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The Relationship Between Depressive Symptoms and Four Cognitive Constructs

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ABSTRACT

Many studies on depression and cognition are restricted to small, clinical samples. Using baseline data from the Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE), this study utilized a large, community-dwelling sample of older adults to investigate the relationship between depressive symptoms and four cognitive constructs: processing speed, reasoning, memory, and subjective memory (n=2694). The study aims were to (1) examine the associations between depressive symptoms and each of the constructs, (2) assess these relationships after accounting for age, gender, race, and education covariates, and (3) investigate the relationship between objective memory scores and subjective memory reports. Age, race, gender, and education were established as covariates based on past literature. Results indicated that fewer depressive symptoms were weakly associated with better performance in all cognitive domains. This relationship remained after adjusting for covariates. Younger age, being a woman, White race, and higher education also predicted lower depressive symptoms, better reasoning performance, better memory performance and better subjective memory scores. Younger age, White race, and higher education predicted processing speed performance while gender did not. Objective memory and subjective memory scores are weakly correlated. These findings indicate that depressive symptoms are an important consideration when assessing cognition in healthy older adults.

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This thesis is in loving memory of my maternal grandparents who lived with cognitive impairment, but despite it all, loved and supported me throughout every milestone in my life. My dedication to aging research will always be in their name.

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INTRODUCTION

Depression is widely studied because of its high prevalence in the United States. In 2017, 17.3 million people reported having at least one major depressive episode and of this group, 11 million reported experiencing severe impairment along with it (National Institute of Mental Health, 2017). Depression and depressive symptoms have been examined in multiple populations ranging from medical students and primary care workers to post-partum women (Josefsson et al., 2001; Rotenstein et al., 2016; Zung, Broadhead, & Roth, 1993). Depression and depressive symptoms have also been associated with various health outcomes like diabetes, obesity, cancer, and decreased cognitive function (Golden et al., 2008; Jantaratnotai et al, 2017, Jia et al., 2017, Lee et al., 2019). This research project will examine the relationship between depressive symptoms and cognition in one of the fastest growing age groups in the United States – older adults.

Over the past decade, the 65+ population has grown by over 30% according to the United States Census Bureau (2020). In 2016, approximately 10% of those ages 65 to 79 displayed depressive symptoms of clinical significance, and the number rose to 16% for those over 80 years old (Federal Interagency Forum, 2016). Aside from cancer, memory loss from Alzheimer's disease and cognitive decline are among the most common fears people have about aging (Awang, Mansor, Nai Peng, & Nik Osman, 2018; Blazer, 2017; Dark-Freudeman, West, & Viverito, 2006; Laditka et al., 2011). The aging fears of the American public and the rates of depression in older adulthood drive this research project to look at four cognitive constructs of processing speed, executive function, objective memory, and subjective memory and their relationship with depressive symptoms.

The majority of literature investigating processing speed and depressive symptoms is limited to clinically depressed samples. Generally, the relationship between processing speed and clinical depression is consistent. In a study with 39 clinically depressed participants and matched controls, depressed individuals performed significantly worse on processing speed tasks (Nebes et al., 2000). In a larger study, depression scores negatively correlated with processing speed task scores (Sheline et al., 2006). Processing speed performance has also been studied in a clinical sample of older individuals with small vessel disease. Findings from this study indicated that adults with late-life depression performed worse on processing speed measures (Oberlin et al., 2021).

Executive function and depression research are also concentrated on clinical samples. Depression scores are negatively correlated with executive function (Sheline et al., 2006). In the same study as above investigating small vessel disease, those with late-life depression also performed worse on executive function tests (Oberlin et al., 2021). In a study with 49 older participants with Bipolar Disorder, 40 participants had a severe executive dysfunction profile during the depressive phase of the disorder (Caixeta et al., 2017). Another study gave depressed participants strategy tips to help them on executive function tasks. Regardless of the strategy aid, depressed individuals performed significantly worse on both immediate and delayed recall and for the multiple scheduling task (Channon & Green, 1999).

Historically, depression and memory have had a strong and consistent relationship. Consider this 1977 study where participants with major depressive disorder demonstrated that depression significantly impairs memory functioning (Stromgren, 1977). However, more recently, a study contradicted those findings. Depressive symptoms were related to poor

performance on memory until adjusting for age, general cognitive ability, and sex. After adjustment, no relationship was found (Schweizer et al., 2018).

Objective memory tests have been the main measure of memory performance for years. Some researchers are using subjective memory as a more feasible way to gauge an individual's memory performance rather than administering objective memory tests. A study found that objective memory scores were correlated with an individual's subjective memory complaints (Zandi et al., 2004). Contradicting this, a study found that there was no relationship between objective measures of memory and subjective memory complaints (Mowla et al., 2008). Subjective memory has also been argued as a preclinical symptom of cognitive decline (Kryscio et al., 2014; Tripodis et al., 2017). Using subjective memory as a measuring tool is beneficial for this research project because of subjective memory's possible relationship with cognition and established relationship with depression. In a nondepressed sample, those with memory complaints had higher depression scale scores than those without memory complaints (Zandi et al., 2004). Another study demonstrated that the frequency of memory complaints was also related to depressive symptoms. Those with more depressive symptoms reported more memory issues (Schweizer et al., 2018).

The associations between depressive symptoms and the cognitive outcomes will be assessed after adjusting for age, education, gender, and race covariates. While it is understood that as fluid cognitive abilities decline with age, there are age group differences when separating older adults into more specific age categories (Murman, 2015). Adults in oldest-old age group (78 – 100 years) perform worse cognitively compared to adults in youngest-old and middle-old age groups (65 to 77 years) (Colsher et al., 1991; Singer, Verhaeghen, Ghisletta, Lindenberger, & Baltes, 2003). Education has shown to be related to cognitive performance. Lower levels of

education have been associated with lower cognitive functioning and higher levels of education have seemingly been protective against cognitive decline (Cagney & Lauderdale, 2002; Farias et al., 2011; Reas et al., 2017). In terms of gender, there does not seem to be one gender that performs better on all cognitive batteries than the other. Men tend to perform better on problem-solving tasks, visuospatial tasks, and episodic memory (Voyer, Voyer & Philip 1995; Lei et al., 2021; Hyde 2014). However, men have also been shown to have their cognition decline more with age compared to women (Reas et al., 2017). Women tend to perform better on verbal fluency and list recalling tasks (Heaton, Ryan, Grant, & Matthews, 1996; Kimura, 1999; Rosser, Ensing, Glider, & Lane, 1984; Hyde 2014). Race will also be accounted for because of its established relationship with baseline cognition. Non-Hispanic White individuals have been shown to outperform other racial groups (Brewster et al., 2014; Diaz-Venegas et al., 2016); however, such relationships are likely due to sociodemographic factors as well as psychosocial determinates of health (Cogburn, 2019; Fitzpatrick et al., 2015; Verney et al., 2018).

The gap in the literature is clear when looking at the samples used for measuring processing speed, executive function, and objective memory. Small, clinical samples are favored over healthy samples when looking at the current research. There are also few projects that strictly look at depressive symptoms and these cognitive constructs in healthy, older adult participant pools (Brewster et al, 2017; Gatchel et al., 2019). This research project will aim to fill this gap by looking at depressive symptoms in a large, healthy sample of older adults. Secondly, with the inconsistencies seen in the literature on subjective memory's relationship with objective memory (Mowla et al., 2008; Zandi et al., 2004), this research project will add to the research in this area by assessing if there is a relationship between these two measures.

This research project will examine the relationships between depressive symptoms and four different cognitive domains – processing speed, reasoning, objective memory, and subjective memory. A second aim of this study is to examine the relationship between depressive symptoms and the four cognitive constructs after assessing for covariates of age, race, gender, and education. A final aim of this study is to examine the relationship between objective memory and subjective memory. It was hypothesized that those with high depressive symptom scores will perform worse on all measures of cognition before adjusting for covariates. After assessing for age, race, gender, and education, it is hypothesized that relations between depressive symptoms and the cognitive constructs will still remain. Specifically, it was hypothesized that younger age will be associated with better performance on processing speed, reasoning, memory, and better subjective memory reports. Being a woman will be associated with better performance on processing speed, reasoning, memory, and better subjective memory reports. Being White in race will be associated with better performance on processing speed, reasoning, memory, and better subjective memory reports. Having higher levels of education will be associated with better performance on processing speed, reasoning, memory, and better subjective memory reports. For the third aim, it is hypothesized that subjective memory complaints and objective memory scores will be related.

METHODS

Participants and Procedures

This study uses data from the Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) which recruited participants between March 1998 and October 1999 (n=2802). Data collection occurred between 1999 and 2004. The goal of ACTIVE was to aid older adults in maintaining their independent function through the cognitive training. Baseline data for ACTIVE was collected via telephone, three in-person sessions, and a self-administered take-home battery (Jobe, 2001). This research project will use only the baseline data (n=2694).

Eligible participants were those (1) 65 years of age or older; (2) living mostly independent of formal care; (3) having no cognitive or functional decline; (4) having no medical condition leading to functional decline or possible death; (5) having no severe sensory or communication difficulties; (6) no recent participation in cognitive training; (7) and not planning to move out of the area. Participants were recruited in areas where older adults tend to congregate (i.e., church groups, senior centers, community organizations). Active is comprised of 2802 eligible participants. The analytic sample for this study is 2649 participants. Due to small sample size (n=22), participants identifying as races other than White (n=1956, 73.8%) and Black (n=639, 26.2%) were excluded. There were more female participants (n=2003, 75.6%) than male participants (n=646, 24.4%). The average age of the sample was 73.46 years (SD=5.77) and the on average, the sample had 13.52 years of education (SD=2.70).

Measures

Depressive Symptoms. Depressive symptoms were measured using the Center for Epidemiological Studies-Depression-12 (CES-D-12). The CES-D-12 contains 12 items that assess the frequency of twelve depressive symptoms during the participant's past week.

Responses range from (0) “Never” to (3) “5-7 days.” Those with scores greater than 9 will be considered to have high depressive symptoms (Pascoe, Stolfi, & Ormond, 2006).

Reasoning. Executive function was labeled as reasoning in the ACTIVE study. Reasoning was measured using Word Series, Letter Series, and Letter Sets. The Word Series task consists of identifying a pattern in a series of words and choosing the correct word to complete the pattern of the series. Participants were given 6 minutes to complete 30 items (Willis & Caskie, 2013; Gonda & Schaie. 1985). The Letter Series consists of identifying the pattern among a series of letters and choosing the correct letter to complete the pattern of the series. Participants were again given 6 minutes to complete 30 items (Willis & Caskie, 2013; Thurstone & Thurstone, 1949). The Letter Sets consists of identifying a pattern among a set of letters. There are 4 letter sets and a participant must identify which does not fit based on the pattern of the set. Participants were given 6 minutes to complete 15 items (Willis & Caskie, 2013; Ekstrom, French, Harman, & Derman, 1976). Tests were z-scored and summed making higher scores indicative of better performance. A composite was formed using Word Series, Letter Series, and Letter Sets scores for each participant.

Processing Speed. Processing speed was measured using four computer-administered Useful Field of View (UFOV) tasks 1-4. All subtests include the 75th percentile correct stimulus display time (17-500 ms). For UFOV 1, computer screens display a fixation box that will briefly present a car or truck. The screen then displays a random dot pattern immediately after the fixation box display time is completed. Participants must then identify the object (truck or car) that was displayed in the fixation box (Aust & Edwards, 2016; Edwards et al., 2005). For UFOV 2, there

is an object in the center of the computer screen known as the central target. A car is presented on the computer screen with a possibility of eight different positions. Participants will mark where the car was located in one of the eight peripheral locations (Aust & Edwards, 2016; Edwards et al., 2005). For UFOV 3, 47 identical triangles form in concentric circles surround the central target. The triangles' purpose is to serve as distractors. Like UFOV 2, an object will appear briefly in the peripheral, but this time it is among the triangles. Participants will indicate the peripheral object location (Aust & Edwards, 2016; Edwards et al., 2005). For UFOV 4, two objects will be displayed in the central target. Again, an object will briefly appear in the peripheral. Participants will indicate whether the objects in the central target are the same or different. Participants will then indicate the peripheral object location (Aust & Edwards, 2016; Edwards et al., 2005). A composite for processing speed was created once z-scores for all four UFOV tests were completed. Composites were summed making higher scores indicative of better performance.

Objective Memory. Objective memory was measured using the Hopkins Verbal Learning Test (HVLT) (Brandt, 1991), Rey Auditory-Verbal Learning Test (AVLT) (Schmidt, 2004), and the Rivermead Behavioral Memory Test (Wilson, Cockburn, Baddeley, & Hiorns, 1989). This study excluded the Rivermead Behavioral Memory Test when creating the composite for memory because of the high correlation between HVLT and AVLT ($r = .68$, $p < .01$). HVLT consists of 12 total words related to three categories that each contain four semantically related words (Brandt, 1991; Brandt & Benedict, 2001; Gross et al., 2012). AVLT consists of 15 total words that are not semantically related to one another. AVLT is administered for five immediate-recall

trials (Gross et al. 2012; Rey, 1964; Schmidt, 2004). Tests were z-scored and summed making higher scores indicative of better performance.

Subjective Memory. Subjective memory was measured using the Memory Functioning Questionnaire (MFQ) to gauge the participants' feelings of their own memory performance (Gilewski & Zelinski, 1988). MFQ consists of questions (i.e., How often do these present a problem for you?) with different examples to rate on a frequency scale (always, sometimes, never). Higher scores were indicative of better subjective memory reports (Zelinski, Gilewski, & Anthony-Bergstone, 1990).

Covariates. Participants indicated at baseline their age, race, gender, and level of education through telephone screenings. Participants indicated their numeric age, chose from a list of 8 options regarding race (White/Caucasian, Black/African American, Asian, Native Hawaiian/Pacific Islander, American Indian/Alaskan Native, Biracial, Other, Don't Know), indicated their gender regarding the gender binary scale (male or female), and indicated their level of education after high school (vocational training/some college, associate degree, college graduate/BA-BS, some professional school/after college grad, master's degree, doctoral degree – PhD, MD, DVM, DDS, JD, etc.).

Statistical Approach

Aim 1, which explores the relationships between each cognitive construct and depressive symptoms, was examined using Pearson correlations. Aim 2, which examined the relationship between the cognitive constructs and depressive symptoms, while accounting for covariates of

age, race, gender, and education will be assessed with a multiple linear regression. Aim 3, which investigated the relationship between objective and subjective memory scores, was assessed using Pearson correlations. All analyses will be conducting using SPSS software (version 23).

RESULTS

Aim 1 examined the relationships between depressive symptoms and four different cognitive domains (reasoning, processing speed, objective memory, and subjective memory) using Pearson's correlations. All reported correlations were weak in strength and positive in directionality. Higher depressive symptoms are associated with poorer performance on reasoning ($r = .22$, $p < .001$), processing speed ($r = .17$, $p < .001$), memory ($r = .19$, $p < .001$) and subjective memory ($r = .29$, $p < .001$).

Aim 2 examined the relationship between depressive symptoms and the four cognitive constructs after accounting for covariates of age, gender, race, and education using four linear multiple regression analyses. After accounting for the above covariates, fewer depressive symptoms predicted better processing speed performance even after accounting for covariates ($\beta = .10$, $p < .001$). Additionally, younger age ($\beta = -.43$, $p < .001$), being white ($\beta = .15$, $p < .001$) and obtaining higher levels of education ($\beta = .13$, $p < .001$) predicted better processing speed performance. Gender was the only covariate to not predict processing speed scores ($\beta = .11$, $p = .37$). Covariates accounted for 23% of the variance in processing speed scores. Depressive symptoms accounted for an additional .9% of variance.

In terms of reasoning scores, fewer depressive symptoms significantly predicted better reasoning scores even after accounting for covariates ($\beta = .12$, $p < .001$). Additionally, younger age ($\beta = -.32$, $p < .001$), being a woman ($\beta = .04$, $p < .05$), being white ($\beta = .31$, $p < .001$), and obtaining higher levels of education ($\beta = .36$, $p < .001$) predicted better reasoning performance. Covariates accounted for 36% of the variability in reasoning scores. Depressive symptoms accounted for an additional 1.3% of variance.

In terms of objective memory, fewer depressive symptoms were associated with better memory scores (β = .13, p < .001). Younger age (β= - .35, p < .001), being a woman (β= .28, p < .001), being White (β= .21, p < .001), and obtaining higher levels of education (β= .20, p < .001) predicted better memory performance. Covariates accounted for 28% of the variance in memory performance. Depressive symptoms accounted for an additional 1.6% of variance.

In terms of subjective memory reports, less depressive symptoms significantly predicted lower subjective memory reports (β = .28, p < .001) even after accounting for covariates. Additionally, younger age (β = - .10, p < .001), being a man (β = - .06, p < .05), being white (β = .08, p < .001), and obtaining higher levels of education (β = - .00, p < .001) significantly predicted better subjective memory reports. Covariates accounted for 10% of the variability in memory reports. Depressive symptoms accounted for an additional 7.4% of variance.

Aim 3 examined the correlation between objective and subjective memory scores. There was a significant positive correlation between objective and subjective memory scores. Specifically, better memory performance was related to better self-rating of memory; however, the magnitude of this relationship was small (r = .24, p < .001).

DISCUSSION

This study investigated the relationship between depressive symptoms and four cognitive constructs of processing speed, reasoning, objective memory, and subjective memory. The aims of this study were to (1) examine the associations between depressive symptoms and each of the constructs, (2) assess these relationships after accounting for age, gender, race, and education covariates, and (3) investigate the relationship between objective memory scores and subjective memory reports. Overall, this research is important because cognitive decline is a common fear among the American public (Awang, Mansor, Nai Peng, & Nik Osman, 2018; Blazer, 2017; Freudeman, 2006; Laditka et al., 2011) and a leading reason for disability among older adults (Burton et al, 2009; Gold, 2015). More recently, this research is important because of the affect the COVID-19 pandemic has on older individuals. While depression rates among older adults was relatively low compared to other age groups before the pandemic, loneliness and depression rates are rising (Federal Interagency Forum, 2016; Troutman-Jordam & Kazemi, 2020). This increase poses risk on overall cognitive functioning (Troutman-Jordam & Kazemi, 2020).

For aim 1, depressive symptoms had weak positive correlations with the four cognitive constructs. Past literature on depressive symptoms' effect on processing speed and reasoning highlighted that both cognitive domains were worse in clinical samples (Sheline et al., 2006; Oberlin et al., 2021; Caixeta et al., 2017; Channon & Green, 1999; Nebes et al., 2000). The findings of the current study align with those found in clinical samples, while also adding insight into those same relationships in a community-dwelling sample of older adults.

As for memory, there were discrepancies in the literature when it came to the relationship between depressive symptoms and memory. Studies with clinical samples demonstrated strong relations between depression and memory (Stromgren, 1977), while non-clinical samples failed

to show this relationship (Schweizer et al., 2018). The current study adds to the literature by demonstrating a weak positive relationship between depressive symptoms and memory performance in a non-clinical sample. Regarding subjective memory, these findings were consistent with those of other studies (Zandi et al., 2004; Schweizer et al., 2018). It was demonstrated that those with more depressive symptoms had worse views of their own memory abilities.

Results indicated that depressive symptoms and memory performance remained significant even after accounting for covariates. This finding adds to the current literature as there were discrepancies between depression and memory after adjusting for covariates of age, general cognitive ability, and sex (Stromgren, 1977; Schweizer et al., 2018). However, this study also indicated that depressive symptoms were significantly associated with processing speed and reasoning even after accounting for covariates. It also adds to the literature by investigating this relationship in a community-dwelling sample of older adults rather than a clinical sample.

The findings of this study further add to the current literature regarding the relationship age has on general cognitive function. However, this relationship goes deeper than just comparing older adults to younger ones. Even age group differences within the 65+ population exists, and this study further demonstrates that (Colsher et al., 1991; Singer, Verhaeghen, Ghisletta, Lindenberger, & Baltes, 2003). Age predicted performance on processing speed, reasoning, and memory at the $p < .001$ significance level. Age's relationship with cognitive performance further supports the practice to cognitively test individuals as they age, however these findings also add to the literature on age and subjective memory. Based on the coefficient, age was directly predictive of memory complaints indicating that older adults may have more

complaints that younger-old adults. Taken a step further, this indicates that an awareness of performance changes.

Race predicted all four cognitive constructs at the $p < .001$ significance level. This finding fits with the current literature that Non-Hispanic White individuals outperform other racial groups on cognitive exams (Brewster et al., 2014; Diaz-Venegas et al., 2016). Specifically, regarding subjective memory reports, this study found that Black participants reported more subjective memory complaints than White participants. This finding contradicts a study demonstrating no group differences regarding subjective cognitive concerns between White and Black individuals (Jackson et al., 2017). While this study looked at cognition overall rather than memory specifically, there is a relationship between race and subjective memory that must be further investigated in other health contexts outside of depression (Braveman & Gottlieb, 2014; Gamaldo et al., 2017). Overall, social determinants of health such as health insurance, generation in the U.S., health literacy, and occupational status need to be addressed not only with cognition, but health for minority populations (Marmot & Allen, 2014).

Past literature on gender differences and cognition seemed promising considering each gender had unique cognitive advantages compared to the other. For instance, past literature demonstrates that men have visuospatial, problem-solving, and episodic memory advantages while women have verbal fluency and list recalling advantages (Heaton, Ryan, Grant, & Matthews, 1996; Kimura, 1999; Rosser, Ensing, Glider, & Lane, 1984; Hyde 2014; Reas et al., 2017). The current study both aligns and conflicts with the current research. It was found that women outperformed men on reasoning tasks, where past literature suggests the opposite effect should have taken place (Voyer, Voyer & Philip 1995; Lei et al., 2021; Hyde 2014). However, this study does align with research suggesting that women have better list recalling abilities

considering they outperformed men on memory (Heaton, Ryan, Grant, & Matthews, 1996; Kimura, 1999; Rosser, Ensing, Glider, & Lane, 1984; Hyde 2014; Reas et al., 2017). It is also important to note that gender was the only covariate that did not predict processing speed performance. While there was not specific research available detailing any relationship between processing speed and gender, it aligns with the research because neither gender seems to have a clear advantage over the other when it comes to processing speed (Voyer, Voyer & Philip 1995; Lei et al., 2021; Hyde 2014; Heaton, Ryan, Grant, & Matthews, 1996; Kimura, 1999; Rosser, Ensing, Glider, & Lane, 1984; Hyde 2014; Reas et al., 2017). Lastly, gender was the weakest covariate when it came to predicting both reasoning and subjective memory complaints. Although results were significant at a $p < .05$ level, other covariates predicted results at a $p < .001$ level. This finding suggests that less attention should be placed on gender differences in cognition and instead be focused on age, race, and education differences.

Regarding education, this research project aligns with the current literature regarding education's relationship with cognition (Cagney & Lauderdale, 2002; Farias et al., 2011; Reas et al., 2017). Those with higher levels of education performed better on processing speed, reasoning, and memory in the current study. Results also indicated that those with lower levels of education had worse subjective memory reports.

Aim 3 demonstrated a small positive association between subjective memory reports and objective memory scores. Past literature had conflicting findings on the relationship between the subjective and objective memory tasks (Mowla et al., 2008; Zandi et al., 2004). Future studies would need to investigate this relationship further in various samples to understand the true relationship between objective memory scores and subjective memory reports.

Limitations of this study are seen when looking at the diversity of the sample. Geographically, most of the recruitment sites were located in the Northern region of the United States (e.g., Michigan, Indiana, Pennsylvania, Maryland, Boston) with Alabama being the exception. Racially, the study was not nationally representative of other racial groups in the United States besides White (73.8%) and Black (26.2%) racial groups. Replication of this study should include not only other racial groups, but those of mixed races. Sample diversity also lacked in gender considering women (75.6%) were overrepresented. Future studies should aim to represent the relatively even population split there is between men and women (U.S. Census Bureau, 2019).

There are several strengths of this study with the main strength being sample size. This is the only study to our knowledge to investigate depression and all four of the cognitive constructs in a community-dwelling sample. This study is also one of the first specifically to investigate depressive symptoms, processing speed, and reasoning in a non-clinical sample of older adults. This study utilized composites for measures of processing speed, reasoning, and objective memory rather than relying on just one assessment to measure these outcomes. Using composites helped avoid collinearity between measures. There is also a clear advantage to using a shortened version of the CES-D to assess for depressive symptoms in older samples (Andresen, Malmgren, Carter, & Patrick, 1994; Irwin, Artin & Oxman, 1999; Mohebbi et al., 2018). Lastly, using an assessment of subjective memory like the Memory Functioning Questionnaire (MFQ) is more reliable than singular questions regarding self-perceptions of memory (Zelinski, Gilewski & Anthony-Bergstone, 1990).

There are several areas in need of future work. Replicating this study with representation from the western and southern parts of the United States would be ideal considering this study

recruited participants primarily from the Northern region. Inclusion of a nationally representative sample of other races besides just White and Black groups would also be advantageous to include because of the understanding of cognition differences in racial groups (Brewster et al., 2014; Diaz-Venegas et al., 2016; Varnum, Grossmann, Kitayama, & Nisbett, 2010). This study further demonstrated racial differences in both cognitive function and subjective memory. Including other racial groups would help identify other group differences in these domains, and most importantly, key modifiable factors, such as healthcare access and improved economic and educational advantages, that may be targeted for intervention to reduce such inequities.

Overall, the findings of this study highlight the importance of many health care and societal issues that need to be addressed. This study has demonstrated support for appropriately trained medical staff to administer cognitive assessments as their adult patients age. The findings also implicate that certain groups are in greater need of these assessments (i.e., Black patients, older patients, those with low levels of education). The results of this study also imply the importance of asking individuals how they feel about their own memory abilities. Since it was found that worse subjective memory was related to worse performance on objective memory, there is evidence to support administering a cognitive test to someone who complains about their memory (Kryscio et al., 2014; Tripodis et al., 2017). Finally, while rates of depression are relatively low in older adults compared to other age groups (Federal Interagency Forum, 2016), this study has demonstrated that having depressive symptoms in late life has a relationship with cognitive performance. With 35% of dementia cases being preventable through lifestyle modification, allotting funding for community resources that target depression in older adults would be beneficial for potentially preserving cognition and lowering the number of cognitive impairment cases that escalate into dementia (Livingston et al., 2017).

Table 1.

Predictors of Cognitive Constructs

Predictors	Memory		Reasoning		Processing speed		Subjective Memory	
	Beta	CI	Beta	CI	Beta	CI	Beta	CI
Age	-.35***	(-.06, -.05)	-.32***	(-.05, -.04)	-.43***	(-.23, -.20)	-.10***	(-.43, -.20)
Gender	.28***	(.53, .66)	.04*	(.02, .15)	.02	(-.13, .34)	-.06*	(-3.98, -.89)
Race	.21***	(.37, .49)	.31***	(.56, .68)	.15***	(.75, 1.21)	.08***	(1.72, 4.72)
Years of Education	.20***	(.06, .08)	.36***	(.11, .130	.13***	(.11, .18)	-.00***	(-.26, .24)
Depressive Symptoms	.13***	(.01, .03)	.12***	(.02, .03)	.10***	(.04, .08)	.28***	(.85, 1.11)

Note. *p<.05; **p<.01; ***p<.001; CI is the 95% Confidence Interval

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ACADEMIC VITA

Cassidy Doyle

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Education

Pennsylvania State University, Schreyer Honors College — May 2021
Bachelor of Science Human Development and Family Studies
Minors: Psychology, Gerontology

Research Appointments

The relationship between depressive symptoms and four cognitive constructs, Schreyer Honors College Thesis

Pennsylvania State University, Schreyer Honors College — 2019 – Present
Dr. Lesley Ross, Mentor

Falling in love or falling because of it? An investigation into widowhood and fall outcomes, HDFS 310H Final Paper

Pennsylvania State University — Spring 2019
Dr. Alyssa Gamaldo, Instructor

Research Assistant, Pennsylvania State University — 2019 – Present
The Study of Healthy Aging and Applied Research Programs (SHAARP) Lab, State College, PA

- Schedule participants for in-person lab visits to collect data for the Feasibility and Enjoyment of Exergame Study (FLEX) and the Everyday Function Intervention Trial (E-FIT)
- Code FLEX data and journal entry data from the Cognitive and Physical Exercise Study (CAPES)
- Assist with a systematic literature review on older drivers by analyzing articles for specific inclusion criteria and fulfilling administrative tasks
- Recruit participants via phone calls and in-person events
- Input research articles into EndNote to serve as a resource for all lab members
- Participate in pilot studies and conduct mock laboratory tests to ensure in-person visits are efficient and consistent
- Design professional business cards, posters, and flyers to recruit participants and potential lab members
- Design and update the lab website
- Participate in community outings (i.e., holiday cookie decorating, crafts, picnics) to become integrated with older adults in the community and build rapport

Academic Experience

Teaching Assistant, Pennsylvania State University — Spring 2020
HDFS 129 – Introduction to Human Development and Family Studies

- Lead review sessions prior to exams by preparing a PowerPoint presentation and answering questions about course material
- Assist professor during lectures, grade papers and assignments, and proctor exams

Professional Experience

Age-Friendly Care, PA – Media Writer 2020 – Present

- Create and manage social media accounts (Twitter, Facebook) to promote Age-Friendly Care, PA and the 4Ms Framework – What Matters, Medication, Mind, Mobility
- Collaborate bi-weekly with The Penn State College of Nursing's Center for Geriatric Nursing Excellence, The Penn State College of Medicine, and The Primary Health Network on best ways to create an age-friendly health system in rural Pennsylvania
- Input survey data from community members over the age of 65 regarding their knowledge on caregiver, end-of-life preferences, and their satisfaction with their healthcare

Gateway Hospice of Southwestern Pennsylvania – Social Work Intern Summer 2020

- Visit hospice patients to provide life-enrichment, music therapy, and other services
- Assist social media team by creating posts and informing the community of our services via LinkedIn and Facebook
- Attend interdisciplinary team meetings and shadow chaplains, social workers, nurses, and administrators

Help-A-Person Enterprises (HAP) – Outreach Intern Summer 2018

- Interview and discuss the life goals of the facility's 50 adults with intellectual disabilities
- Schedule fieldtrips based on personal preference to integrate them into their communities

Universal Cheerleader Association – Camp Instructor 2017 – 2020

- Travel to instruct camps with up to 500 participants at more than 30 high schools across the Northeast U.S. to teach athletes their important role in their schools, proper technique, and safe stunting practices
- Apply active listening to assist customers in creating 1 to 3-day personalized camp schedules
- Adapt to handle high-stress situations and requests from customers needing immediate action

Leadership

Alpha Omicron Pi – Epsilon Alpha Chapter 2019 – Present

Wellness Chair – Founder 2019 – Present

- Promote the overall well-being of the 300-person chapter through organized events (i.e., yoga sessions, self-care supplies distribution, walking goals, and water drinking goals)
- Provide the sorority with on-campus resources for mental and physical health

Greek Week Chair Spring 2019

- Organize a week of on-campus activities to integrate the 57 Greek life organizations

THON Committee 2019 – Present

- Create fundraisers throughout the year to raise money for Pediatric Cancer research

Certifications

Health and Human Services (HHS)/Assistant Secretary for Preparedness and Response (ASPR): Addressing the Needs of Older Adults in Disasters
End-of-Life Nursing Education Consortium (ELNEC)
CITI Training
- Social and Behavioral Human Subjects Research (IRB) Course
- GCP - Social and Behavioral Research Best Practices for Clinical Research

Awards and Honors

Dean's List	2017 – 2020
Alpha Omicron Pi – Epsilon Alpha Chapter's Most Honorable Sister	Spring 2020
American Airlines Education Foundation Scholarship	2020 – Present
Renaissance Scholarship, Pennsylvania State University	2019 – Present

Notable Courses Taken

Adult Aging and Development (HDFS 249), Empirical Inquiry (HDFS 312), Honors Research Seminars (HDFS 300H, HDFS 310H), Intervention and Prevention (HDFS 311), Development Throughout Adulthood (HDFS 445), Introduction to Grant Writing in the Human Services Profession (HDFS 497), Perspectives on Aging (HDFS 497), Social Distancing and Loneliness: Helping Older Adults Combat Social Isolation in a Pandemic (HDFS 497), Developmental Psychology (PSYCH 212), Positive Psychology (PSYCH 243), Introduction to Cognitive Psychology (PSYCH 256), Introduction to Clinical Psychology (PSYCH 418), Aging Policy in the United States (HPA 444), Physiology (BIOL 141), Biology of Aging (BIOL 155), Elementary Statistics (STAT 200), Dying and Death (NURS 464)

Service

Independent Student Fundraiser for Penn State THON 2020 – Present
- Independently raised over $6,000 and was one of 300 dancer couples selected to dance in THON 2021

Sister of Alpha Omicron Pi – Epsilon Alpha Chapter	2019 – Present
Arthritis Research Advocate	2019 – Present
Meals on Wheels Volunteer	2019 – 2020
St. Jude Children's Hospital Advocate	2017 – 2019