety	17.33	9.32	1-48
Social Connectedness (UCLA LS)	45.79	13.86	21-74
Social Capital	2.19	0.80	0-3

Note. Standard scores (SS) have a mean of 100 and SD of 15, scaled scores (ss) have a mean of 10 and SD of 3. T-scores have a mean of 50 and SD of 10.

Table 5.
Bivariate Correlations between Major Study Variables

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Age	-													
2	Education	.21 **	-												
3	Sex	-.01	.10	-											
4	Race/Ethnicity	-.19 *	-.29 ***	.06	-										
5	Rel. Stat.	.17	.19 *	-.07	-.19 *	-									
6	Liv. Arrange.	-.08	.05	.13	-.01	.37 ***	-								
7	Emp. Stat.	-.30 ***	.18 *	.05	-.09	.03	.19 *	-							
8	Had COVID	-.09	.04	.05	-.12	.01	.05	.19 *	-						
9	Lost to COVID	-.15	.07	-.03	-.01	.08	.02	-.03	.12	-					
10	General Cognitive Fxn.	.03	.43 ***	.00	-.23 **	.11	.01	.31 ***	.10	-.03	-				
11	Verbal Comprehension	.03	.50 ***	-.08	-.31 ***	.06	-.01	.28 ***	.05	-.05	.85 ***	-			
12	Perceptual Reasoning	-.04	.31 ***	-.02	-.15	.13	-.00	.27 ***	.07	-.01	.87 ***	.58 ***	-		
13	Working Memory	.08	.31 ***	.02	-.20 *	.17	-.01	.26 ***	.12	.02	.88 ***	.64 ***	.70 ***	-	
14	Processing Speed	.07	.26 ***	.21 **	-.04	.06	-.01	.27 **	.16 *	-.01	.75 ***	.46 ***	.57 ***	.64 ***	-
15	Premorbid Cog. Fxn.	.02	.48 ***	-.03	-.42 ***	.02	-.05	.18 *	.04	.07	.64 ***	.75 ***	.42 ***	.55 ***	.29 ***
16	Verb. Mem. Ret. (Unst.)	.05	.22 **	.20 *	-.13	.19 *	.01	.16 *	.03	-.03	.43 ***	.37 ***	.30 ***	.37 ***	.43 ***
17	Verb. Mem. Ret. (Str.)	.06	.28 **	.19 *	-.15	.02	-.02	.07	.07	.02	.47 ***	.44 **	.36 ***	.42 ***	.33 **
18	Visual Mem. Retrieval	-.04	.23 **	.06	-.06	.12	.07	.28 ***	.13	.09	.58 ***	.38 ***	.60 ***	.52 ***	.52 ***
19	Attention	.17 *	.00	.06	.05	.18	.02	.23 **	-.02	-.09	.52 ***	.28 ***	.44 ***	.49 ***	.63 ***
20	Exec. Fxn. - Set Shifting	.13	.05	.05	.00	.06	-.06	.19 *	.09	.04	.60 ***	.35 ***	.54 ***	.58 ***	.62 ***
21	Exec. Fxn. - Resp. Inh.	-.13	-.11	-.03	.05	-.06	.07	.24 **	.10	.02	.54 ***	.33 ***	.47 ***	.51 ***	.56 ***
22	WCST Cat.	.19 *	.41 ***	.15	-.11	.18	-.06	.05	-.02	-.03	.43 ***	.31 ***	.43 ***	.41 ***	.36 ***
23	WCST Pers. Err.	.17 *	.08	.10	-.05	.20 *	.06	.03	.09	.02	.40 ***	.26 **	.45 ***	.39 ***	.24 **
24	WCST FMS	-.01	.19 *	.02	-.05	-.02	-.12	.14	-.05	-.06	.25 **	.17	.23 **	.23 **	.21 *
25	PTSD	-.25 **	-.35 ***	.02	.31 ***	-.26 *	-.15	-.10	-.04	-.07	-.23 **	-.23 **	-.21 *	-.11	-.17 *
26	Health Anxiety	-.15	-.19	.13	.31 ***	-.21	.18	.02	-.11	-.02	-.20 *	-.22 *	-.17	-.09	-.06
27	Depression	-.23 **	-.34 ***	.10	.29 ***	-.31 **	-.09	-.12	.03	-.12	-.16	-.19 *	-.11	-.08	-.10
28	Generalized Anxiety	-.24 **	-.28 **	.06	.25 **	-.14	-.03	.01	.01	.01	-.12	-.14	-.10	-.06	-.02
29	Social Connect.[+]	-.41 ***	-.34 ***	.07	.36 ***	-.43 ***	-.15	-.11	-.04	-.14	-.25 *	-.21 *	-.31 **	-.17	-.10 *
30	Social Capital	-.22 *	.17	.01	-.08	.67 ***	.62 ***	.69 ***	.13	.01	.21 *	.14	.22 *	.22 *	.17

Note. *$p \leq .05$; **$p \leq .01$; ***$p \leq .001$; [+]Reverse-coded

Table 5 (continued).

Bivariate Correlations between Major Study Variables

	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1 Age															
2 Education															
3 Sex															
4 Race/Ethnicity															
5 Rel. Stat.															
6 Liv. Arrange.															
7 Emp. Stat.															
8 Had COVID															
9 Lost to COVID															
10 General Cognitive Fxn.															
11 Verbal Comprehension															
12 Perceptual Reasoning															
13 Working Memory															
14 Processing Speed															
15 Premorbid Cog. Fxn.	-														
16 Verb. Mem. Ret. (Unst.)	.24 **	-													
17 Verb. Mem. Ret. (Str.)	.34 ***	.50 ***	-												
18 Visual Mem. Retrieval	.25 **	.45 ***	.33 ***	-											
19 Attention	.15	.28 ***	.22 **	.43 ***	-										
20 Exec. Fxn. - Set Shifting	.30 ***	.38 ***	.27 **	.53 ***	.64 ***	-									
21 Exec. Fxn. - Resp. Inh.	.16	.28 ***	.23 **	.43 ***	.46 ***	.52 ***	-								
22 WCST Cat.	.20 *	.33 ***	.26 **	.41 ***	.13	.24 **	.24 **	-							
23 WCST Pers. Err.	.11	.14	.19 *	.33 ***	.27 **	.34 ***	.34 ***	.61 ***	-						
24 WCST FMS	.18 *	.16 **	.12	.18 *	.06	.16	.19 *	.36 ***	.13	-					
25 PTSD	-.26 *	-.26 **	-.12	-.10	-.05	-.06	.03	-.06	.04	-.04	-				
26 Health Anxiety	-.26 **	-.18	-.07	-.10	-.08	-.11	.07	-.07	-.03	.04	.46 ***	-			
27 Depression	-.30 ***	-.19 *	-.02	-.07	.03	-.10	.04	-.07	.06	-.07	.78 ***	.49 ***	-		
28 Generalized Anxiety	-.24 **	-.22 **	-.07	-.04	.09	-.04	.09	-.04	.06	-.06	.82 ***	.50 ***	.75 ***	-	
29 Social Connect.[+]	-.21 *	.14	-.15	-.28 **	-.16	-.22 *	-.06	-.27 *	-.20 *	.02	.71 ***	.52 ***	.64 ***	.66 ***	-
30 Social Capital	.04	.20 *	-.00	.24 *	.25 **	.16	.15	.09	.16	.01	-.12	.00	-.19	.03	-.30 **

Note. *$p \leq .05$; **$p \leq .01$; *Note. *$p \leq .05$; **$p \leq .01$; ***$p \leq .001$; [+]Reverse-coded

Aim 1: GAD, PTSD, and Health Anxiety Predicting Cognitive Functioning

Regression results for Aim 1 are presented in Table 6. Of note, throughout the Results section, the term "predict" is used as a convention when describing regression analyses; however, there is no implication of causality or temporality between the variables examined in using "predict." Consistent with Hypothesis 1, PTSD was significantly associated with greater deficits in general cognitive functioning relative to GAD. There was evidence of a possible suppression effect as indicated by the unexpected positive coefficient for GAD despite a negative bivariate correlation between GAD and general cognitive functioning. This is likely due to possible multicollinearity between PTSD and GAD, as the Tolerance and VIF were near the recommended cut-offs. In partial support of Hypothesis 2, PTSD was significantly associated with greater deficits in processing speed relative to GAD, though neither PTSD nor GAD was significantly associated with visual or verbal memory recognition. Hypothesis 3 was not supported, as health anxiety was not significantly associated with any of the cognitive domains.

In addition, PTSD was significantly associated with lower perceptual reasoning and marginally associated with lower verbal comprehension and attention. GAD was significantly associated with greater attention, though there was again evidence of a possible suppression effect. Neither PTSD, GAD, nor health anxiety were significantly associated with working memory, executive functioning related to set-shifting, executive functioning related to response inhibition, executive functioning related to problem-solving and non-verbal abstract reasoning, verbal memory retrieval (for both structured and unstructured information), or visual memory retrieval.

Table 6.

Effects of PTSD, GAD, and Health Anxiety Symptomology on Each Cognitive Domain

	b	*SE*	*β*	*p*
Attention				
HAI	-0.158	0.149	-.123	.294
GAD7	0.823	0.366	.414	.027 *
PCL5	-0.220	0.111	-.375	.051 +
Executive Functioning				
Response Inhibition				
HAI	0.096	0.153	.075	.532
GAD7	0.342	0.374	.173	.362
PCL5	-0.060	0.114	-.103	.598
Set-shifting				
HAI	-0.073	0.152	-.056	.630
GAD7	0.228	0.372	.113	.542
PCL5	0.005	0.113	.009	.962
WCST Number of Categories				
HAI	-0.004	0.015	-.028	.815
GAD7	0.010	0.037	.049	.795
PCL5	-0.001	0.011	-.017	.929
WCST % Perseverative Errors				
HAI	-0.083	0.189	-.053	.660
GAD7	0.163	0.461	.067	.724
PCL5	-0.018	0.140	-.025	.898
WCST Failure to Maintain Set				
HAI	0.018	0.016	.134	.261
GAD7	-0.016	0.039	-.076	.689
PCL5	0.003	0.012	.051	.792
General Cognitive Functioning				
HAI	-0.118	0.158	-.068	.457
GAD7	0.691	0.386	.257	.077 +
PCL5	-0.283	0.117	-.358	.018 *
Memory				
Verbal Memory Retrieval (unstructured)				
HAI	-0.024	0.046	-.061	.595
GAD7	0.002	0.112	.003	.986
PCL5	-0.049	0.034	-.272	.153
Verbal Memory Retrieval (structured)				
HAI	-0.001	0.025	-.004	.975
GAD7	0.005	0.061	.016	.929
PCL5	-0.025	0.018	-.250	.178
Visual Memory Retrieval				
HAI	-0.011	0.023	-.053	.650
GAD7	0.049	0.057	.160	.391
PCL5	-0.015	0.017	-.165	.391

Notes. $^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$. Premorbid Estimated Functioning and Depression were included as covariates in all analyses.

Table 6 (continued).

Effects of PTSD, GAD, and Health Anxiety Symptomology on Each Cognitive Domain

	b	*SE*	*β*	*p*	
Perceptual Reasoning					
HAI	-0.154	0.181	-.091	.396	
GAD7	0.599	0.443	.229	.179	
PCL5	-0.301	0.135	-.391	.028	*
Processing Speed					
HAI	0.031	0.182	.019	.866	
GAD7	0.922	0.445	.370	.041	*
PCL5	-0.325	0.136	-.442	.019	*
Verbal Comprehension					
HAI	-0.103	0.141	-.058	.464	
GAD7	0.527	0.344	.192	.129	
PCL5	-0.207	0.105	-.256	.051	+
Working Memory					
HAI	0.043	0.182	.024	.813	
GAD7	0.258	0.446	.093	.564	
PCL5	-0.106	0.136	-.129	.437	

Notes. $^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$. Premorbid Estimated Functioning and Depression were included as covariates in all analyses.

Table 7 provides an overview of the findings for Aim 1. Of the 14 cognitive domains examined, PTSD was significantly related to three and marginally related to two, GAD was significantly related to two and marginally related to one, and health anxiety was not significantly or marginally related to any of the cognitive domains. In addition, five of the 14 cognitive domains were associated with one or more of the mental health symptom measures with processing speed being significantly associated with two; general cognitive functioning and attention significantly associated with one and marginally associated with another; perceptual reasoning significantly associated with one; and verbal comprehension marginally associated with one symptom measure.

Table 7

Summary of PTSD, GAD, Health Anxiety, Social Connectedness, and Social Capital as Predictors of Cognitive Functioning for Aims 1 and 2

	PTSD	GAD	Health Anxiety	Social Connectedness	Social Capital
Attention	+	*	*ns*	*	**
Executive Functioning					
Response Inhibition	*ns*	*ns*	*ns*	*ns*	+
Executive Functioning - Set-Shifting	+	*	*ns*	*ns*	+
WCST Number of Categories	*ns*	*ns*	*ns*	**	*ns*
WCST Perseverative Errors	*ns*	*ns*	*ns*	**	+
WCST Failures to Maintain Set	*ns*	*ns*	*ns*	*ns*	*ns*
General Cognitive Functioning	*	+	*ns*	*	**
Memory					
Verbal Memory Retrieval (Unstructured)	*ns*	*ns*	*ns*	*ns*	+
Verbal Memory Retrieval (Structured)	*ns*	*ns*	*ns*	+	*ns*
Visual Memory Retrieval	*ns*	*ns*	*ns*	**	*
Perceptual Reasoning	*	*ns*	*ns*	***	**
Processing speed	*	*	*ns*	*ns*	+
Verbal Comprehension	+	*ns*	*ns*	*ns*	+
Working Memory	*ns*	*ns*	*ns*	+	**

Note. Depression and Estimated Premorbid Functioning were controlled for in all analyses. +$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$, *ns* = non-significant

Aim 2: Social Connectedness Predicting Cognitive Functioning

Regression results for Aim 2 are presented in Table 8. In partial support of Hypothesis 4, social connectedness was significantly associated with greater general cognitive functioning and some aspects of executive functioning related to problem-solving and non-verbal abstract reasoning (i.e., WCST Number of Categories, WCST Perseverative Errors). However, social connectedness was not significantly associated with processing speed, executive functioning related to response inhibition or set-shifting, or one other aspect of executive functioning related to problem-solving and non-verbal abstract reasoning (i.e., WCST Failure to Maintain Set).

In addition, social connectedness was significantly associated with greater perceptual reasoning, visual memory retrieval, and attention. Social connectedness was marginally associated with greater working memory and verbal memory retrieval for structured information. Social connectedness was not significantly associated with verbal comprehension, verbal memory retrieval for unstructured information, or executive functioning related to set-shifting.

Social Capital Predicting Cognitive Functioning

Each Aim 2 analysis was also conducted using the measure of social capital (regression results are presented in Table 8). Social capital was significantly associated with greater general cognitive functioning and was marginally positively associated with one aspect of executive functioning related to problem-solving and non-verbal abstract reasoning (i.e., WCST Percent Perseverative Errors), executive functioning related to set-shifting, and executive functioning related to response inhibition. However, social capital was not significantly or marginally associated with other aspects of executive functioning related to

problem-solving and non-verbal abstract reasoning (i.e., WCST Number of Categories). In addition, social capital was significantly associated with greater perceptual reasoning, working memory, visual memory retrieval, and attention. Social capital was marginally associated with greater verbal comprehension, processing speed, and verbal memory retrieval for unstructured information.

Table 8.

Effects of Social Connectedness and Social Capital on Major Cognitive Domains

	b	*SE*	*β*	*p*		*b*	*SE*	*β*	*p*
Social Connectedness					**Social Capital**				
Attention					*Attention*				
TOPF	0.159	0.098	.168	.106	TOPF	0.172	0.094	.182	.069 +
PHQ-9	0.456	0.227	.265	.047 *	PHQ-9	0.226	0.173	.131	.195
Soc. Conn.	-0.254	0.111	-.293	.025 *	Soc. Cap.	4.027	1.450	.267	.007 **
Executive Functioning					*Executive Functioning*				
Response Inhibition					*Response Inhibition*				
TOPF	0.176	0.099	.187	.078 +	TOPF	0.183	0.095	.194	.057 +
PHQ-9	0.322	0.229	.188	.164	PHQ-9	0.225	0.176	.132	.203
Soc. Conn.	-0.120	0.113	-.139	.291	Soc. Cap.	2.449	1.471	.164	.099 +
Set-shifting					*Set-shifting*				
TOPF	0.089	0.022	.399	<.001 **	TOPF	0.290	0.094	.301	.003 **
PHQ-9	0.051	0.052	.125	.328	PHQ-9	0.037	0.174	.021	.831
Soc. Conn.	-0.024	0.025	-.116	.352	Soc. Cap.	2.412	1.458	.158	.101 +
WCST Number of Categories					*WCST Number of Categories*				
TOPF	0.018	0.009	.189	.064 +	TOPF	0.019	0.010	.200	.053 +
PHQ-9	0.038	0.022	.225	.084 +	PHQ-9	0.001	0.018	.004	.970
Soc. Conn.	-0.032	0.011	-.372	.004 **	Soc. Cap.	0.121	0.147	.081	.415
WCST Perseverative Errors					*WCST Perseverative Errors*				
TOPF	0.147	0.117	.127	.211	TOPF	0.163	0.117	.141	.168
PHQ-9	0.732	0.271	.350	.008 **	PHQ-9	0.276	0.217	.132	.206
Soc. Conn.	-0.418	0.133	-.397	.002 **	Soc. Cap.	3.220	1.811	.176	.078 +
WCST Failure to Maintain Set					*WCST Failure to Maintain Set*				
TOPF	0.018	0.010	.183	.086 +	TOPF	0.018	0.010	.180	.084 +
PHQ-9	-0.016	0.024	-.089	.509	PHQ-9	-0.002	0.019	-.014	.896
Soc. Conn.	0.011	0.012	.120	.365	Soc. Cap.	-0.006	0.156	-.004	.971
General Cognitive Functioning					*General Cognitive Functioning*				
TOPF	0.823	0.103	.642	<.001 ***	TOPF	0.836	0.099	.653	<.001 ***
PHQ-9	0.409	0.239	.176	.091 +	PHQ-9	0.164	0.184	.070	.375
Soc. Conn.	-0.267	0.118	-.228	.026 *	Soc. Cap.	4.070	1.536	.200	.009 **

Notes. $^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$

Table 8 (continued).

Effects of Social Connectedness and Social Capital on Major Cognitive Domains

	b	*SE*	*β*	*p*			*b*	*SE*	*β*	*p*	
Memory						*Memory*					
Verbal Memory Retrieval (Unstructured)						*Verbal Memory Retrieval (Unstructured)*					
TOPF	0.059	0.030	.203	.052	+	TOPF	0.061	0.029	.208	.038	*
PHQ-9	-0.056	0.070	-.106	.425		PHQ-9	-0.049	0.053	-.093	.359	
Soc. Conn.	-0.009	0.035	-.033	.802		Soc. Cap.	0.793	0.447	.171	.079	+
Verbal Memory Retrieval (Structured)						*Verbal Memory Retrieval (Structured)*					
TOPF	0.058	0.016	.361	<.001	***	TOPF	0.059	0.016	.367	<.001	***
PHQ-9	0.069	0.037	.236	.065	+	PHQ-9	0.028	0.029	.094	.347	
Soc. Conn.	-0.033	0.018	-.224	.073	+	Soc. Cap.	0.080	0.244	.003	.973	
Visual Memory Retrieval						*Visual Memory Retrieval*					
TOPF	0.036	0.014	.246	.015	*	TOPF	0.038	0.014	.261	.009	**
PHQ-9	0.065	0.033	.246	.055	+	PHQ-9	0.013	0.026	.049	.624	
Soc. Conn.	-0.051	0.016	-.383	.003	**	Soc. Cap.	0.551	0.220	.238	.014	*
Perceptual Reasoning						*Perceptual Reasoning*					
TOPF	0.521	0.114	.419	<.001	***	TOPF	0.539	0.114	.434	<.001	***
PHQ-9	0.606	0.265	.268	.024	*	PHQ-9	0.136	0.211	.060	.521	
Soc. Conn.	-0.449	0.130	-.395	<.001	***	Soc. Cap.	4.32	1.764	.219	.016	**
Processing Speed						*Processing Speed*					
TOPF	0.335	0.122	.282	.007	**	TOPF	0.341	0.117	.287	.004	**
PHQ-9	0.041	0.284	.019	.886		PHQ-9	0.036	0.216	.017	.868	
Soc. Conn.	-0.058	0.139	-.054	.678		Soc. Cap.	3.046	1.808	.161	.095	+
Working Memory						*Working Memory*					
TOPF	0.751	0.117	.566	<.001	***	TOPF	0.764	0.111	.576	<.001	***
PHQ-9	0.492	0.272	.204	.074	+	PHQ-9	0.317	0.206	.132	.126	
Soc. Conn.	-0.223	0.134	-.184	.099	+	Soc. Cap.	4.737	1.719	.225	.007	**
Verbal Comprehension						*Verbal Comprehension*					
TOPF	0.984	0.093	.753	<.001	***	TOPF	0.992	0.089	.759	<.001	***
PHQ-9	0.252	0.215	.106	.244		PHQ-9	0.135	0.165	.057	.414	
Soc. Conn.	-0.138	0.106	-.116	.194		Soc. Cap.	2.558	1.379	.123	.066	+

Notes. $^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$

Aim 3: Moderating Role of Social Connectedness between Symptomatology and Cognitive Functioning

PTSD and Social Connectedness Predicting Cognitive Functioning

The main and interaction effects for the regression analyses predicting cognitive functioning from PTSD and social connectedness are presented in Table 9. Social connectedness was hypothesized to moderate the association between health anxiety, GAD, and PTSD and cognitive functioning, such that higher levels of social connectedness would be associated with a weaker association between each of the mental health variables and cognitive functioning, while lower levels of social connectedness would be associated with a stronger association. Overall, this hypothesis was partially supported.

Significant main effects for social connectedness indicated that greater social connectedness was associated with greater visual memory retrieval, attention, and one aspect of executive functioning related to problem-solving and non-verbal abstract reasoning (i.e., WCST Perseverative Errors). There were marginal main effects for social connectedness and executive functioning related to set-shifting and one other aspect of executive functioning related to problem-solving and non-verbal abstract (i.e., WCST Number of Categories), with greater social connectedness associated with greater scores in each domain. There was a marginal main effect for PTSD and verbal memory retrieval (unstructured), with greater PTSD associated with lower verbal memory retrieval. There were no other significant main effects for social connectedness or PTSD.

In the models predicting each cognitive domain from PTSD and social connectedness, there was only one significant interaction for verbal comprehension, though conditional effects were non-significant. However, the Johnson-Neyman floodlight analysis revealed

that, for those with relatively low levels of social connectedness of 73.1 or higher) only, greater PTSD symptomatology was associated with lower verbal comprehension. The association between PTSD and verbal comprehension was not significant for those with a UCLA LS score below 73.1. There were marginal interactions for perceptual reasoning and verbal memory retrieval for unstructured information. For those with relatively low levels of social connectedness (i.e., UCLA LS scores greater than 56.13) only, greater PTSD was associated with lower perceptual reasoning, whereas the association was not significant for those with mean and high levels of social connectedness (i.e., UCLA LS scores below 56.13). For those with relatively low levels of social connectedness (i.e., UCLA LS score greater than 61.79) only, greater PTSD was marginally associated with lower verbal memory retrieval for structured information, whereas the association was not significant for those with mean and high levels of social connectedness (i.e., UCLA LS score below 61.79). In the models predicting general cognitive functioning, working memory, processing speed, executive functioning related to response inhibition, and some aspects of executive functioning related to problem-solving and non-verbal abstract reasoning (i.e., WCST Number of Categories, Failure to Maintain Set) from PTSD and social connectedness, there were no significant main or interaction effects.

Table 9.
Main and Interactive Effects of PTSD and Social Connectedness on Cognitive Functioning

	b	*SE*	*t*	*p*	
Attention (N = 90*)*					
PTSD	0.081	0.089	0.914	.363	
Soc. Con.	-0.241	0.102	-2.362	.021	*
PTSD x Soc. Con.	0.002	0.004	0.433	.666	
Executive Functioning					
Response Inhibition (N = 91*)*					
PTSD	0.040	0.101	0.397	.692	
Soc. Con.	-0.066	0.117	-0.565	.574	
PTSD x Soc. Con.	-0.001	0.005	-0.144	.886	
Set-shifting (N = 90*)*					
PTSD	0.117	0.101	1.158	.250	
Soc. Con.	-0.231	0.117	-1.984	.051	+
PTSD x Soc. Con.	0.000	0.005	-0.050	.961	
WCST Number of Categories (N = 93*)*					
PTSD	-0.002	0.010	-0.231	.818	
Soc. Con.	-0.018	0.011	-1.701	.093	+
PTSD x Soc. Con.	0.000	0.000	-0.533	.595	
WCST Perseverative Errors (N = 93*)*					
PTSD	0.043	0.122	0.353	.725	
Soc. Con.	-0.482	0.139	-3.476	.0008	***
PTSD x Soc. Con.	-0.002	0.005	-0.277	.782	
WCST Failure to Maintain Set (N = 91*)*					
PTSD	0.002	0.011	0.1544	.878	
Soc. Con.	0.018	0.013	1.403	.164	
PTSD x Soc. Con.	0.000	0.001	0.720	.474	
General Cognitive Functioning (N = 95*)*					
PTSD	-0.090	0.100	-0.901	.370	
Soc. Con.	-0.025	0.116	-0.215	.831	
PTSD x Soc. Con.	-0.007	0.004	-1.652	.102	
Memory					
Verbal Memory Retrieval - Unstructured (N = 96*)*					
PTSD	-0.056	0.032	-1.697	.093	+
Soc. Con.	0.037	0.037	0.995	.322	
PTSD x Soc. Con.	0.000	0.001	0.120	.904	

Note . Depression and Estimated Pre-morbid Functioning were included as covariates in all analyses.
$^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$

Table 9 (continued).

Main and Interactive Effects of PTSD and Social Connectedness on Cognitive Functioning

	b	*SE*	*t*	*p*
Memory				
Verbal Memory Retrieval - Structured (N = 96)				
PTSD	-0.017	0.018	-0.967	.336
Soc. Con.	-0.004	0.020	-0.213	.832
PTSD x Soc. Con.	-0.001	0.001	-1.797	.076 +
Visual Memory Retrieval (N = 96)				
PTSD	-0.006	0.015	-0.407	.685
Soc. Con.	-0.040	0.018	-2.266	.026 *
PTSD x Soc. Con.	0.001	0.001	0.682	.497
Perceptual Reasoning (N = 96)				
PTSD	-0.146	0.118	-1.250	.216
Soc. Con.	-0.196	0.136	-1.442	.153
PTSD x Soc. Con.	-0.009	0.005	-1.746	.084 +
Processing Speed (N = 95)				
PTSD	-0.167	0.110	-1.520	.132
Soc. Con.	0.129	0.127	1.017	.312
PTSD x Soc. Con.	0.003	0.005	0.702	.484
Verbal Comprehension (N = 96)				
PTSD	0.004	0.097	0.014	.989
Soc. Con.	0.044	0.113	0.393	.695
PTSD x Soc. Con.	-0.010	0.004	-2.373	.020 *
Working Memory (N = 96)				
PTSD	0.002	0.114	0.030	.990
Soc. Con.	-0.059	0.132	-0.448	.655
PTSD x Soc. Con.	-0.005	0.005	-0.933	.353

Note . Depression and Estimated Pre-morbid Functioning were included as covariates in all analyses.

$^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$

PTSD and Social Capital Predicting Cognitive Functioning.

Tables for all Aim 3 exploratory analyses can be found in Appendix D. In the exploratory analyses using the measure of social capital, there was a significant interaction for processing speed, such that, for those with relatively higher social capital only (i.e., 1 SD above the mean; score greater than 2.80), increased PTSD was associated with decreased processing speed, whereas for those with mean or relatively low social capital (i.e., score lower than 2.80) the association was not significant. There were no significant interactions for general cognitive functioning, verbal comprehension, perceptual reasoning, working memory, verbal memory retrieval for unstructured and structured information, visual memory retrieval, attention, executive functioning related to set-shifting, executive functioning related to response inhibition, or executive functioning as measured by the WCST (Number of Categories, Perseverative Errors, Failure to Maintain Set.

GAD and Social Connectedness Predicting Cognitive Functioning

The main and interaction effects for the regression analyses predicting cognitive functioning from GAD and social connectedness are presented in Table 10. Given the large number of analyses conducted for (i.e., 42) only significant main effects and interactions are discussed in detail here.

Significant main effects for social connectedness indicated that greater social connectedness was associated with greater perceptual reasoning, visual memory retrieval, attention, and one aspect of executive functioning related to problem-solving and non-verbal abstract reasoning (i.e., WCST Perseverative Errors). There were marginally significant main effects for social connectedness which suggested greater social connectedness was marginally associated with greater executive functioning related to set-shifting and one other

aspect of executive functioning related to problem-solving and non-verbal abstract reasoning (i.e., WCST Number of Categories). There were no significant main effects for GAD.

In the models predicting global cognitive functioning, verbal comprehension, working memory, verbal memory retrieval for structured and unstructured information, executive related to response inhibition, and one other aspect of executive functioning related to problem-solving and non-verbal abstract reasoning (WCST Failure to Maintain Set) from GAD and social connectedness, there were no significant interactions.

Table 10.
Main and Interactive Effects of GAD and Social Connectedness on Cognitive Functioning

	b	*SE*	*t*	*p*	
Attention (N = 93)					
GAD	0.406	0.272	1.492	.139	
Soc. Con.	-0.255	0.099	-2.579	.012	*
GAD x Soc. Con.	0.016	0.014	1.107	.272	
Executive Functioning					
Response Inhibition (N = 91)					
GAD	0.428	0.313	1.366	.175	
Soc. Con.	-0.107	0.114	-0.938	.351	
GAD x Soc. Con.	-0.001	0.017	-0.085	.932	
Set-shifting (N = 90)					
GAD	0.293	0.315	0.930	.355	
Soc. Con.	-0.220	0.115	-1.913	.059	+
GAD x Soc. Con.	0.009	0.018	0.554	.581	
WCST Number of Categories (N = 95)					
GAD	0.002	0.029	0.082	.935	
Soc. Con.	-0.020	0.010	-1.892	.062	+
GAD x Soc. Con.	-0.002	0.002	-1.352	.180	
WCST Perseverative Errors (N = 95)					
GAD	0.327	0.370	0.886	.378	
Soc. Con.	-0.502	0.133	-3.761	.0003	***
GAD x Soc. Con.	-0.003	0.019	-0.159	.874	
WCST Failure to Maintain Set (N = 93)					
GAD	0.009	0.036	0.242	.810	
Soc. Con.	0.018	0.012	1.413	.161	
GAD x Soc. Con.	0.001	0.002	0.465	.643	
General Cognitive Functioning (N = 97)					
GAD	0.212	0.311	0.680	.498	
Soc. Con.	-0.118	0.115	-1.025	.308	
GAD x Soc. Con.	-0.004	0.017	-0.250	.804	
Memory					
Verbal Memory Retrieval - Unstructured (N = 98)					
GAD	-0.116	0.098	-1.183	.240	
Soc. Con.	0.023	0.036	0.624	.534	
GAD x Soc. Con.	0.005	0.005	0.989	.325	

Note . Depression and Estimated Pre-morbid Functioning were included as covariates in all analyses.

$^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$

Table 10 (continued).

Main and Interactive Effects of GAD and Social Connectedness on Cognitive Functioning

	b	*SE*	*t*	*p*
Memory				
Verbal Memory Retrieval - Structured (N = 98)				
GAD	0.003	0.054	0.062	.951
Soc. Con.	-0.016	0.020	-0.771	.443
GAD x Soc. Con.	-0.003	0.003	-0.848	.399
Visual Memory Retrieval (N = 98)				
GAD	0.031	0.046	0.679	.499
Soc. Con.	-0.047	0.017	-2.820	.006 **
GAD x Soc. Con.	0.003	0.002	1.261	.210
Perceptual Reasoning (N = 96)				
GAD	0.145	0.366	0.397	.693
Soc. Con.	-0.309	0.135	-2.288	.024 *
GAD x Soc. Con.	-0.010	0.020	-0.487	.628
Processing Speed (N = 97)				
GAD	0.216	0.331	0.653	.516
Soc. Con.	0.014	0.123	0.110	.913
GAD x Soc. Con.	0.026	0.018	1.462	.147
Verbal Comprehension (N = 98)				
GAD	0.226	0.302	0.748	.456
Soc. Con.	-0.005	0.112	-0.042	.966
GAD x Soc. Con.	-0.018	0.016	-1.128	.262
Working Memory (N = 98)				
GAD	0.213	0.353	0.604	.548
Soc. Con.	-0.100	0.130	-0.766	.446
GAD x Soc. Con.	0.001	0.019	0.032	.974

Note . Depression and Estimated Pre-morbid Functioning were included as covariates in all analyses.

$^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$

GAD and Social Capital Predicting Cognitive Functioning.

When examining the above analyses using the measure of social capital, there was a significant interaction for processing speed such that, for those with relatively low social capital (i.e., 1 SD below the mean; score less than 1.40) only, increased GAD was associated with decreased processing speed. The association between social capital and processing speed was not significant for those with mean and high scores on the composite measure (i.e., composite score greater than 1.40). There was also a significant interaction for attention, though conditional effects were non-significant. However, a Johnson-Neyman floodlight analysis revealed that, for those with relatively low social capital (i.e., score less than 1.01) only, greater GAD was associated with decreased attention, whereas the association was not significant for those with social capital scores greater than 1.01. There was a significant interaction for executive functioning related to response inhibition, though conditional effects were non-significant. However, a Johnson-Neyman floodlight analysis revealed that, for those with relatively low social capital (i.e., score less than 0.72) only, increased GAD was associated with decreased response inhibition, whereas the association was not significant for those with social capital scores greater than 0.72.

There were no significant interactions for general cognitive functioning, verbal comprehension, perceptual reasoning, working memory, verbal memory retrieval for unstructured and structured information, visual memory retrieval, executive functioning related to set-shifting, or executive functioning related to problem-solving and non-verbal abstract reasoning (Number of Categories, Perseverative Errors, Failure to Maintain Set) when using the social capital measure (see Appendix D for regression results).

Health Anxiety and Social Connectedness Predicting Cognitive Functioning

The main and interaction effects for the regression analyses predicting cognitive functioning from health anxiety and social connectedness are presented in Table 11.

Significant main effects for social connectedness indicated that greater social connectedness was associated with greater perceptual reasoning, visual memory retrieval, and some aspects of executive functioning related problem-solving and non-verbal abstract reasoning (i.e., WCST Number of Categories and Perseverative Errors). There were no significant main effects for health anxiety.

In the model predicting each cognitive domain from health anxiety and social connectedness, there was only one marginally significant interaction for working memory. For those with relatively high levels of social connectedness (i.e., 1 SD below the mean; UCLA LS score below 57.21) only, greater health anxiety was associated with greater working memory abilities, whereas the association was not significant for those with mean and relatively low levels of social connectedness (i.e., UCLA LS score above 57.21).

In the models predicting general cognitive functioning, verbal comprehension, processing speed, verbal memory retrieval for structured and unstructured information, attention, executive functioning related to set-shifting, executive related to response inhibition, and one aspect of executive functioning related to problem-solving and non-verbal abstract reasoning (i.e., WCST Failure to Maintain Set) from health anxiety and social connectedness, there were no significant interactions.

Table 11.

Main and Interactive Effects of Health Anxiety and Social Connectedness on Cognitive Functioning

	b	*SE*	*t*	*p*	
Attention (N = 89*)*					
Health Anxiety	-0.059	0.144	-0.408	.685	
Soc. Con.	-0.139	0.106	-1.309	.194	
Health Anxiety x Soc. Con.	-0.014	0.009	-1.578	.118	
Executive Functioning					
Response Inhibition (N = 91*)*					
Health Anxiety	0.072	0.166	0.430	.668	
Soc. Con.	-0.071	0.122	-0.577	.565	
Health Anxiety x Soc. Con.	-0.012	0.011	-1.131	.261	
Set-shifting (N = 90*)*					
Health Anxiety	0.061	0.173	0.350	.727	
Soc. Con.	-0.188	0.129	-1.459	.149	
Health Anxiety x Soc. Con.	-0.011	0.011	-1.011	.315	
WCST Number of Categories (N = 89*)*					
Health Anxiety	0.016	0.014	1.125	.264	
Soc. Con.	-0.030	0.011	-2.721	.008	*
Health Anxiety x Soc. Con.	0.001	0.001	0.912	.364	
WCST Perseverative Errors (N = 91*)*					
Health Anxiety	0.190	0.186	1.020	.310	
Soc. Con.	-0.583	0.140	-4.159	.0001	***
Health Anxiety x Soc. Con.	0.001	0.012	0.049	.961	
WCST Failure to Maintain Set (N = 91*)*					
Health Anxiety	0.022	0.017	1.253	.214	
Soc. Con.	0.012	0.013	0.932	.354	
Health Anxiety x Soc. Con.	0.001	0.001	0.943	.348	
General Cognitive Functioning (N = 93*)*					
Health Anxiety	-0.070	0.162	-0.042	.967	
Soc. Con.	-0.105	0.121	-0.865	.390	
Health Anxiety x Soc. Con.	-0.011	0.010	-1.013	.314	
Memory					
Verbal Memory Retrieval - Unstructured (N = 94*)*					
Health Anxiety	-0.026	0.052	-0.510	.612	
Soc. Con.	0.006	0.039	0.115	.885	
Health Anxiety x Soc. Con.	0.001	0.006	0.350	.727	

Note . Depression and Estimated Pre-morbid Functioning were included as covariates in all analyses.

$^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$

Table 11 (continued).

Main and Interactive Effects of Health Anxiety and Social Connectedness on Cognitive Functioning

	b	*SE*	*t*	*p*	
Memory					
Verbal Memory Retrieval - Structured (N = 94)					
Health Anxiety	0.027	0.028	0.937	.351	
Soc. Con.	-0.021	0.021	-0.993	.323	
Health Anxiety x Soc. Con.	-0.001	0.002	-0.593	.555	
Visual Memory Retrieval (N = 94)					
Health Anxiety	0.025	0.024	1.025	.308	
Soc. Con.	-0.045	0.018	-2.501	.014	*
Health Anxiety x Soc. Con.	0.000	0.002	-0.279	.781	
Perceptual Reasoning (N = 94)					
Health Anxiety	0.035	0.189	0.184	.855	
Soc. Con.	-0.343	0.143	-2.404	.018	*
Health Anxiety x Soc. Con.	-0.004	0.012	-0.338	.736	
Processing Speed (N = 93)					
Health Anxiety	-0.005	0.176	-0.027	.979	
Soc. Con.	0.073	0.132	0.551	.583	
Health Anxiety x Soc. Con.	0.005	0.011	0.396	.693	
Verbal Comprehension (N = 94)					
Health Anxiety	-0.099	0.157	-0.630	.531	
Soc. Con.	-0.005	0.118	-0.046	.964	
Health Anxiety x Soc. Con.	-0.004	0.010	-0.423	.674	
Working Memory (N = 94)					
Health Anxiety	0.250	0.177	1.412	.162	
Soc. Con.	-0.096	0.133	-0.719	.474	
Health Anxiety x Soc. Con.	-0.021	0.011	-1.850	.068	+

Note . Depression and Estimated Pre-morbid Functioning were included as covariates in all analyses.

$^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$

Health Anxiety and Social Capital Predicting Cognitive Functioning.

When using the measure of social capital, there was a significant interaction for verbal memory retrieval for unstructured information; however, neither conditional effects nor the Johnson-Neyman floodlight analysis was significant. There were no significant interactions for general cognitive functioning, verbal comprehension, perceptual reasoning, working memory, processing speed, verbal memory retrieval for structured information, visual memory retrieval, attention, executive functioning related to set-shifting, executive functioning related to response inhibition, or executive functioning related to problem-solving and non-verbal abstract reasoning (see Appendix D for regression results).

Aim 4: Moderating Roles of Sex and Race/Ethnicity between Symptomatology and Cognitive Functioning

Sex and Symptomatology Predicting Cognitive Functioning

PTSD and Sex. The main and interaction effects for the exploratory regression analyses predicting cognitive functioning from PTSD and biological sex are presented in Table 12; only significant interactions are presented here. There was a significant interaction when predicting executive functioning related to set-shifting from PTSD and biological sex such that, for males only, there was a marginally positive association between PTSD and set-shifting abilities, whereas the association was negative and not significant for females. There was a marginal interaction in the model predicting visual memory retrieval from sex and PTSD, though conditional effects were not significant. However, the beta weight for females was stronger and negative, suggesting that, for females, increased PTSD was somewhat associated with decreased visual memory retrieval. There was also a marginal interaction in the model predicting executive functioning related to response inhibition from sex and

PTSD, though conditional effects were non-significant. However, examination of the beta weights of conditional effects suggested that the association between PTSD and response inhibition was positive for males and negative for females (though not significant for either sex). In the models predicting general cognitive functioning, verbal comprehension, perceptual reasoning, working memory, attention, and executive functioning related to problem-solving and non-verbal abstract reasoning from sex and PTSD, there were no significant main or interaction effects.

Table 12.
Main and Interactive Effects of PTSD and Biological Sex on Cognitive Functioning

	b	*SE*	*t*	*p*	
Attention (N = 120*)*					
PTSD	0.048	0.085	0.561	.576	
Sex	1.260	1.957	0.644	.521	
PTSD x Sex	-0.060	0.094	-0.640	.524	
Executive Functioning					
Set-shifting (N = 118*)*					
PTSD	0.160	0.089	1.808	.073	+
Sex	1.500	2.055	0.730	.467	
PTSD x Sex	-0.209	0.100	-2.086	.039	*
Response Inhibition (N = 120*)*					
PTSD	0.070	0.092	0.764	.446	
Sex	-1.300	2.117	-0.614	.540	
PTSD x Sex	-0.172	0.102	-1.697	.093	+
WCST Number of Categories (N = 121*)*					
PTSD	0.004	0.008	0.476	.635	
Sex	0.156	0.204	0.762	.447	
PTSD x Sex	-0.002	0.010	-0.157	.875	
WCST Perseverative Errors (N = 120*)*					
PTSD	-0.014	0.111	-0.123	.902	
Sex	0.838	2.491	0.337	.737	
PTSD x Sex	-0.069	0.118	-0.584	.560	
WCST Failure to Maintain Set (N = 119*)*					
PTSD	-0.001	0.010	-0.097	.923	
Sex	-0.054	0.228	-0.237	.813	
PTSD x Sex	0.005	0.011	0.410	.682	
General Cognitive Functioning (N = 123*)*					
PTSD	-0.054	0.093	-0.510	.563	
Sex	-0.400	2.126	-0.188	.851	
PTSD x Sex	-0.097	0.103	-0.942	.348	
Memory					
Verbal Memory Retrieval - Unstructured (N = 125*)*					
PTSD	-0.041	0.028	-1.473	.143	
Sex	1.362	0.634	2.150	.033	*
PTSD x Sex	0.025	0.031	0.803	.424	
Verbal Memory Retrieval - Structured (N = 125*)*					
PTSD	-0.010	0.015	-0.628	.531	
Sex	0.875	0.344	2.543	.012	*
PTSD x Sex	-0.011	0.017	-0.642	.522	

Note. $^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$; Sex was coded as: 0 = male, 1 = female.
Depression and Estimated Pre-morbid functioning were included as covariates in all analyses.

Table 12 (continued).

Main and Interactive Effects of PTSD and Biological Sex on Cognitive Functioning

	b	*SE*	*t*	*p*
Visual Memory Retrieval (N = 125)				
PTSD	0.008	0.014	0.560	.576
Sex	0.120	0.313	0.382	.704
PTSD x Sex	-0.028	0.015	-1.867	.064 +
Perceptual Reasoning (N = 125)				
PTSD	-0.142	0.111	-1.280	.203
Sex	-1.830	2.528	-0.724	.471
PTSD x Sex	-0.128	0.122	-1.050	.296
Processing Speed (N = 124)				
PTSD	-0.019	0.106	-0.177	.860
Sex	6.518	2.409	2.706	.008 **
PTSD x Sex	-0.098	0.116	-0.843	.401
Verbal Comprehension (N = 125)				
PTSD	-0.038	0.084	-0.452	.652
Sex	-2.738	1.919	-1.428	.156
PTSD x Sex	0.006	0.092	0.067	.947
Working Memory (N = 124)				
PTSD	0.060	0.103	0.584	.560
Sex	0.585	2.374	0.246	.806
PTSD x Sex	-0.109	0.114	-0.955	.341

Note. $^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$; Sex was coded as: 0 = male, 1 = female.
Depression and Estimated Pre-morbid functioning were included as covariates in all analyses.

GAD and Sex. The main and interaction effects for the exploratory regression analyses predicting cognitive functioning from GAD and biological sex are presented in Table 13. There were no significant interactions in any of the models tested.

Table 13.
Main and Interactive Effects of GAD and Biological Sex on Cognitive Functioning

	b	*SE*	*t*	*p*	
Attention (N = 125*)*					
GAD	0.292	0.288	1.013	.313	
Sex	0.257	1.969	0.130	.897	
GAD x Sex	-0.042	0.318	-0.131	.896	
Executive Functioning					
Set-shifting (N = 118*)*					
GAD	0.343	0.312	1.105	.271	
Sex	0.689	2.134	0.323	.747	
GAD x Sex	-0.494	0.347	-1.425	.157	
Response Inhibition (N = 124*)*					
GAD	0.262	0.317	0.825	.411	
Sex	-1.029	2.153	-0.478	.633	
GAD x Sex	-0.127	0.350	-0.364	.716	
WCST Number of Categories (N = 124*)*					
GAD	-0.001	0.026	-0.036	.971	
Sex	0.217	0.203	1.068	.288	
GAD x Sex	-0.011	0.033	-0.343	.732	
WCST Perseverative Errors (N = 123*)*					
GAD	0.044	0.365	0.121	.904	
Sex	0.272	2.431	0.112	.911	
GAD x Sex	-0.328	0.397	-0.827	.410	
WCST Failure to Maintain Set (N = 122*)*					
GAD	-0.019	0.035	-0.553	.581	
Sex	-0.020	0.223	-0.092	.927	
GAD x Sex	0.046	0.037	1.243	.216	
General Cognitive Functioning (N = 128*)*					
GAD	0.033	0.323	0.102	.919	
Sex	-0.430	2.185	-0.197	.844	
GAD x Sex	-0.058	0.359	-0.162	.872	
Memory					
Verbal Memory Retrieval - Unstructured (N = 130*)*					
GAD	-0.119	0.093	-1.280	.203	
Sex	1.357	0.626	2.167	.032	*
GAD x Sex	0.030	0.102	0.291	.772	
Verbal Memory Retrieval - Structured (N = 130*)*					
GAD	-0.019	0.050	-0.371	.711	
Sex	0.768	0.340	2.262	.025	*
GAD x Sex	-0.036	0.056	-0.651	.516	

Note. $^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$; Sex was coded as: 0 = male, 1 = female.
Depression and Estimated Pre-morbid functioning were included as covariates in all analyses.

Table 13 (continued).

Main and Interactive Effects of GAD and Biological Sex on Cognitive Functioning

	b	*SE*	*t*	*p*	
Visual Memory Retrieval (N = 130)					
GAD	0.050	0.046	1.074	.285	
Sex	0.111	0.311	0.358	.721	
GAD x Sex	-0.076	0.051	-1.490	.139	
Perceptual Reasoning (N = 130)					
GAD	-0.068	0.379	-0.179	.860	
Sex	-1.542	2.552	-0.604	.547	
GAD x Sex	-0.171	0.417	-0.409	.683	
Processing Speed (N = 129)					
GAD	0.266	0.366	0.727	.468	
Sex	6.203	2.479	2.502	.014	*
GAD x Sex	0.109	0.404	0.270	.788	
Verbal Comprehension (N = 130)					
GAD	0.024	0.278	0.088	.930	
Sex	-2.521	1.876	-1.344	.181	
GAD x Sex	0.001	0.307	0.004	.997	
Working Memory (N = 128)					
GAD	0.084	0.362	0.231	.818	
Sex	-0.063	2.422	-0.026	.979	
GAD x Sex	-0.186	0.401	-0.465	.643	

Note. $^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$; Sex was coded as: 0 = male, 1 = female. Depression and Estimated Pre-morbid functioning were included as covariates in all analyses.

Health Anxiety and Sex. The main and interaction effects for the exploratory regression analyses predicting cognitive functioning from health anxiety and biological sex are presented in Table 14; only significant interactions are discussed here. There were significant interactions for working memory and one aspect of executive functioning related to problem-solving and non-verbal abstract problem-solving (i.e., WCST Failure to Maintain Set). For males only, greater health anxiety was associated with greater working memory abilities, whereas for females the association was negative and not significant. For females only, greater health anxiety was associated with greater executive functioning related to problem-solving and non-verbal abstract reasoning (i.e., WCST Failure to Maintain Set), whereas the association was not significant for males.

In the models predicting general cognitive functioning, verbal comprehension, perceptual reasoning, visual memory retrieval, attention, executive functioning related to set-shifting, executive functioning related to response inhibition, and some aspects executive functioning related to problem-solving and non-verbal abstract reasoning (i.e., WCST Number of Categories and Perseverative Errors) from biological sex and health anxiety, there were no significant interaction effects.

Table 14.
Main and Interactive Effects of Health Anxiety and Biological Sex on Cognitive Functioning

	b	*SE*	*t*	*p*	
Attention (N = 94*)*					
Health Anxiety	0.002	0.186	0.009	.993	
Sex	0.755	2.151	0.351	.726	
Health Anxiety x Sex	-0.251	0.229	-1.095	.277	
Executive Functioning					
Set-shifting (N = 93*)*					
Health Anxiety	0.085	0.213	0.400	.690	
Sex	0.883	2.468	0.358	.721	
Health Anxiety x Sex	-0.255	0.263	-0.970	.335	
Response Inhibition (N = 94*)*					
Health Anxiety	0.245	0.210	1.165	.247	
Sex	-0.013	2.432	-0.008	.994	
Health Anxiety x Sex	-0.327	0.259	-1.260	.211	
WCST Number of Categories (N = 96*)*					
Health Anxiety	0.006	0.014	0.436	.664	
Sex	-0.029	0.220	-0.132	.896	
Health Anxiety x Sex	-0.005	0.024	-0.201	.841	
WCST Perseverative Errors (N = 96*)*					
Health Anxiety	0.177	0.251	0.703	.484	
Sex	-0.321	2.973	-0.108	.914	
Health Anxiety x Sex	-0.409	0.317	-1.293	.200	
WCST Failure to Maintain Set (N = 89*)*					
Health Anxiety	0.002	0.021	0.093	.926	
Sex	-0.220	0.249	-0.886	.378	
Health Anxiety x Sex	0.048	0.026	1.830	.071	+
General Cognitive Functioning (N = 98*)*					
Health Anxiety	0.032	0.208	0.154	.878	
Sex	-0.829	2.418	-0.334	.732	
Health Anxiety x Sex	-0.154	0.260	-0.594	.554	
Memory					
Verbal Memory Retrieval - Unstructured (N = 99*)*					
Health Anxiety	-0.049	0.062	-0.793	.430	
Sex	1.456	0.729	1.997	.049	*
Health Anxiety x Sex	0.044	0.079	0.566	.573	
Verbal Memory Retrieval - Structured (N = 99*)*					
Health Anxiety	0.028	0.034	0.825	.412	
Sex	0.782	0.399	1.962	.053	+
Health Anxiety x Sex	-0.030	0.043	-0.700	.486	

Note. $^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$; Sex was coded as: 0 = male, 1 = female.
Depression and Estimated Pre-morbid functioning were included as covariates in all analyses.

Table 14 (continued).

Main and Interactive Effects of Health Anxiety and Biological Sex on Cognitive Functioning

	b	*SE*	*t*	*p*	
Visual Memory Retrieval (N = 99)					
Health Anxiety	0.003	0.030	0.095	.925	
Sex	0.017	0.356	0.047	.962	
Health Anxiety x Sex	0.000	0.038	-0.001	.995	
Perceptual Reasoning (N = 99)					
Health Anxiety	0.033	0.253	0.129	.897	
Sex	-2.412	2.969	-0.812	.419	
Health Anxiety x Sex	-0.208	0.320	-0.650	.517	
Processing Speed (N = 98)					
Health Anxiety	0.032	0.223	0.143	.886	
Sex	6.096	2.598	2.348	.021	*
Health Anxiety x Sex	0.058	0.279	0.209	.835	
Verbal Comprehension (N = 99)					
Health Anxiety	-0.029	0.194	-0.149	.882	
Sex	-2.278	2.283	-0.998	.321	
Health Anxiety x Sex	-0.070	0.246	-0.284	.777	
Working Memory (N = 99)					
Health Anxiety	0.407	0.223	1.829	.071	+
Sex	-0.179	2.614	-0.069	.946	
Health Anxiety x Sex	-0.501	0.281	-1.780	.078	+

Note. $^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$; Sex was coded as: 0 = male, 1 = female. Depression and Estimated Pre-morbid functioning were included as covariates in all analyses.

Race/Ethnicity and Symptomatology Predicting Cognitive Functioning

PTSD and Race/Ethnicity. The main and interaction effects for the exploratory regression analyses predicting cognitive functioning from PTSD and race/ethnicity are presented in Table 15; only significant interactions are discussed here. There were no significant interactions for any of the models tested.

Table 15.
Main and Interactive Effects of PTSD and Race/Ethnicity on Cognitive Functioning

	b	*SE*	*t*	*p*
Attention (N = 120)				
PTSD	0.031	0.076	0.407	.684
Race/Ethnicity	0.347	2.164	0.160	.873
PTSD x Race/Ethnicity	-0.161	0.100	-1.610	.110
Executive Functioning				
Set-shifting (N = 118)				
PTSD	0.055	0.081	0.680	.498
Race/Ethnicity	4.456	2.272	1.962	.052 $^{+}$
PTSD x Race/Ethnicity	-0.144	0.106	-1.360	.178
Response Inhibition (N = 120)				
PTSD	0.035	0.104	0.338	.736
Race/Ethnicity	3.334	2.365	1.410	.161
PTSD x Race/Ethnicity	-0.088	0.109	-0.810	.420
WCST Number of Categories (N = 121)				
PTSD	0.003	0.008	0.318	.751
Race/Ethnicity	-0.115	0.225	-0.511	.610
PTSD x Race/Ethnicity	0.013	0.010	1.256	.212
WCST Perseverative Errors (N = 120)				
PTSD	-0.003	0.124	-0.027	.979
Race/Ethnicity	-1.804	2.766	-0.652	.516
PTSD x Race/Ethnicity	-0.059	0.127	-0.461	.646
WCST Failure to Maintain Set (N = 119)				
PTSD	-0.005	0.012	-0.437	.663
Race/Ethnicity	0.251	0.255	0.983	.328
PTSD x Race/Ethnicity	0.007	0.012	0.631	.829
General Cognitive Functioning (N = 123)				
PTSD	-0.060	0.105	-0.571	.569
Race/Ethnicity	0.459	2.386	0.192	.848
PTSD x Race/Ethnicity	-0.060	0.110	-0.551	.583
Memory				
Verbal Memory Retrieval - Unstructured (N = 125)				
PTSD	-0.063	0.032	-1.972	.051 $^{+}$
Race/Ethnicity	0.113	0.723	0.156	.877
PTSD x Race/Ethnicity	0.044	0.033	1.330	.188
Verbal Memory Retrieval - Structured (N = 125)				
PTSD	-0.020	0.018	-1.150	.23
Race/Ethnicity	-0.131	0.398	-0.329	.743
PTSD x Race/Ethnicity	0.006	0.018	0.303	.762

Note. $^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$; Sex was coded as: 0 = White, 1 = Non-White. Depression and Estimated Pre-morbid functioning were included as covariates in all analyses.

Table 15 (continued).

Main and Interactive Effects of PTSD and Race/Ethnicity on Cognitive Functioning

	b	*SE*	*t*	*p*
Memory				
Visual Memory Retrieval (N = 125)				
PTSD	-0.006	0.016	-0.361	.719
Race/Ethnicity	0.159	0.357	0.444	.658
PTSD x Race/Ethnicity	0.000	0.017	-0.007	.994
Perceptual Reasoning (N = 125)				
PTSD	-0.111	0.126	-0.878	.382
Race/Ethnicity	0.545	2.849	0.191	.849
PTSD x Race/Ethnicity	-0.139	0.131	-1.060	.110
Processing Speed (N = 124)				
PTSD	-0.090	0.123	-0.773	.466
Race/Ethnicity	2.034	2.791	0.729	.468
PTSD x Race/Ethnicity	-0.018	0.129	-0.142	.888
Verbal Comprehension (N = 125)				
PTSD	-0.045	0.096	-0.470	.639
Race/Ethnicity	-0.581	2.172	-0.278	.790
PTSD x Race/Ethnicity	0.044	0.100	0.439	.661
Working Memory (N = 124)				
PTSD	0.094	0.118	0.799	.426
Race/Ethnicity	-0.299	2.658	-0.112	.911
PTSD x Race/Ethnicity	-0.136	0.122	-1.113	.268

Note. $^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$; Sex was coded as: 0 = White, 1 = Non-White. Depression and Estimated Pre-morbid functioning were included as covariates in all analyses.

GAD and Race/Ethnicity. The main and interaction effects for the exploratory regression analyses predicting cognitive functioning from PTSD and race/ethnicity are presented in Table 16. There were no significant interactions for any of the models tested.

Table 16.
Main and Interactive Effects of GAD and Race/Ethnicity on Cognitive Functioning

	b	*SE*	*t*	*p*
Attention (N = 125)				
GAD	0.510	0.288	1.772	.079 +
Race/Ethnicity	0.751	2.187	0.343	.732
GAD x Race/Ethnicity	-0.492	0.326	-1.510	.134
Executive Functioning				
Set-shifting (N = 123)				
GAD	0.263	0.309	0.852	.396
Race/Ethnicity	4.973	2.312	2.115	.037 *
GAD x Race/Ethnicity	-0.385	0.353	-1.091	.277
Response Inhibition (N = 124)				
GAD	0.298	0.317	0.941	.349
Race/Ethnicity	3.501	2.397	1.461	.147
GAD x Race/Ethnicity	-0.244	0.360	-0.678	.499
WCST Number of Categories (N = 124)				
GAD	0.000	0.025	-0.009	.993
Race/Ethnicity	-0.128	0.226	-0.568	.571
GAD x Race/Ethnicity	0.048	0.034	1.386	.168
WCST Perseverative Errors (N = 123)				
GAD	-0.106	0.369	-0.287	.775
Race/Ethnicity	-1.734	2.723	-0.637	.526
GAD x Race/Ethnicity	-0.020	0.412	-0.048	.962
WCST Failure to Maintain Set (N = 122)				
GAD	-0.008	0.035	-0.230	.818
Race/Ethnicity	0.251	0.251	1.000	.319
GAD x Race/Ethnicity	0.021	0.038	0.551	.583
General Cognitive Functioning (N = 128)				
GAD	0.119	0.325	0.365	.716
Race/Ethnicity	0.263	2.455	0.107	.915
GAD x Race/Ethnicity	-0.226	0.368	-0.615	.540
Memory				
Verbal Memory Retrieval - Unstructured (N = 130)				
GAD	-0.149	0.096	-1.558	.122
Race/Ethnicity	-0.066	0.719	-0.092	.927
GAD x Race/Ethnicity	0.082	0.108	0.761	.448
Verbal Memory Retrieval - Structured (N = 130)				
GAD	-0.032	0.052	-0.612	.542
Race/Ethnicity	-0.146	0.392	-0.372	.711
GAD x Race/Ethnicity	-0.013	0.059	-0.224	.823

Note. $^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$; Sex was coded as: 0 = White, 1 = Non-White. Depression and Estimated Pre-morbid functioning were included as covariates in all analyses.

Table 16 (continued).

Main and Interactive Effects of GAD and Race/Ethnicity on Cognitive Functioning

	b	*SE*	*t*	*p*
Memory				
Visual Memory Retrieval (N = 130)				
GAD	0.022	0.047	0.472	.638
Race/Ethnicity	0.070	0.354	0.199	.843
GAD x Race/Ethnicity	-0.023	0.053	-0.440	.660
Perceptual Reasoning (N = 130)				
GAD	-0.007	0.384	-0.019	.985
Race/Ethnicity	-0.282	2.884	-0.098	.922
GAD x Race/Ethnicity	-0.279	0.432	-0.656	.520
Processing Speed (N = 129)				
GAD	0.293	0.380	0.772	.442
Race/Ethnicity	1.550	2.866	0.541	.590
GAD x Race/Ethnicity	0.013	0.427	0.029	.977
Verbal Comprehension (N = 130)				
GAD	0.068	0.284	0.238	.812
Race/Ethnicity	-0.553	2.133	-0.259	.796
GAD x Race/Ethnicity	-0.066	0.319	-0.207	.836
Working Memory (N = 128)				
GAD	0.212	0.362	0.587	.559
Race/Ethnicity	0.408	2.718	0.150	.881
GAD x Race/Ethnicity	-0.460	0.412	-1.117	.266

Note. $^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$; Sex was coded as: 0 = White, 1 = Non-White. Depression and Estimated Pre-morbid functioning were included as covariates in all analyses.

Health Anxiety and Race/Ethnicity. The main and interaction effects for the exploratory regression analyses predicting cognitive functioning from PTSD and race/ethnicity are presented in Table 17; only significant interactions are discussed here. There were significant interactions in the models predicting general cognitive functioning, working memory, and attention from health anxiety and race/ethnicity. For non-White individuals only, increased health anxiety was marginally associated with decreased general cognitive functioning and attention, whereas the associations were negative and not significant for White individuals. For White individuals only, increased health anxiety was associated with increased working memory, whereas for non-White individuals the association was negative and non-significant. There was also a marginally significant interaction in the model predicting executive functioning related to set-shifting from race/ethnicity and health anxiety, such that, for non-White individuals only, increased health anxiety was marginally associated with decreased set-shifting abilities, whereas the association was not significant for White individuals.

In the models predicting verbal comprehension, perceptual reasoning, processing speed, verbal memory retrieval for unstructured and structured information, visual memory retrieval, executive functioning related to response inhibition, and executive functioning related to problem-solving and non-verbal abstract reasoning from race/ethnicity and health anxiety, there were no significant main or interaction effects.

Table 17.
Main and Interactive Effects of Health Anxiety and Race/Ethnicity on Cognitive Functioning

	b	*SE*	*t*	*p*	
Attention (N = 94*)*					
Health Anxiety	0.189	0.180	1.046	.299	
Race/Ethnicity	1.481	2.302	0.643	.522	
Health Anxiety x Race/Ethnicity	-0.695	0.241	-2.886	.005	**
Executive Functioning					
Set-shifting (N = 93*)*					
Health Anxiety	0.156	2.090	0.747	.457	
Race/Ethnicity	4.064	2.669	1.523	.131	
Health Anxiety x Race/Ethnicity	-0.553	0.280	-1.977	.051	+
Response Inhibition (N = 94)					
Health Anxiety	0.195	0.212	0.919	.360	
Race/Ethnicity	1.768	2.707	0.653	.515	
Health Anxiety x Race/Ethnicity	-0.319	0.283	-1.125	.264	
WCST Number of Categories (N = 96*)*					
Health Anxiety	0.007	0.014	0.492	.624	
Race/Ethnicity	-0.107	0.241	-0.442	.660	
Health Anxiety x Race/Ethnicity	0.008	0.025	0.322	.748	
WCST Perseverative Errors (N = 96*)*					
Health Anxiety	0.063	0.260	0.241	.810	
Race/Ethnicity	-3.131	3.269	-0.958	.341	
Health Anxiety x Race/Ethnicity	-0.143	0.340	-0.420	.675	
WCST Failure to Maintain Set (N = 94*)*					
Health Anxiety	0.011	0.022	0.525	.601	
Race/Ethnicity	0.231	0.277	0.832	.408	
Health Anxiety x Race/Ethnicity	0.027	0.029	0.935	.352	
General Cognitive Functioning (N = 98*)*					
Health Anxiety	0.239	0.207	1.155	.251	
Race/Ethnicity	-0.345	2.631	-0.131	.896	
Health Anxiety x Race/Ethnicity	-0.568	0.287	-2.063	.042	*
Memory					
Verbal Memory Retrieval - Unstructured (N = 99*)*					
Health Anxiety	0.005	0.065	0.070	.944	
Race/Ethnicity	-0.598	0.822	-0.728	.468	
Health Anxiety x Race/Ethnicity	-0.027	0.086	-0.312	.756	
Verbal Memory Retrieval - Structured (N = 99*)*					
Health Anxiety	0.056	0.035	1.588	.116	
Race/Ethnicity	-0.311	0.445	-0.697	.487	
Health Anxiety x Race/Ethnicity	-0.068	0.464	-1.472	.144	

Note. $^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$; Sex was coded as: 0 = White, 1 = Non-White. Depression and Estimated Pre-morbid functioning were included as covariates in all analyses.

Table 17 (continued).

Main and Interactive Effects of Health Anxiety and Race/Ethnicity on Cognitive Functioning

	b	*SE*	*t*	*p*	
Memory					
Visual Memory Retrieval (N = 99)					
Health Anxiety	0.032	0.031	1.017	.312	
Race/Ethnicity	-0.044	0.390	-0.112	.911	
Health Anxiety x Race/Ethnicity	-0.053	0.041	-1.308	.194	
Perceptual Reasoning (N = 99)					
Health Anxiety	0.128	0.260	0.493	.623	
Race/Ethnicity	-1.581	3.276	-0.483	.631	
Health Anxiety x Race/Ethnicity	-0.385	0.341	-1.127	.263	
Processing Speed (N = 98)					
Health Anxiety	0.191	0.233	0.823	.413	
Race/Ethnicity	1.395	2.956	0.472	.638	
Health Anxiety x Race/Ethnicity	-0.227	0.309	-0.734	.465	
Verbal Comprehension (N = 99)					
Health Anxiety	0.053	0.201	0.264	.793	
Race/Ethnicity	-0.640	2.527	-0.253	.801	
Health Anxiety x Race/Ethnicity	-0.237	0.263	-0.900	.371	
Working Memory (N = 99)					
Health Anxiety	0.617	0.223	2.773	.007	**
Race/Ethnicity	-1.316	2.804	-0.470	.640	
Health Anxiety x Race/Ethnicity	-0.882	0.282	-3.019	.003	**

Note. $^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$; Sex was coded as: 0 = White, 1 = Non-White. Depression and Estimated Pre-morbid functioning were included as covariates in all analyses.

Chapter 5

Discussion

The current study investigated the associations between generalized anxiety disorder (GAD), posttraumatic stress disorder (PTSD), and health anxiety symptomatology and cognitive functioning. Additionally, the association between social connectedness and cognitive functioning was examined, and whether social connectedness might protect against some of the negative effects of GAD, PTSD, and health anxiety symptomatology on cognitive functioning. Exploratory analyses were also conducted to examine differences in the associations between social connectedness versus social capital and cognitive functioning and with social capital as a moderator between each mental health disorder and cognitive functioning. Lastly, biological sex and race/ethnicity were explored as potential moderators between each mental health disorder and cognitive functioning. The specific aims were to examine: 1) the association between health anxiety, GAD, and PTSD symptomatology and cognitive functioning; 2) the association between social connectedness and cognitive functioning; 3) social connectedness as a moderator in the association between health anxiety, GAD, and PTSD symptomatology and cognitive functioning; and, 4) biological sex and race/ethnicity as potential moderators in the association between health anxiety, GAD, and PTSD and cognitive functioning.

For Aim 1, PTSD was predicted to be associated with greater deficits in general cognitive functioning (*Hypothesis 1*) and greater deficits in verbal memory retrieval and processing speed relative to GAD (*Hypothesis 2*). Health anxiety was predicted to be associated with deficits in cognitive functioning (*Hypothesis 3*), though no hypotheses were made regarding the specific cognitive domains impacted. For Aim 2, higher levels of social connectedness were predicted to be associated with higher functioning in the domains of

general cognitive functioning, executive functioning, and processing speed (*Hypothesis 4*). For Aim 3, social connectedness was predicted to moderate the association between health anxiety, GAD, and PTSD symptomatology and each cognitive domain, such that higher levels of social connectedness would be associated with a weaker association between each of the mental health variables and each cognitive domain, whereas lower levels of social connectedness would be associated with a stronger association (*Hypothesis 5*). Overall, the findings partially supported each of these hypotheses, as detailed below.

The Relationship between Mental Illness Symptomatology and Cognitive Functioning

Regarding Aim 1, findings supported Hypothesis 1 such that PTSD symptomatology was significantly associated with worse general cognitive functioning relative to GAD and health anxiety. This finding is in line with prior research suggesting the significant negative impact PTSD has on overall cognitive functioning (e.g., Malarbi et al., 2017). In partial support of Hypothesis 2, increased PTSD symptomatology was more strongly associated with processing speed deficits relative to GAD. However, neither PTSD nor GAD symptomatology was significantly associated with visual or verbal memory retrieval. These findings are in line with existing research demonstrating the negative association between PTSD and processing speed (e.g., Wrocklage et al., 2016) as well as for GAD (e.g., Tempesta et al., 2013).

However, the lack of findings regarding deficits in verbal and visual memory was surprising, especially given a large body of research suggesting the significant impact of PTSD on verbal memory (e.g., Johnsen & Asbjornsen, 2008). One possible reason for the lack of significant findings for memory in the current study is the small sample size. It could also be that only certain aspects of memory (i.e., initial learning, spontaneous recall) are

impacted by PTSD, whereas retrieval is not. Alternatively, it may be that only those with severe PTSD symptomatology experience significant deficits in memory. However, given the large proportion of the current sample reporting clinically significant PTSD symptoms (i.e., 40%), the latter possibility seems unlikely. Another possibility is that the type of trauma experienced has a stronger impact on the degree of cognitive deficits, which aligns with prior research findings suggesting differential impacts on verbal memory depending on the type of trauma experience (e.g., Johnsen and Asbjornsen, 2008). Information on the type of trauma experienced was not collected as part of the current study, and therefore there was not an opportunity to explore this possibility.

In addition to these findings, greater PTSD symptomatology was found to be associated with lower verbal comprehension, perceptual reasoning, and attention, whereas GAD symptomatology was associated with greater simple attention. The finding that PTSD is associated with decreased attentional abilities is in line with prior research suggesting individuals with PTSD experience deficits in attention (e.g., Evans et al., 2022; Castenada et al., 2018). However, the positive association between GAD and attention was somewhat surprising, given evidence that GAD is typically associated with decreased attentional abilities (e.g., Tempesta et al., 2013). One possible reason for this finding is that the test environment, which often produces anxiety even among those without GAD, may have led those with GAD to selectively attend to the test materials, leading to increased performance on tasks of attention. Anxiety disorders are often associated with attentional bias particularly towards threat stimuli (e.g., Mobini & Grant, 2007) and stress/arousal can lead to a narrowing of attention (e.g., Easterbrook 1959), each of which could result in better test performance. Lastly, given the possibility of a suppression effect, it may be that the

association between GAD and processing speed and attention is actually negative. Taken together, it appears that GAD, when controlling for other mental health symptomatology, may be associated with increased attention.

Hypothesis 3 was not supported, as health anxiety was not significantly associated with any of the cognitive domains examined. While it is possible that health anxiety does not have a significant impact on cognitive functioning, this seems unlikely. Rather, the current findings may be due to the measure used for health anxiety. While the HAI is a comprehensive measure assessing symptoms of health anxiety, it does not necessarily align completely with DSM-V-TR diagnostic criteria for illness anxiety disorder (IAD) or somatic symptom disorder (SSD). Further, the HAI does not currently include a clinical cut-off; therefore, it is unclear how many individuals in the current sample reported clinically significant levels of health anxiety. However, the initial validation study (Salkovskis et al., 2002) indicated that those with health anxiety scored an average of 37.9 (*SD* = 6.8) on the HAI, those with anxiety scored an average of 18.5 (*SD* = 7.3), and controls scored an average of 12.2 (*SD* = 6.2). The current sample had an average HAI score of 17.33 (*SD* = 9.32), suggesting that much of the sample likely experienced levels of health anxiety consistent with general anxiety though not necessarily with clinical health anxiety. It may be that only clinically significant levels of health anxiety result in cognitive deficits, in which case utilizing a measure that aligns with diagnostic criteria may provide more accurate results.

However, the most likely explanation is that PTSD, above and beyond both health anxiety and GAD, predicted greater cognitive deficits. The current study supported this explanation as evidenced by significant bivariate correlations between PTSD, GAD, and health anxiety and each cognitive domain, with the association for GAD and health anxiety

weakening in strength or becoming non-significant when including each in models with PTSD. With this in mind, an important next step may be to further examine the aspects of PTSD that lead to cognitive impairments above and beyond those seen in other mental health disorders.

Interestingly, none of the mental health variables were significantly associated with deficits in working memory, which was unexpected given the consistently demonstrated link between it and both GAD and PTSD (e.g., Held et al., 2020; Moran et al., 2016), as well as other disorders (e.g., Scott et al., 2015) although at least one study failed to find a link (Wrocklage et al., 2016). One possibility is that the measure used in the current study (i.e., WAIS-IV WMI) is not as sensitive a measure of working memory others, such as the Paced Auditory Simple Addition Test (PASAT; Diehr et al., 1998). Given these conflicting findings, future research should further explore the relationship between mental illness symptoms and working memory using a variety of measures.

The Relationship between Social Relationships and Cognitive Functioning

Regarding Aim 2, Hypothesis 4 was partially supported as social connectedness was positively associated with general cognitive functioning and aspects of executive functioning related to problem-solving and non-verbal abstract reasoning. However, in contrast to Hypothesis 4, social connectedness was not associated with processing speed or other aspects of executive functioning (i.e., set-shifting, response inhibition). The current findings are in line with prior research suggesting the important role social connectedness plays in the development and maintenance of executive functioning processes as well as its role in overall cognitive functioning (e.g., Kelly et al., 2017). The lack of significant findings for processing speed may be due to the types of processing speed included in the current study (i.e., motor

processing speed on the WAIS-IV). It may be that other types of processing speed, such as mental processing speed, are more strongly impacted by social connectedness.

In addition to these primary findings, social connectedness was found to be associated with greater perceptual reasoning, visual memory retrieval, and attention, as well as marginally associated with greater working memory abilities and verbal memory retrieval for structured information. These findings are consistent with other research demonstrating positive associations between social connectedness and each of these domains (i.e., Kelly et al., 2017; Boss et al., 2015). Thus, overall, current findings further highlight the important role social connectedness plays in overall cognitive functioning as well as specific cognitive domains.

When examining Aim 2 using the measure of social capital, social capital was found to be associated with general cognitive functioning and marginally associated with some aspects of executive functioning (i.e., set-shifting, response inhibition, and problem-solving and non-verbal abstract reasoning as measured by perseverative errors and failures to maintain set). Thus, findings were generally consistent, though with some areas of differences, when utilizing the social capital measure. One reason for these subtle differences may be due to underlying differences in the UCLA Loneliness Scale versus the social capital composite variable. Whereas the UCLA Loneliness Scale measures more subjective aspects of social relationships such as the individual's experience of loneliness (i.e., feeling lonely, isolated, etc. from others), the composite social capital variable measured more objective aspects including the presence of some opportunities for social connection (i.e., living with others, being employed, being in a relationship) in the individual's life. This is an important distinction, as an individual may feel lonely despite being surrounded by others, and

therefore simply measuring the number of possible social connections may not provide an accurate picture of how an individual actually feels and vice versa (i.e., someone may not have many social connections though may not feel lonely). This is supported by the relatively weak correlation observed between the two variables in the current study.

Additionally, the strong correlation between PTSD and the UCLA Loneliness Scale, as well as the observed interaction effects (described below), highlight a possible explanation for why PTSD has such a strong impact on cognitive functioning and well-being. It may be that individuals with PTSD feel a greater degree of social isolation and estrangement from others, relative to what is experienced in other mental health disorders such as GAD or health anxiety, which in turn could negatively impact overall cognitive functioning. Indeed, avoidance and detachment are both key features of PTSD and, as such, this possibility will be an important topic of future research.

The Moderating Role of Social Relationships

PTSD and Cognitive Functioning

Regarding Aim 3, findings partially supported Hypothesis 5, such that, for individuals with relatively low levels of social connectedness, increased PTSD symptomatology was associated with lower verbal comprehension, perceptual reasoning, and verbal memory retrieval for structured information, whereas the association was not significant for those with mean and high levels of social connectedness. As there was only one significant interaction and two marginally significant interactions out of 14 analyses, social connectedness may not play as strong a protective role as hypothesized. However, the lack of significant findings may alternatively be due to the small sample size which was likely insufficient to detect small effects. Further, the significant interactions that did arise

suggested that social connectedness does play a protective role for the cognitive domains that were most impacted by PTSD symptomatology in the current study.

Additionally, these findings may provide further insight into one aspect of PTSD (i.e., avoidance and detachment from others) that may account for its significant negative impact on cognitive functioning over and above other mental health disorders (i.e., GAD, depression, health anxiety). Findings suggest the importance of treatment modalities for PTSD that focus especially on reintegration and building supportive social networks, a factor that is not necessarily a key focus area in frequently used treatment modalities for the disorder, such as Cognitive Processing Therapy (CPT). Other recent research (e.g., Revranche et al., 2023) has also highlighted the interplay of trauma exposure and social isolation. Specifically, utilizing a large representative sample (N = 4,445) of individuals exposed to traumatic events, Reyranche et al. (2023) observed that individuals exposed to traumatic events who reported having no one that cared about them, no confidant, and no one to rely on when making important decisions were at a higher risk of developing PTSD. In the current study, socially isolated individuals who experienced a traumatic event (such as the COVID-19 pandemic) may have been at greater risk of developing PTSD and experiencing deficits in cognitive functioning. This possibility is especially important given the impact of COVID-19 as a traumatic event that often also increased social isolation (e.g., personal illness; losing close others to the virus; exposure to news coverage on significant deaths, etc. associated with COVID-19).

When using the social capital measure, only one significant interaction arose, such that for those with high levels of social connectedness, increased PTSD symptomatology was associated with decreased processing speed. This finding was surprising, as it goes against

the notion that social connectedness may have a protective role. However, this difference may have been due to differences in the measure used for social connectedness, or some third variable not assessed. Additionally, given the small sample size and the large number of analyses conducted, it is possible this was a chance significant finding.

GAD and Cognitive Functioning

For GAD, there were no significant interactions between GAD and social connectedness in predicting each cognitive domain, possibly due to the sample size. Somewhat different findings emerged, however, when using the social capital variable. Specifically, for those with relatively low levels of social capital, increased GAD symptomatology was associated with decreased processing speed, attention, and response inhibition. Therefore, Hypothesis 5 was also partially supported by the findings for GAD with social capital measure.

Health Anxiety and Cognitive Functioning

In partial support of Hypothesis 5, for those with high levels of social connectedness, increased health anxiety was associated with better working memory. This was somewhat surprising, as one would not expect higher levels of a mood symptomatology to be associated with greater cognitive abilities, particularly working memory, as most research has demonstrated the detrimental impact of mental illness on working memory (e.g., Langarita-Llorente & Gracia-Garcia, 2019; Moran et al., 2016). As previously noted, it is possible that this was a chance finding due to small sample size and only 1 of 14 interactions being significant. This notion is further supported by the lack of significant interactions when examining social capital in the association between health anxiety and cognitive functioning as well. Alternatively, it may be that health anxiety enhances performance on tasks of

working memory, which also typically involve some degree of attention. Given the current findings regarding positive associations between GAD and processing speed and attention, similar mechanisms may be at play between health anxiety and working memory. However, no research to date has examined this possibility.

In sum, findings for Aim 3 partially supported the hypothesis that higher levels of social connectedness would protect against the negative effects of each mental health disorder on cognitive functioning, as evidenced by non-significant associations for those with mean and high levels of social connectedness. Current findings suggest the important role social connectedness (even at mean levels) may have in protecting against cognitive decline, particularly for those with mental illness. These findings also highlight the importance of addressing feelings of loneliness, social detachment, and isolation for those in psychotherapy with mental illness, as such difficulties may not only exacerbate their mental health but also their cognitive functioning. Further, current findings may point to an important characteristic of PTSD (i.e., social isolation, detachment) that may put those with the disorder at greater risk of developing cognitive difficulties. Relatedly, it appears that social connectedness may play a greater protective role for PTSD relative to GAD and health anxiety, given the lack of significant findings for GAD and health anxiety. Lastly, the subtle differences in these associations when examining social connectedness versus social capital highlights the importance of examining more subjective versus objective aspects of social relationships separately, as each appears to impact different domains of cognitive functioning.

Moderating Roles of Biological Sex and Race/Ethnicity

Biological Sex and Cognitive Functioning

For Aim 4, a few interesting interaction effects emerged when examining biological sex as a moderator between each of the mental health variables (PTSD, GAD, health anxiety) and each cognitive domain. There was some evidence in the current study that for females only, increased PTSD symptomatology was associated with decreased visual memory retrieval. Other sex differences also arose, such that the association between PTSD and executive functioning related to set-shifting was positive and significant for males, but negative and not significant for females. Similarly, there was some evidence that the association between PTSD and response inhibition was positive for males and negative for females (though non-significant for both).

Though much research has focused on examining sex differences in PTSD, most studies have focused on examining the experience of traumatic events and prevalence rates, rather than examining differences in symptomatology and how the impact of PTSD on cognitive functioning might differ by sex. For example, review findings (Tolin & Foa, 2006) suggest that although males are more likely to experience traumatic events, females are more likely to meet diagnostic criteria for PTSD than males. Additionally, they found that females are more likely to experience sexual assault or abuse whereas males are more likely to experience accidents, witness death or injury, nonsexual assault, serious illness, disaster or fire, and combat or war. Based on these findings, some have suggested that differences in the type of trauma experienced may account for sex differences in PTSD symptomatology.

One recent study (Guina et al., 2019), however, found that sex differences remained even after controlling for type of trauma, such that women who experienced trauma reported

more severe and different symptoms than men. Specifically, women reported greater excessive startle, external avoidance, physical and psychological reactivity, and suicide attempts than men, whereas men reported more alcohol use problems. Based on these findings, it is possible that the differential impact of PTSD on cognitive functioning may be partially attributable to sex differences in the type and severity of symptoms experienced. The current findings highlight possible differences in the impact of PTSD on cognitive functioning based on sex and the need to further explore such differences.

There were no significant interactions between GAD and biological sex in predicting cognitive functioning. However, there were several interactions for health anxiety. An interaction was observed between health anxiety and biological sex for working memory, such that increased health anxiety was associated with increased working memory abilities for males only, though this finding was marginally significant. There was also a marginally significant interaction for executive functioning related to problem-solving and non-verbal abstract reasoning as measured by WCST failures to maintain set. Specifically, increased health anxiety was associated with better performance on this task for females only. This finding was also surprising, similar to that of increased health anxiety being associated with increased working memory. As described previously, these positive associations may be spurious given the large number of analyses conducted and small sample size, and thus should be interpreted with caution.

Race/Ethnicity and Cognitive Functioning

There were no significant interactions between PTSD or GAD and race/ethnicity in predicting cognitive functioning; however, several interactions emerged between health anxiety and race/ethnicity. Specifically, for non-White individuals only, increased health

anxiety was associated with decreased attention and marginally associated with decreased general cognitive functioning and set-shifting abilities. Though no studies to date have examined differences in executive functioning related to set-shifting based on race/ethnicity, much research has examined race/ethnicity differences in executive functioning more broadly. For example, a recent meta-analysis (Rea-Sandin et al., 2021) found that White and Asian American individuals evidenced greater executive functioning abilities than Latino and Black individuals. Given that the current finding contrasts with meta-analytic findings, it is possible that this finding was spurious due to small sample size and the large number of analyses conducted.

Additionally, for White individuals only, increased health anxiety was associated with increased working memory, whereas the association was negative and not significant for non-White individuals. As described previously, this finding may be due to chance or may suggest that health anxiety has an enhancing effect on some aspects of cognitive functioning. Taken together, the significant interactions suggest that health anxiety may differentially impact racial and ethnic minorities relative to White individuals. This possibility is feasible in light of a recent systematic review and meta-analysis (Barbek et al., 2022) suggesting that migrants and/or ethnic minorities are at a higher risk of developing health anxiety and early research findings suggesting racial and ethnic minorities report more somatic symptoms (e.g., Escobar 1995).

However, other more recent studies have called into question the notion that racial and ethnic minorities experience more somatic symptoms. For example, one study (Evangelidou et al., 2020) found that Asian and Latino individuals were less likely to report medically unexplained physical symptoms than non-Latino White individuals. Interestingly,

another recent study (Dunlop et al., 2020) observed that Hispanic patients reported higher levels of somatic symptoms relative to Black and White non-Hispanic patients, though only when they were evaluated in Spanish. Taken together, these discrepant findings highlight the need to further examine how health anxiety might manifest differently across various groups. Additionally, together with the current study findings, there appears to be a need to further examine how differences in the experience of health anxiety across groups may also result in functional differences, such as in the impact on cognitive functioning.

Limitations and Future Directions

Though the current study had several strengths including a diverse sample in terms of race/ethnicity, age, and education, the use of a clinical sample, and the inclusion of both self-report of symptoms and ability measures of cognitive functioning, there are several important limitations that likely impacted current results and that indicate clear directions for future research. A primary limitation is the small sample size (N = 157), which was considerably smaller than the target sample size of 264 and 395 suggested by a preliminary power analysis. The sample was further reduced as there was a large percentage of missing data on key study variables (i.e., UCLA LS; HAI). While the current sample was likely sufficient to address Aims 1 and 2, it is unlikely that it was sufficient for the moderation analyses for Aims 3 and 4. As discussed, several of the findings did not align with prior research or did not make conceptual sense (i.e., greater health anxiety associated with greater working memory), which may have been due to the small sample size. Similarly, there were several findings that approached significance, suggesting that, with a larger sample size, more significant findings may have emerged.

The small sample size was compounded by the large number of analyses conducted for Aim 3 (i.e., 42 analyses, 84 when including the social capital analyses) and Aim 4 (i.e., 42 analyses each for biological sex and race/ethnicity as moderators). As such, the current findings should be interpreted with caution and considered exploratory in nature. Nonetheless, current findings highlighted several important associations between mental illness and cognitive functioning, as well as the moderating roles of social connectedness, biological sex, and race/ethnicity. Future studies should seek to further examine these associations with larger samples and with more targeted analyses to increase the robustness and statistical soundness of findings.

A second limitation of the current study is the use of cross-sectional data. Though each mental health disorder was posited to be impacted cognitive functioning, it is possible that the opposite may also be true (i.e., deficits in cognitive functioning impact mental illness). However, exploring this possibility was not possible as the current study relied on cross-sectional data, which limits conclusions implying causation. A clear future direction will be to examine these associations longitudinally. Doing so would also allow for examination of changes in cognitive functioning that may occur as a result of treatment of physical health problems and/or psychopathology (e.g., PTSD treatment).

A third limitation pertains to the measure of social capital. Though the UCLA Loneliness Scale appears to be a good indicator of subjective feelings of social connectedness, the social capital measure was somewhat limited. Given the lack of a strong objective measure of social relationships and as this was not a primary study aim, the current study did not fully examine differences between subjective versus objective aspects of social relationships. As there was some evidence that each had a different impact on cognitive

functioning, it will be important for future studies to more thoroughly examine how subjective measures (e.g., social connectedness) versus objective measures (e.g., social capital) of social relationships might protect against cognitive decline associated with mental illness.

A fourth and related limitation may lie in the measure of health anxiety. The Health Anxiety Inventory may not have been sensitive enough to detect clinically significant levels of health anxiety (i.e., somatic symptom disorder; illness anxiety disorder), as it is not a clinical measure and does not provide cut-offs to determine clinically significant levels of health anxiety. Thus, it was unclear to what extent individuals were experiencing clinical levels of health anxiety. Future research might utilize measures such as the Somatic Symptom Disorder Questionnaire (SSD-12; Toussaint et al., 2017) and/or DSM-V-TR criteria to examine health anxiety more accurately. It might be that health anxiety only has an impact on cognitive functioning when experienced at clinically significant levels and/or in a way that is dysfunctional. This is key in considering the impact of the COVID-19 pandemic, as although many may have experienced some level of health anxiety, many of these fears were likely warranted and may have even served a protective (versus dysfunctional) role. For example, concerns about virus transmission may have led individuals to utilize face masks more consistently, practice social distancing, etc.

Finally, this study highlights the need to further examine the characteristics of PTSD that result in greater cognitive impairment relative to other similar disorders. Though the current dissertation focused especially on health anxiety, many of the key findings pertained to PTSD. Given the strong correlation between PTSD and the UCLA Loneliness Scale, as

well as the interactions observed, future research should further examine the interactive effects of loneliness and PTSD in predicting cognitive functioning.

Conclusion

The current study examined the impact of PTSD, GAD, and health anxiety symptomatology as well as social connectedness on cognitive functioning. Additionally, the potential protective role of social connectedness in the association between mental health symptomatology and cognitive functioning was examined. Biological sex and race/ethnicity were also explored as potential moderators in this association. Overall, findings suggest that PTSD has a negative impact on several aspects of cognitive functioning, above and beyond GAD and health anxiety, whereas social connectedness appears to have a positive impact on several cognitive domains. There was some evidence that social connectedness might protect against the negative effects of mental health symptomatology on some cognitive domains, though further research is needed to support this claim. Lastly, exploratory findings suggest that the impact of PTSD on cognitive functioning differs by sex, and that health anxiety may present differently across White versus non-White individuals which may in turn result in different impacts on cognitive functioning. Taken together, the current findings suggest the importance of better understanding how mental health symptomatology might impact cognitive functioning, and the benefits of examining factors which may mitigate some of this harm. Relatedly, findings highlight the importance of addressing protective factors such as social relationships in therapy for mental health disorders, particularly PTSD.

LIST OF APPENDICES

APPENDIX A: Demographic Questionnaire

Neuropsychological Symptom Checklist

Confidential – do not copy without permission

Name:_____ Appointment Date:_____

Date of Birth:_____ Current Age:_____ Sex at Birth: Male Female

Accompanied to appointment by:_____ Relationship to patient_____

Dominant Hand: Right Left Ambidextrous Any family members who are left-handed:_____

Ethnicity: African American Hispanic Caucasian Native American Asian Other:_____

Years of Education: <HS High School Some College Bachelor's Master's Ph.D. / M.D. / J.D.

Area of Study:_____ GPA/Grades:_____

Is English your primary language? Yes No *Please list other languages spoken and the order you learned them:*

_____

Did you have difficulty with any subject(s) in school? Yes No *If yes, please describe:*_____

_____

Did you repeat a grade or require special classes or tutoring? Yes No *If yes, please describe:*_____

_____

Did you have any speech or physical therapy as a child? Yes No *If yes, please describe:*_____

_____

Employment History:

Position	Place	Dates	Reason for Leaving

Are you applying or in the process of applying for disability? Yes or No

Have you ever received disability or workers' compensation? Yes or No

*If yes, please describe (including reasons and dates):*_____

Have you ever been arrested or had legal problems? Yes or No

*If yes, please describe (including dates and violations):*_____

Have you ever had a neuropsychological evaluation before? Yes or No

If yes, with who?_____

Date(s):_____

Test(s):_____

Results:_____

Are you currently involved in litigation, or expect to be in the near future? Yes or No

If yes, please describe:

Do you live alone? Yes or No *If no, please describe your living situation:*

Please describe any current stressful situations or events (e.g., major life changes, financial difficulties, job stress, etc.):

APPENDIX B: COVID-19 Questionnaire

COVID-19 QUESTIONNAIRE

Have you lost anyone to COVID-19? ☐ Yes ☐ No

If yes, what was your relationship to that person:

Have you had or ever been diagnosed with COVID-19? ☐ Yes ☐ No

If no, STOP here.

If yes, when were you diagnosed? _____

Did you experience symptoms? ☐ Yes ☐ No

- If yes, what was the first symptom you experienced? _____
- If yes, what was the most severe symptom you experienced? _____

If you were asymptomatic, how did you find out you had COVID-19?

☐ Family/friend was diagnosed

☐ Routine screening

☐ Other (please explain):

Were you hospitalized for your symptoms? ☐ Yes ☐ No

- If yes, how long were you hospitalized? _____

Were you admitted to the Intensive Care Unit (ICU)? ☐ Yes ☐ No

- If yes, how long were you admitted to the ICU? _____
- Were you put on a ventilator? If yes, how long? _____
- What were your oxygen (O_2) levels? _____

Have you experienced other medical complications as a result of COVID-19? ☐ Yes ☐ No

If yes, please explain:

Since recovering from COVID-19, do you continue to experience any symptoms? ☐ Yes ☐ No

If yes, please explain:

APPENDIX C: Self-report Measures

PATIENT HEALTH QUESTIONNAIRE (PHQ-9)

NAME:_____ DATE:_____

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 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 down	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 figety 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	0	1	2	3

add columns _____ + _____ + _____

TOTAL: _____

(Healthcare professional: For interpretation of TOTAL, please refer to accompanying scoring card).

10. 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 _____

Generalized Anxiety Disorder 7-Item (GAD-7) Scale

Name: Click here to enter text. **Date:** Click here to enter text.

Over the last 2 weeks, how often have you been bothered by the following problems?	Not At All	Several Days	Over Half 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 Scores for Each Column	☐ +	☐ +	☐ +	☐
Total Score (Sum of Column Scores)				

If any of the above problems were identified, 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**

PCL-5

Instructions: Below is a list of problems that people sometimes have in response to a very stressful experience. Please read each problem carefully and then circle one of the numbers to the right to indicate how much you have been bothered by that problem in the past month.

In the past month, how much were you bothered by:	Not at all	A little bit	Moderately	Quite a bit	Extremely
1. Repeated, disturbing, and unwanted memories of the stressful experience?	0	1	2	3	4
2. Repeated, disturbing dreams of the stressful experience?	0	1	2	3	4
3. Suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there reliving it)?	0	1	2	3	4
4. Feeling very upset when something reminded you of the stressful experience?	0	1	2	3	4
5. Having strong physical reactions when something reminded you of the stressful experience (for example, heart pounding, trouble breathing, sweating)?	0	1	2	3	4
6. Avoiding memories, thoughts, or feelings related to the stressful experience?	0	1	2	3	4
7. Avoiding external reminders of the stressful experience (for example, people, places, conversations, activities, objects, or situations)?	0	1	2	3	4
8. Trouble remembering important parts of the stressful experience?	0	1	2	3	4
9. Having strong negative beliefs about yourself, other people, or the world (for example, having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)?	0	1	2	3	4
10. Blaming yourself or someone else for the stressful experience or what happened after it?	0	1	2	3	4
11. Having strong negative feelings such as fear, horror, anger, guilt, or shame?	0	1	2	3	4
12. Loss of interest in activities that you used to enjoy?	0	1	2	3	4
13. Feeling distant or cut off from other people?	0	1	2	3	4
14. Trouble experiencing positive feelings (for example, being unable to feel happiness or have loving feelings for people close to you)?	0	1	2	3	4
15. Irritable behavior, angry outbursts, or acting aggressively?	0	1	2	3	4
16. Taking too many risks or doing things that could cause you harm?	0	1	2	3	4
17. Being "superalert" or watchful or on guard?	0	1	2	3	4
18. Feeling jumpy or easily startled?	0	1	2	3	4
19. Having difficulty concentrating?	0	1	2	3	4
20. Trouble falling or staying asleep?	0	1	2	3	4

HAI (Short version)

Each question in this section consists of four statements. Please read each group of statements carefully and then select the one which best describes your feelings, over the past six months. Identify the statement by circling the letter next to it, i.e. if you think that statement (a) is correct, circle statement (a); it maybe that more than one statement applies, in which case, please circle any that are applicable.

1.	(a) I do not worry about my health (b) I occasionally worry about my health (c) I spend much of my time worrying about my health (d) I spend most of my time worrying about my health
2.	(a) I notice aches / pains less than most other people (of my age) (b) I notice aches / pain a much as most other people (of my age) (c) I notice aches/ pains more than most other people (of my age) (d) I am aware of aches / pains in my body all the time
3.	(a) As a rule I am not aware of bodily sensations or changes (b) Sometimes I am aware of bodily sensations or changes (c) I am often aware of bodily sensations or changes (d) I am constantly aware of bodily sensations or changes
4.	(a) Resisting thoughts of illness is never a problem (b) Most of the time I can resist thoughts of illness (c) I try to resist thoughts of illness but am often unable to do so (d) Thoughts of illness are so strong that I no longer even try to resist them
5.	(a) As a rule I am not afraid that I have a serious illness (b) I am sometimes afraid that I have a serious illness (c) I am often afraid that I have a serious illness (d) I am always afraid that I have a serious illness
6.	(a) I do not have images (mental pictures) of myself being ill (b) I occasionally have images of myself being ill (c) I frequently have images of myself being ill (d) I constantly have images of myself being ill
7.	(a) I do not have any difficulty taking my mind off thoughts about my health (b) I sometimes have difficulty taking my mind off thoughts about my health (c) I often have difficulty in taking my mind off thoughts about my health (e) Nothing can take my mind off thoughts about my health
8.	(a) I am lastingly relieved if my doctor tells me there is nothing wrong (b) I am initially relieved but the worries sometimes return later (c) I am initially relieved but the worries always return later (d) I am not relieved if my doctor tells me there is nothing wrong
9.	(a) If I hear about an illness I never think I have it myself (b) If I hear about an illness I sometimes think I have it myself (c) If I hear about an illness I often think I have it myself (d) If I hear about an illness I always think I have it myself
10.	(a) If I have a bodily sensation or change I rarely wonder what it means (b) If I have a bodily sensation or change I often wonder what it means (c) If I have a bodily sensation or change I always wonder what it means (e) If I have a bodily sensation or change I must know what it means

Continued on next page

11.	(a) I usually feel at very low risk for developing a serious illness (b) I usually feel at fairly low risk for developing a serious illness (c) I usually feel at moderate risk for developing a serious illness (d) I usually feel at high risk for developing a serious illness
12.	(a) I never think I have a serious illness (b) I sometimes think I have a serious illness (c) I often think I have a serious illness (d) I usually think that I am seriously ill
13.	(a) If I notice an unexplained bodily sensation I don't find it difficult to think about other things (b) If I notice an unexplained bodily sensation I sometimes find it difficult to think about other things (c) If I notice an unexplained bodily sensation I often find it difficult to think about other things (d) If I notice an unexplained bodily sensation I always find it difficult to think about other things
14.	(a) My family / friends would say I do not worry enough about my health (b) My family / friends would say I have a normal attitude towards my health (c) My family / friends would say I worry too much about my health (d) My family / friends would say I am a hypochondriac

For the following questions, please think about what it would be like if you had a serious of a type which particularly concerns you (such as heart disease, cancer, multiple sclerosis and so on). Obviously, you cannot know for definite what it would be like; please give your best estimate of what you think might happen, basing your estimate on what you know about yourself and serious illness in general.

15.	(a) If I had a serious illness I would still be able to enjoy things in my life quite a lot (b) If I had a serious illness I would still be able to enjoy things in my life a little (c) If I had a serious illness I would be almost completely unable to enjoy things in my life (d) If I had a serious illness I would be completely unable to enjoy my life at all
16.	(a) If I developed a serious illness there is a good chance that modern medicine would be able to cure me (b) If I developed a serious illness there is a moderate chance that modern medicine would be able to cure me (c) If I developed a serious illness there is a very small chance that modern medicine would be able to cure me (d) If I developed a serious illness there is no chance that modern medicine would be able to cure me
17.	(a) A serious illness would ruin some aspects of my life (b) A serious illness would ruin many aspects of my life (c) A serious illness would ruin almost every aspect of my life (e) A serious illness would ruin every aspect of my life
18.	(a) If I had a serious illness I would not feel that I had lost my dignity (b) If I had a serious illness I would feel that I had lost a little of my dignity (c) If I had a serious illness I would feel that I had lost quite a lot of mydignity (d) If I had a serious illness I would feel that I had totally lost my dignity

TABLE 1
UCLA Loneliness Scale (Version 3)

Instructions: The following statements describe how people sometimes feel. For each statement, please indicate how often you feel the way described by writing a number in the space provided.

Here is an example:

How often do you feel happy?

If you never felt happy, you would respond "never"; if you always feel happy, you would respond "always."

NEVER	RARELY	SOMETIMES	ALWAYS
1	2	3	4

*1. How often do you feel that you are "in tune" with the people around you?	
2. How often do you feel that you lack companionship?	
3. How often do you feel that there is no one you can turn to?	
4. How often do you feel alone?	
*5. How often do you feel part of a group of friends?	
*6. How often do you feel that you have a lot in common with the people around you?	
7. How often do you feel that you are no longer close to anyone?	
8. How often do you feel that your interests and ideas are not shared by those around you?	
*9. How often do you feel outgoing and friendly?	
*10. How often do you feel close to people?	
11. How often do you feel left out?	
12. How often do you feel that your relationships with others are not meaningful?	
13. How often do you feel that no one really knows you well?	
14. How often do you feel isolated from others?	
*15. How often do you feel you can find companionship when you want it?	
*16. How often do you feel that there are people who really understand you?	
17. How often do you feel shy?	
18. How often do you feel that people are around you but not with you?	
*19. How often do you feel that there are people you can talk to?	
*20. How often do you feel that there are people you can turn to?	

Scoring: Items that are asterisked should be reversed (i.e., 1 = 4, 2 = 3, 3 = 2, 4 = 1), and the scores for each item then summed together. Higher scores indicate greater degrees of loneliness.

Note.

APPENDIX D: Tables of Main and Interactive Effects for Aim 3 Exploratory Analyses using the Social Capital Composite Variable

Table 18.

Main and Interactive Effects of PTSD and Social Capital on Cognitive Functioning

	b	*SE*	*t*	*p*	
Attention (N = 91)					
PTSD	0.004	0.089	0.047	.963	
Social Capital	4.430	1.511	2.931	.004	**
PTSD x Social Capital	-0.126	0.081	-1.551	.125	
Executive Functioning					
Response Inhibition (N = 91)					
PTSD	0.003	0.104	0.028	.978	
Social Capital	3.568	1.767	2.019	.043	*
PTSD x Social Capital	-0.154	0.095	-1.626	.108	
Set-shifting (N = 90)					
PTSD	0.038	0.100	0.377	.707	
Social Capital	3.450	1.699	2.031	.045	*
PTSD x Social Capital	-0.112	0.091	-1.235	.220	
WCST Number of Categories (N = 90)					
PTSD	-0.008	0.012	-0.634	.528	
Social Capital	0.144	0.199	0.720	.474	
PTSD x Social Capital	-0.005	0.011	-0.436	.664	
WCST Perseverative Errors (N = 90)					
PTSD	-0.089	0.123	-0.725	.471	
Social Capital	2.749	2.027	1.356	.179	
PTSD x Social Capital	0.069	0.108	0.641	.523	
WCST Failure to Maintain Set (N = 88)					
PTSD	-0.004	0.011	-0.388	.699	
Social Capital	-0.005	0.182	-0.029	.977	
PTSD x Social Capital	-0.015	0.010	-1.516	.133	
General Cognitive Functioning (N = 93)					
PTSD	-0.110	0.102	-1.082	.282	
Social Capital	4.058	1.730	2.346	.021	**
PTSD x Social Capital	-0.117	0.093	-1.262	.210	
Memory					
Verbal Memory Retrieval - Unstructured (N = 94)					
PTSD	-0.057	0.030	-1.890	.062	+
Social Capital	1.282	0.510	2.514	.014	*
PTSD x Social Capital	-0.043	0.027	-1.576	.119	

Note. Depression and Estimated Pre-morbid Functioning were included as covariates in all analyses.

$^{+}p < .10$, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Table 18 (continued).

Main and Interactive Effects of PTSD and Social Capital on Cognitive Functioning

	b	*SE*	*t*	*p*	
Memory					
Verbal Memory Retrieval - Structured (N = 94)					
PTSD	-0.014	0.017	-0.807	.422	
Social Capital	0.039	0.287	0.137	.891	
PTSD x Social Capital	-0.009	0.015	-0.600	.550	
Visual Memory Retrieval (N = 94)					
PTSD	-0.007	0.014	-0.544	.588	
Social Capital	0.503	0.231	2.176	.032	*
PTSD x Social Capital	-0.009	0.012	-0.762	.448	
Perceptual Reasoning (N = 94)					
PTSD	-0.175	0.121	-1.443	.153	
Social Capital	3.876	2.057	1.885	.063	
PTSD x Social Capital	0.035	0.109	0.318	.751	
Processing Speed (N = 93)					
PTSD	-0.106	0.117	-0.907	.367	
Social Capital	3.603	1.987	1.813	.073	+
PTSD x Social Capital	-0.231	0.107	-2.172	.033	*
Verbal Comprehension (N = 94)					
PTSD	-0.027	0.093	-0.287	.775	
Social Capital	2.295	1.572	1.460	.148	
PTSD x Social Capital	-0.079	0.084	-0.939	.350	
Working Memory (N = 94)					
PTSD	-0.064	0.116	-0.548	.585	
Social Capital	5.174	1.970	2.627	.010	**
PTSD x Social Capital	-0.102	0.105	-0.978	.331	

Note . Depression and Estimated Pre-morbid Functioning were included as covariates in all analyses.

$^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$

Table 19.
Main and Interactive Effects of GAD and Social Capital on Cognitive Functioning

	b	*SE*	*t*	*p*	
Attention (N = 95)					
GAD	0.183	0.262	0.699	.487	
Social Capital	3.842	1.471	2.612	.011	*
GAD x Social Capital	-0.548	0.263	-2.083	.040	*
Executive Functioning					
Response Inhibition (N = 94)					
GAD	0.019	0.302	0.064	.949	
Social Capital	2.776	1.692	1.640	.105	
GAD x Social Capital	-0.419	0.302	-1.386	.169	
Set-shifting (N = 94)					
GAD	0.205	0.314	0.651	.517	
Social Capital	3.216	1.768	1.819	.072	+
GAD x Social Capital	-0.713	0.343	-2.077	.041	*
WCST Number of Categories (N = 92)					
GAD	-0.015	0.036	-0.428	.670	
Social Capital	0.118	0.194	0.608	.545	+
GAD x Social Capital	0.002	0.038	0.046	.964	
WCST Perseverative Errors (N = 92)					
GAD	-0.200	0.362	-0.551	.583	
Social Capital	3.044	1.969	1.546	.126	
GAD x Social Capital	0.340	0.387	0.878	.382	
WCST Failure to Maintain Set (N = 90)					
GAD	0.006	0.033	0.183	.856	
Social Capital	-0.081	0.179	-0.452	.652	
GAD x Social Capital	-0.015	0.036	-0.425	.672	
General Cognitive Functioning (N = 97)					
GAD	-0.108	0.310	-0.349	.728	
Social Capital	3.691	1.732	2.131	.036	*
GAD x Social Capital	-0.290	0.311	-0.935	.353	
Memory					
Verbal Memory Retrieval - Unstructured (N = 98)					
GAD	-0.157	0.089	-1.768	.080	+
Social Capital	1.098	0.490	2.242	.027	*
GAD x Social Capital	-0.112	0.088	-1.264	.209	

Note. Depression and Estimated Pre-morbid Functioning were included as covariates in all analyses.

$^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$

Table 19 (continued).

Main and Interactive Effects of GAD and Social Capital on Cognitive Functioning

	b	*SE*	*t*	*p*	
Memory					
Verbal Memory Retrieval - Structured (N = 98)					
GAD	0.005	0.050	0.097	.923	
Social Capital	-0.036	0.275	-0.132	.895	
GAD x Social Capital	0.018	0.496	0.370	.712	
Visual Memory Retrieval (N = 98)					
GAD	-0.002	0.040	-0.037	.971	
Social Capital	0.551	0.219	2.517	.014	*
GAD x Social Capital	-0.038	0.040	-0.955	.342	
Perceptual Reasoning (N = 98)					
GAD	-0.142	0.358	-0.397	.692	
Social Capital	4.537	1.980	2.291	.024	*
GAD x Social Capital	0.119	0.357	0.333	.740	
Processing Speed (N = 97)					
GAD	0.260	0.350	0.744	.459	
Social Capital	2.284	1.956	1.168	.246	
GAD x Social Capital	-0.823	0.351	-2.347	.021	*
Verbal Comprehension (N = 98)					
GAD	-0.026	0.271	-0.095	.925	
Social Capital	1.863	1.499	1.243	.217	
GAD x Social Capital	-0.046	0.270	-0.171	.865	
Working Memory (N = 97)					
GAD	-0.269	0.362	-0.743	.459	
Social Capital	5.451	2.004	2.721	.008	**
GAD x Social Capital	-0.558	0.393	-1.421	.159	

Note . Depression and Estimated Pre-morbid Functioning were included as covariates in all analyses.

$^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$

Table 20.

Main and Interactive Effects of Health Anxiety and Social Capital on Cognitive Functioning

	b	*SE*	*t*	*p*
Attention (N = 76)				
Health Anxiety	-0.063	0.154	-0.412	.682
Social Capital	3.433	1.810	1.897	.062 +
Health Anxiety x Social Capital	-0.100	0.179	-0.56	.577
Executive Functioning				
Response Inhibition (N = 76)				
Health Anxiety	0.177	0.174	1.018	.312
Social Capital	3.423	2.046	1.676	.098 +
Health Anxiety x Social Capital	-0.161	0.202	-0.795	.429
Set-shifting (N = 76)				
Health Anxiety	0.001	0.177	0.003	.998
Social Capital	3.494	2.085	1.675	.098 +
Health Anxiety x Social Capital	-0.284	0.206	-1.377	.173
WCST Number of Categories (N = 76)				
Health Anxiety	0.014	0.02	0.708	.482
Social Capital	0.201	0.242	0.831	.409
Health Anxiety x Social Capital	-0.035	0.030	-1.484	.142
WCST Perseverative Errors (N = 76)				
Health Anxiety	0.032	0.215	0.150	.881
Social Capital	3.410	2.567	1.329	.188
Health Anxiety x Social Capital	-0.063	0.247	-0.255	.800
WCST Failure to Maintain Set (N = 74)				
Health Anxiety	0.048	0.018	2.751	.008 **
Social Capital	-0.039	0.211	-0.186	.853
Health Anxiety x Social Capital	-0.014	0.021	-0.697	.488
General Cognitive Functioning (N = 78)				
Health Anxiety	-0.045	0.178	-0.254	.801
Social Capital	3.732	2.113	1.767	.082 +
Health Anxiety x Social Capital	-0.082	0.209	-0.390	.698
Memory				
Verbal Memory Retrieval - Unstructured (N = 79)				
Health Anxiety	-0.019	0.053	-0.360	.720
Social Capital	0.905	0.624	1.449	.152
Health Anxiety x Social Capital	-0.123	0.061	-2.021	.047 *

Note . Depression and Estimated Pre-morbid Functioning were included as covariates in all analyses.

$^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$

Table 20 (continued).

Main and Interactive Effects of Health Anxiety and Social Capital on Cognitive Functioning

	b	*SE*	*t*	*p*	
Memory					
Verbal Memory Retrieval - Structured (N = 79)					
Health Anxiety	-0.009	0.029	-0.308	.759	
Social Capital	0.044	0.345	0.128	.899	
Health Anxiety x Social Capital	0.006	0.034	0.174	.862	
Visual Memory Retrieval (N = 79)					
Health Anxiety	0.018	0.023	0.778	.439	
Social Capital	0.694	0.275	2.527	.014	*
Health Anxiety x Social Capital	-0.030	0.027	-1.119	.267	
Perceptual Reasoning (N = 79)					
Health Anxiety	-0.108	0.211	-0.512	.610	
Social Capital	4.940	2.499	1.977	.052	+
Health Anxiety x Social Capital	-0.149	0.243	-0.612	.543	
Processing Speed (N = 78)					
Health Anxiety	0.172	0.199	0.862	.392	
Social Capital	1.846	2.367	0.780	.438	
Health Anxiety x Social Capital	-0.359	0.234	-1.533	.130	
Verbal Comprehension (N = 79)					
Health Anxiety	-0.125	0.162	-0.775	.441	
Social Capital	2.225	1.918	1.160	.250	
Health Anxiety x Social Capital	0.158	0.187	0.848	.400	
Working Memory (N = 79)					
Health Anxiety	0.179	0.194	0.912	.365	
Social Capital	5.241	2.303	2.276	.026	*
Health Anxiety x Social Capital	-0.241	0.224	-1.074	.286	

Note . Depression and Estimated Pre-morbid Functioning were included as covariates in all analyses.

$^{+}p < .10$, $*p < .05$, $**p < .01$, $***p < .001$

References

Abramovitch, A., Short, T., & Schweiger, A. (2021). The C factor: Cognitive dysfunction as a transdiagnostic dimension in psychopathology. *Clinical Psychology Review*, *86*, 1-27. https://doi.org/10.1016/j.cpr.2021.102007

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). https://doi.org/10.1176/appi.books.9780890425596

Barbek, R., Henning, S., Ludwig, J., & von dem Knesebeck, O. (2022). Ethnic and migration-related inequalities in health anxiety: A systematic review and meta-analysis. *Frontiers in Psychology*, *13*, 1-11. https://doi.org/10.3389/fpsyg.2022.960256

Barrera, M. (1986). Distinctions between social support concepts, measures, and models. *American Journal of Community Psychology*, *14*, 413-445.

Bennett, D. A. (2001). How can I deal with missing data in my study?.*Australian and New Zealand journal of Public Health*, *25*, 464-469.

Blevins, C. A., Weathers, F. W., Davis, M. T., Witte, T. K., & Domino, J. L. (2015). The Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5): Development and initial psychometric evaluation. *Journal of Traumatic Stress*, *28*, 489–498. https://doi.org/10.1002/jts.22059

Boss, L., Kang, D-H., & Branson, S. (2015). Loneliness and cognitive function in the older adult: A systematic review. *International Psychogeriatrics*, *27*, 541-553. https://doi.org/10.1017/S1041610214002749

Byrne, R. W. (1994). The evolution of intelligence. In P. J. B. Slater, T. R. Halliday (Eds.) & P. Barrett, *Behaviour and evolution* (pp. 223–265). Cambridge University Press.

Cacioppo, J.T., & Cacioppo, S. (2014). Social relationships and health: The toxic effects of perceived social isolation. *Social and Personality Psychology Compass, 8,* 58-72. https://doi-org.libproxy.unm.edu/10.1111/spc3.12087

Castaneda, A.E., Tuulio-Henriksson, A., Marttunen, M., Suvisaari, J., & Lonnqvist, J. (2018). A review on cognitive impairments in depressive and anxiety disorders with a focus on young adults. *Journal of Affective Disorders*, *106,* 1-27. https://doi.org/10.1016/j.jad.2007.06.006

Centers for Disease Control and Prevention (2022, July 11). *Long COVID or Post-COVID Conditions*. Centers for Disease Control and Prevention. https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects/index.html

Cohen, S., & Lyme, S.L. (1985). Issues in the study and application of social support. In Cohen, S., & Lyme, S.L. (Eds.), *Social Support and Health* (3-22). Academic Press.

Delis, D.C., Kramer, J.H., Kaplan, E., & Ober, B.A. (2017). California Verbal Learning Test (3rd ed.). Pearson.

Diehr, M. C., Heaton, R. K., Miller, W., & Grant, I. (1998). The Paced Auditory Serial Addition Task (PASAT): norms for age, education, and ethnicity. *Assessment*, *5,* 375–387. https://doi.org/10.1177/107319119800500407

Drake, S. (1988). Anxiety and working memory capacity. *Cognition and Emotion*, *2,* 145-154. https://doi-org.libproxy.unm.edu/10.1080/02699938808408071

Dunlop, B. W., Still, S., LoParo, D., Aponte-Rivera, V., Johnson, B. N., Schneider, R. L., Nemeroff, C. B., Mayberg, H. S., & Craighead, W. E. (2020). Somatic symptoms in treatment-naïve Hispanic and non-Hispanic patients with major depression. *Depression and anxiety*, *37,* 156–165. https://doi.org/10.1002/da.22984

Eagle, D.E., Hybels, C.F., & Proeschold-Bell, R.J. (2019). Perceived social support, received social support, and depression among clergy. *Journal of Social and Personal Relationships, 36*, 2055-2073. https://doi.org/10.1177/0265407518776134

Easterbrook, J. A. (1959). The effect of emotion on cue utilization and the organization of behavior. *Psychological Review, 66*, 183–201. https://doi.org/10.1037/h0047707

Escobar, J.I. (1995). Transcultural aspects of dissociative and somatoform disorders. *The Psychiatric Clinics of North America*, *18*, 555-569.

Evangelidou, S., NeMoyer, A., Cruz-Gonzalez, M., O'Malley, I., & Alegría, M. (2020). Racial/ethnic differences in general physical symptoms and medically unexplained physical symptoms: Investigating the role of education. *Cultural Diversity and Ethnic Minority Psychology*, *26*, 557–569. https://doi.org/10.1037/cdp0000319

Evans, T.C., Alonso, M.R., Jagger-Rickels, A., Rothlein, D., Zuberer, A., Bernstein, J., Fortier, C.B., Fonda, J.R., Villalon, A., Jorge, R., Milberg, W., McGlinchey, R., DeGutis, J., & Esterman, M. (2022). PTSD symptomatology is selectively associated with impaired sustained attention ability and dorsal attention network synchronization. *NeuroImage: Clinical*, *36*, 103-146. https://doi.org/10.1016/j.nicl.2022.103146

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*, 1149-1160.

Fellman, D., Ritakallio, L., Waris, O., Jylkka, J., & Laine, M. (2020). Beginning of the pandemic: COVID-19-elicited anxiety as a predictor of working memory

performance. *Frontiers in Psychology*, *11*, 1-13. https://doi.org/10.3389/fpsyg.2020.576466

Gregory, M.A., Legg, N.K., Senay, Z., Barden, J-L., Phiri, P., Rathod, S., Turner, B.J., & Paterson, T.S.E. (2021). Mental health and social connectedness across the adult lifespan in the context of the COVID-19 pandemic. *Canadian Journal of Aging*, *40*, 554-569. https://doi.org/10.1017/S0714980821000477

Guina, J., Nahhas, R.W., Kawalec, K., & Farnsworth, S. (2019). Are gender differences in DSM-5 PTSD symptomatology explained by sexual trauma? *Journal of Interpersonal Violence*, *34*, 4713-4740. https://doi.org/10.1177/0886260516677290

Hajek, A., & Konig, H-H. (2022). Prevalence and correlates of loneliness, perceived and objective social isolation during the COVID-19 pandemic. Evidence from a representative survey in Germany. *Social Psychiatry and Psychiatric Epidemiology*. *57*, 1969-1978. https://doi.org/10.1007/s00127-022-02295-x

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach.* Guilford Press.

Heaton, R. K., Chelune, G. J., Talley, J. L., Kay, G. G., Curtiss, G. (1993). Wisconsin Card Sorting Test (WCST) manual: Revised and expanded. Psychological Assessment Resources.

Held, J., Visla, A., Zinbarg, R.E., Wolfer, C., & Fluckiger, C. (2020). How do worry and clinical status impact working memory performance? An experimental investigation. *BMC Psychiatry*, *20*, 1-8. https://doi.org/10.1186/s12888-020-02694-x

Helgeson, V.S. (1993). Two important distinctions in social support: Kind of support and perceived versus received. *Journal of Applied Social Psychology*, 23, 825-845. https://doi.org/10.1111/j.1559-1816.1993.tb01008.x

Johnsen, G.E., & Asbjornsen, A.E. (2008). Consistent impaired verbal memory in PTSD: A meta-analysis. *Journal of Affective Disorders, 111*, 74-82. https://doi.org/10.1016/j.jad.2008.02.007

Johnson, P. O., and Neyman, J. (1936). Tests of certain linear hypotheses and their applications to some educational problems. *Statistical Research Memoirs, 1*, 57–39.

Kelly, M.E., Duff, H., Kelly, S., McHugh Power, J.E., Brennan, S., Lawlor, B.A., & Loughrey, D.G. (2017). The impact of social activities, social networks, social support and social relationships on the cognitive functioning of healthy older adults: A systematic review. *Systematic Reviews, 6*, 1-18. https://doi.org/10.1186/s13643-017-0632-2

Kibbey., M.M., Fedorenko, E.J., & Farris, S.G. (2021). Anxiety, depression, and health anxiety in undergraduate students living in initial US outbreak "hotspot" during COVID-19 pandemic. *Cognitive Behaviour Therapy*, 50, 409-421. https://doi-org.libproxy.unm.edu/10.1080/16506073.2020.1853805

Kim, K.L., Christensen, R.E., Ruggieri, A., Schettini, E., Freeman, J.B., Garcia, A.M., Flessner, C., Stewart, E., Conelea, C., & Dickstein, D.P. (2018). Cognitive performance of youth with primary generalized anxiety disorder versus primary obsessive-compulsive disorder. *Depression and Anxiety, 36*, 130-140. https://doi-org.libproxy.unm.edu/10.1002/da.22848

Kobayashi, L.C., O'Shea, B.Q., Joseph, C., & Finlay, J.M. (2022). Acute relationships between mental health and cognitive function during the COVID-19 pandemic: Longitudinal evidence from middle-aged and older US adults. *SSM-Mental Health, 2*, 1-7. https://doi.org/10.1016/j.ssmmh.2022.100097

Kroenke K., Spitzer, R.L., & Williams, J.B. (2001). The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine, 16*, 606-613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x

Langarita-Llorente, R., & Gracia-Garcia, P. (2019). Neuropsicologia del trastorno de ansiedad generalizada: revision sistematica [Neuropsychology of generalized anxiety disorders: a systematic review]. *Revista de neurologia, 69*, 59–67. https://doi.org/10.33588/rn.6902.2018371

Lara, E., Caballero, F.F., Rico-Uribe, L.A., Olaya, B., Haro, J.M., Ayuso-Mateos, J.L., & Miret, M. (2019). Are loneliness and social isolation associated with cognitive decline? *International Journal of Geriatric Psychiatry, 34*, 1613-1622. https://doi-org.libproxy.unm.edu/10.1002/gps.5174

Liu, Z., Li, S., Shang, S., & Ren, X. (2021). How do critical thinking ability and critical thinking disposition relate to the mental health of university students? *Frontiers in Psychology, 12*, 1-8. https://doi.org/10.3389/fpsyg.2021.704229

Lowe, B., Decker, O., Muller, S., Brahler, E., Schellberg, D., Herzog, W., & Yorck Herzberg, P. (2008). Validation and standardization of the generalized anxiety disorder screener (GAD-7) in the general population. *Medical Care, 46*, 266-274. https://https://doi.org/10.1097/MLR.0b013e318160d093

Lukasik, K.M., Waris, O., Soveri, A., Lehtonen, M., & Laine, M. (2019). The relationship of anxiety and stress with working memory performance in a large non-depressed sample. *Frontiers in Psychology*, *10*, 1-9. https://doi.org/10.3389/fpsyg.2019.00004

Macklin, M.L., Metzger, L.J., Litz, B.T., McNally, R.J., Lasko, N.B., Orr, S.P., & Pitman, R.K. (1998). Lower precombat intelligence is a risk factor for posttraumatic stress disorder. *Journal of Consulting and Clinical Psychology*, *66*, 323-326. https://psycnet.apa.org/doi/10.1037/0022-006X.66.2.323

Malarbi, S., Abu-Rayya, H.M., Muscara, F., & Stargatt, R. (2017). Neuropsychological functioning of childhood trauma and post-traumatic stress disorder: A meta-analysis. *Neuroscience and Biobehavioral Reviews*, *72*, 68-86. https://doi.org/10.1016/j.neubiorev.2016.11.004

Mobini, S., & Grant, A. (2007). Clinical implications of attentional bias in anxiety disorders: An integrative literature review. *Psychotherapy: Theory, Research, Practice, Training*, *44*, 450-462.

Moran, T. P. (2016). Anxiety and working memory capacity: A meta-analysis and narrative review. *Psychological Bulletin, 142*, 831–864. https://doi.org/10.1037/bul0000051

Newby, J.M., Hobbs, M.J., Mahoney, A.E.J., Wong, S., & Andrews, G. (2017). DSM-5 illness anxiety disorder and somatic symptom disorder: Comorbidity, correlates, and overlap with DSM-IV hypochondriasis. *Journal of Psychomatic Research, 101*, 31-37. https://doi.org/10.1016/j.jpsychores.2017.07.010

Nitschke, J.P., Forbes, P.A.G., Ali, N., Cutler, J., Apps, M.A.J., Lockwood, P.L., & Lamm, C. (2020). Resilience during uncertainty? Greater social connectedness during

COVID-19 lockdown is associated with reduced distress and fatigue. *British Journal of Health Psychology*, *26*, 553-569. https://doi.org/10.1111/bjhp.12485

Nyberg, L., McIntosh, A. R., Cabeza, R., Habib, R., Houle, S., & Tulving, E. (1996). General and specific brain regions involved in encoding and retrieval of events: what, where, and when. *Proceedings of the National Academy of Sciences of the United States of America*, *93*, 11280–11285. https://doi.org/10.1073/pnas.93.20.11280

Pai, A., Suris, A.M., & North, C.S. (2017). Posttraumatic stress disorder in the DSM-5: Controversy, change, and conceptual considerations. *Behavioral Sciences*, *7*, 1-7. https://doi.org/10.3390/bs7010007

Paiva, A.F., Cunha, C., Voss, G., & Delerue Matos, A. (2021). The interrelationship between social connectedness and social engagement and its relation with cognition: A study using SHARE data. *Ageing and Society*, *First View*, 1-19. https://doi.org/10.1017/S0144686X2100129X

Perry, B.L., McConnell, W.R., Coleman, M.E., Roth, A.R., Peng, S., & Apostolova, L.G. (2021). Why the cognitive "fountain of youth" may be upstream: Pathways to dementia risk and resilience through social connectedness. *Alzheimer's & Dementia*, *18*, 934-941. https://doi-org.libproxy.unm.edu/10.1002/alz.12443

Perry, R.E., Braren, S.H., Rincon-Cortes, M., Brandes-Aitken, A.N., Chopra, D., Opendak, M., Alberini, C.M., Sullivan, R.M., & Blair, C. (2019). Enhancing executive functions through social interactions: Causal evidence using a cross-species model. *Frontiers in Psychology*, *10*, 1-11. https://doi.org/10.3389/fpsyg.2019.02472

Qiu, J., Shen, B., Zhao, M., Wang, Z., Xie, B., & Xu, Y. (2020). A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic:

implications and policy recommendations. *General Psychiatry*, *33*, 1-4. https://doi.org/10.1136/gpsych-2020-100213

Rask, C. U., Gehrt, T. B., Rimvall, M. K., & Frostholm, L. (2020). Health anxiety: Conceptualization and future directions. *Zeitschrift fur Psychologie*, *228*, 141-144. https://doi.org/10.1027/21512604/a000407

Rea-Sandin, Gianna, Korous, K.M., & Causadias, J.M. (2021). A systematic review and meta-analysis of racial/ethnic differences and similarities in executive function performance in the United States. *Neuropsychology*, *35*, 141-156. https://doi.org/10.1037/neu0000715

Reese, C.S., Suhr, J.A., & Riddle, T.L. (2012). Exploration of malingering indices in the Wechsler Adult Intelligence Scale – Fourth Edition Reliable Digit Span subtest. *Archives of Clinical Neuropsychology*, *27*, 176-181.

Reitan, R. M. (1956). Trail making test. Manual for administration, scoring, and interpretation. Indiana University Press.

Rettie, H., & Daniels, J. (2021). Coping and tolerance of uncertainty: Predictors and mediators of mental health during the COVID-19 pandemic. *American Psychologist*, *76*(3), 427–437. https://doi.org/10.1037/amp0000710

Revranche, M., Hauw, M.E., Kovess-Masfety, V., & Husky, M.M. (2023). Social support, social isolation and mastery among adults exposed to traumatic events. *Journal of Aggression, Maltreatment, & Trauma*, *32*, 285-304. https://doi.org/10.1080/10926771.2022.2112340

Robinson, O.J., Vytal, K., Cornwell, B.R., & Grillon, C. (2013). The impact of anxiety upon cognition: Perspectives from human threat of shock studies. *Frontiers in Human Neuroscience, 7,* 1-21. https://doi.org/10.3389/fnhum.2013.00203

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. https://doi.org/10.1017/S0033291713002535

Russell, D. (1996). UCLA Loneliness Scale (Version 3): Reliability, validity, and factor structure. *Journal of Personality Assessment*, *66*, 20-40. https://doi-org.libproxy.unm.edu/10.1207/s15327752jpa6601_2

Saeri, A.K., Cruwys, T., Barlow, F.K., Stronge, S., & Sibley, C.G. (2018). Social connectedness improves public mental health: Investigating bidirectional relationships in the New Zealand attitudes and values survey. *Australian & New Zealand Journal of Psychiatry*, *52*, 635-374. https://doi.org/10.1177/0004867417723990

Sauer, K.S., Schmidt, A., Jungmann, S.M., Bailer, J., & Witthoft, M. (2022). Do patients with pathological health anxiety fear COVID-19? A time-course analysis of 12 single cases during the "first wave" of the COVID-19 pandemic in Germany. *Journal of Psychosomatic Research*, *152,* 1-8. https://doi.org/10.1016/j.jpsychores.2021.110687

Salkovskis, P. M., Rimes, K. A., Warwick, H. M. C., & Clark, D. M. (2002). The Health Anxiety Inventory: development and validation of scales for the measurement of health anxiety and hypochondriasis. *Psychological Medicine, 32*(5), 843-853. https://doi.org/10.1017/S0033291702005822

Scott, J. C., Matt, G. E., Wrocklage, K. M., Crnich, C., Jordan, J., Southwick, S. M., Krystal, J. H., & Schweinsburg, B. C. (2015). A quantitative meta-analysis of neurocognitive functioning in posttraumatic stress disorder. *Psychological Bulletin, 141*, 105–140. https://doi.org/10.1037/a0038039

Singh Chauhan, V., Chatterjee, K., Singh Chauhan, K., Prakash, J., & Srivastava, K. (2020). Impact on anxiety of COVID-19 and lockdown. *Journal of Marine Medical Society*, *22*, 78-82. https://doi.org/10.4103/jmms.jmms_96_20

Shura, R.D., Epstein, E.L., Ord, A.S., Martindale, S.L., Rowland, J.A., Brearly, T.W., & Taber, K.H. (2020). Relationship between intelligence and posttraumatic stress disorder in veterans. *Intelligence*, *82*, 1-7. https://doi.org/10.1016/j.intell.2020.101472

Souza-Talarico, J., Silva, F., Jesus, M.C., Barbosa, B.J.A.P., Nitrini, R., & Brucki, S.M.D. (2021). Impact of COVID-19 pandemic on mental health, social connectedness, and cognitive performance in older adults. *Innovations in Aging*, *5*, 971. https://doi.org/10.1093/geroni/igab046.3497

Sorg, B.A., & Whitney, P. (1992). The effect of trait anxiety and situational stress on working memory capacity. *Journal of Research in Personality*, *26*, 235-241. https://doi.org/10.1016/0092-6566(92)90041-2

Spitzer, R. L., Kroenke, K., Williams, J. B. W., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine*, *166*(10), 1092-109. https://doi.org/10.1001/archinte.166.10.1092

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology*, *18*, 643–662. https://doi.org/10.1037/h0054651

Tempesta, D., Mazza, M., Serroni, N., Moschetta, F.S., Di Giannatonio, M., Ferrara, M., & De Berardis, D. (2013). Neuropsychological functioning in young subjects with generalized anxiety disorder with and without pharmacotherapy. *Progress in Neuro-Psychopharmacology & Biological Psychiatry*, *45*, 236-241. https://doi.org/10.1016/j.pnpbp.2013.06.006

Tolin, D.F., & Foa, E.B. (2006). Sex differences in trauma and posttraumatic stress disorder: A quantitative review of 25 years of research. *Psychological Bulletin*, *132*, 959-992. https://doi.org/10.1037/0033-2909.132.6.959

Tombaugh, T. N. (1997). The Test of Memory Malingering (TOMM): Normative data from cognitively intact and cognitively impaired individuals. *Psychological Assessment, 9*, 260–268. https://doi.org/10.1037/1040-3590.9.3.260

Toussaint, A., Löwe, B., Brähler, E., & Jordan, P. (2017). The Somatic Symptom Disorder – B criteria scale (SSD-12): Factorial structure, validity and population-based norms. *Journal of Psychosomatic Research*, *97*, 9-17. https://doi.org/10.1016/j.jpsychores.2017.03.017

Tyrer, P. (2020). COVID-19 health anxiety. *World Psychiatry*, *19*, 307-308. https://doi-org.libproxy.unm.edu/10.1002/wps.20798

Tyrer, P., Eilenberg, T., Fink, P., Hedman, E., & Tyrer, H. (2016). Health anxiety: The silent, disabling epidemic. *The British Medical Journal*, *353*, 1-2. https://doi.org/10.1136/bmj.i2250

Vasterling, J.L., Duke, L.M., Brailey, K., Constans, J.I., Allain, A.N., & Sutker, P.B. (2002). Attention, learning, and memory performances and intellectual resources in Vietnam

veterns: PTSD and no disorder comparisons. *Neuropsychology*, *16*, 5-14. https://doi.org/10.1037/0894-4105.16.1.5

Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes* (M. Cole, V. Jolm-Steiner, S. Scrinber, & E. Souberman, Eds.). Harvard University Press. https://doi.org/10.2307/j.ctvjf9vz4

Wechsler, D. (2008). WAIS-IV administration and scoring manual. Psychological Corporation.

Wechsler, D. (2009a). WMS-IV: Wechsler memory scale – fourth edition. Pearson.

Wechsler, D. (2009b). Advanced Clinical Solutions for WAIS-IV and WMS-IV. Pearson.

World Health Organization (2022, March 2). *COVID-19 pandemic triggers 25% increase in prevalence of anxiety and depression worldwide*. https://www.who.int/news/item/02-03-2022-covid-19-pandemic-triggers-25-increase-in-prevalence-of-anxiety-and-depression-worldwide

Wrocklage, K.M., Schweinsburg, B.C., Krystal, J.H., Trejo, M., Roy, A., Weisser, V., Moore, T.M., Southwick, S.M., & Scott, J.C. (2016). Neuropsychological functioning in veterans with posttraumatic stress disorder: Associations with performance validity, comorbidities, and functional outcomes. *Journal of the International Neuropsychological Society*, *22*, 399-411. https://doi.org/10.1017/S1355617716000059

Zalewski, C., Thompson, & W., Gottesman, I. (1994). Comparison of neuropsychological test performance in PTSD, generalized anxiety disorder, and control Vietnam veterans. *Psychological Assessment*, *1*, 133-142.