A COMPARISON OF INHIBITORY CONTROL AND EPISODIC MEMORY DEFICITS ON FUNCTIONAL VARIABLES IN SAMPLES OF MILD COGNITIVE IMPAIRMENT AND MATCHED HEALTHY CONTROLS

by

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(Under the Direction of Lawrence H. Sweet)

ABSTRACT

Episodic memory and inhibitory control deficits are prevalent among those with mild cognitive impairment (MCI). These deficits have been associated with worse functioning; however, the predictive utility of specific cognitive deficits vary. We investigated whether deficits of episodic memory and inhibitory control are associated with less physical activity and life satisfaction among people with probable MCI (pMCI). The study included 79 pMCI and 79 individually matched controls (HC) who participated in the Human Connectome Project - Aging study. Groups were determined based on MoCA scores (pMCI $\leq$ 23; HC $\geq$ 26). Participants completed the Go/No-go (GNG) and Face Name (FNT) tasks during functional MRI. Associations between GNG False Alarms (GNG FA), FNT Recognition Accuracy (FNT RA) scores, the International Physical Activity Questionnaire (IPAQ) and the PROMIS General Life Satisfaction (GLS) self-reports were examined. The pMCI group exhibited deficits compared to the HC on GNG FA ($t(152.17) = -1.26$, $p = .05$) and FNT RA ($t(85.78) = 13.72$, $p < .001$). Regressions revealed that neither the cognitive task scores nor the group differences directly accounted for significant variance in either IPAQ or GLS ($p > .05$). However, hierarchical

regressions revealed that the interaction of these cognitive tasks predicted IPAQ ($\Delta R^2 = 0.02$, $F(1, 78) = 3.74$, $p < .05$). Despite confirmation of expected cognitive deficits, their effects on physical activity and general life satisfaction are complex and more difficult to detect. Therefore, MCI deficits appear to confer complex functional risk that may be detected on screening before they clearly impact functioning. Findings underscore the utility of screening to facilitate more effective earlier interventions.

INDEX WORDS: mild cognitive impairment; MCI; older adults; inhibition; episodic memory

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CHAPTER ONE

INTRODUCTION

Aging is an inevitable process accompanied by many cognitive, emotional, and functional changes. Cognitive changes, in particular, distinguish expected aging from atypical aging. Mild Cognitive Impairment (MCI) is often conceptualized as the preclinical stage of dementia in which individuals present with more problems in memory and thinking than typical compared to their healthy aging peers, but less than expected with dementias. The core clinical symptoms of MCI include subjective complaints of memory loss or other cognitive dysfunction, objective evidence of memory or other cognitive deficits relative to their peers, generally preserved cognitive functions outside of impaired domains, intact independent activities of daily living, and absence of dementia (Kim et al., 2009; Petersen et al., 1997; Petersen et al., 1999). Historically, memory loss has been considered the major hallmark of MCI, due the prevalence of Alzheimer's disease (AD) dementia, but more recently there has been evidence of the presence of other deficits, such as impaired executive function and inhibitory control which may indicate conditions other than AD (Zhang et al., 2006).

The 2020 US census-adjusted prevalence for MCI, in older adults above the age of 65, was 22.7% which was about two times the prevalence of the most common cause of dementia - Alzheimer's Disease (Rajan et al., 2021). Rajan et al. (2021) also recently found that MCI prevalence was higher among Black than White samples (Rajan et al., 2021). The World Health Organization is predicting a dramatic doubling of world-wide incidence of 60-year-olds within just three decades, from 1 billion in 2020 to 2.1 billion in 2050, which draws concern about a

drastic increase of related disabilities, such as MCI and dementia (WHO). The growing prevalence of older adults and aging related problems (e.g., MCI) causes concern for an increase in progression of MCI to dementia. A meta-analysis examining MCI conversion rates to dementia and differing dementia etiologies, over about 4.5 years, revealed that about 39% developed dementia, with an annual conversation rate of 5-10% (Mitchell, Alex, & Mojtaba, 2009).

Three of the most prevalent etiologies of dementia include Alzheimer's disease (AD), Vascular dementia (VaD), and Mixed AD and VaD (Schoenberg & Duff 2010). The major prevalence of these etiologies has led to the development of MCI subtypes: amnestic (MCIa) and non-amnestic or dysexecutive (MCIna). MCIa is characterized by memory specific impairments with decreased hippocampal volume and cortical thinning of the temporal cortex (Clark et al., 2013; Libon et al., 2010). The specificity of these impairments in cognitive functioning and structural brain changes have been more associated with AD (Fleisher et al., 2007; Whitwell et al., 2008; Jungwirth et al., 2012; Marra et al., 2011). MCIna is characterized by executive function impairments with deep white matter changes (Clark et al., 2013; Libon et al., 2010). MCIna impairments and structural brain changes have been more associated with VaD (Jungwirth et al., 2012; Marra et al., 2011). While memory and executive functioning are just two of the many aspects of impairment that can occur in those with MCI, they are the cognitive domains most commonly associated with and occurring in neurocognitive disease processes of MCI and dementia and thus require further in-depth study of their interaction and unique impact on functioning.

One specific aspect of memory that is commonly impaired in individuals with MCI is memory for experienced events (i.e., episodic memory), as compared to memory for learned

information (i.e., semantic memory) (Tulving et al., 1993). Some properties that differentiate episodic memories from other memories are that episodic memories can contain a summary record of sensory-perceptual-conceptual affective processing, are typically remembered in visual form, always have perspective, and are subject to rapid forgetting (Conway et al., 2009).

Episodic memory impairment is the most common symptom of MCI, such as forgetting associated with recently experienced conversations, names of familiar people, and events or appointments, and misplacing objects. In studies comparing healthy control groups to MCI groups, the MCI groups show significantly greater impairment on tests of episodic memory compared to control groups who score in the normal range (Collie et al., 2001; Nordhal et al., 2005). Memory impairment and its trajectory within MCI participants has been shown to be a strong indicator of dementia risk (Ding et al., 2019). This specific episodic memory impairment suggests temporal lobe involvement that is related more to features of AD.

Individuals with MCI also commonly show impairment in the executive function domain. Inhibitory control is a core element of executive functioning as it allows suppression of irrelevant information to focus on a task at hand, resistance to interference from unrelated attention-capturing information, and inhibition of habitual reactions to all stimuli in the environment (Bjorklund & Harnishfeger 1995; Verbruggen et al., 2014). Inhibitory control is required for other aspects of executive functioning (e.g., multitasking, decision making, problem solving) that are utilized to maintain independent daily functioning. While some impulsivity naturally occurs with typical aging, there is evidence of major impairments in inhibitory control (i.e., impulsivity) within dementia populations (Amieva et al., 2004; Hasher & Zacks 1988; Pantsiou et al., 2018). Therefore, there is a great deal of research on impulsivity examining samples with dementia compared to healthy control samples, as executive dysfunction is more commonly thought of as

a characteristic of more severe cognitive and functional impairment (Voss et al., 2004; McDonald et al., 2018). Samples with AD and samples with VaD tend to demonstrate impairments in more controlled inhibition processes, as compared to automatic or reflexive inhibition, when compared to older adults who have risk factors for AD or VaD and healthy young adults (Amieva et al., 2004; Pantsiou et al., 2018).

Inhibitory control is less commonly studied in MCI samples, thus there is less of a consensus whether it is a consistent feature associated with functional variables and risk for dementia. While some studies have found no group differences between MCI and healthy control participants on tests of inhibition (Zhang et al., 2006), they note limitations, such as a ceiling effect of the inhibitory control task, which could have affected the ability to detect group differences (Zhang et al., 2006). Other studies have provided some evidence of differences in impulsivity between MCI and healthy control participants, as well as predictive associations between impulsivity and MCIna (Dwolatzky et al., 2003; Geda et al., 2014; Golimstok et al., 2013). This specific inhibitory control impairment suggests a frontal-subcortical issue that is related more to features of VaD but has been shown as a feature of other dementias as well (Jobson et al., 2021).

Cognitive deficits, such as memory and executive functioning deficits, can have a profound impact on everyday functioning (Farias et al., 2006). One lifestyle factor that plays a major role in the development and progression of decline in expected aging, MCI, and dementia is physical activity. A downward trend of physical activity typically accompanies expected aging and can be a major contributor to functional and cognitive decline, but it has also been identified as a protective lifestyle factor in preventing or delaying cognitive decline (Laurin et al., 2001; Lautenschlager et al., 2022). A systematic review revealed a strong association between

inactivity and impaired cognitive function (Falck et al., 2017). Inactivity has also been shown to be associated with other risk factors of MCI and dementia, particularly vascular etiology (e.g., diabetes, cardiovascular disease, mortality) (Wilmot et al., 2012). Given these findings, it is not surprising that physical activity has become a focus of healthy lifestyle interventions for those with MCI and dementia.

A second lifestyle factor that is impacted by changes in cognitive functioning is general life satisfaction. A typical misconception held by the public is that life satisfaction declines with age; however, increasing life satisfaction is common and has been identified as an indicator of more successful aging (Fisher 1995; Peitch et al., 2016). Beyond expected aging, cognitive impairments due to MCI and dementia have been associated with lower life satisfaction (Peitch et al., 2016). In addition to objective cognitive impairments, subjective cognitive impairments have been associated with lower life satisfaction, as well as more functional problems (Hill et al., 2017). Lower life satisfaction has also been shown to be a strong risk factor of the progression from MCI to dementia (Mank et al., 2022; Zhu et al., 2022).

The Current Study

Given the importance of cognitive functioning in older adults with MCI, particularly in the domains of memory and executive functioning, further assessment of the impact of cognitive impairment on physical and mental health in MCI as risk factors of dementia, is warranted. The current study intends to confirm whether differences in cognitive performance exist between matched samples of probable MCI (pMCI) and healthy control (HC) older adults, then evaluate the impact of expected cognitive impairments on physical activity and life satisfaction.

Specifically, we expect the pMCI group to be more impaired than the HC group and that this greater impairment will exhibit a strong positive association with lower levels of physical

activity and life satisfaction. We predict, as is commonly suggested by the literature, that groups of pMCI participants will demonstrate significantly greater cognitive impairments of inhibitory control and episodic memory than HC participants (hypothesis 1). We also hypothesize that the level of cognitive impairments demonstrated by the pMCI group will be more associated with decreased levels of physical activity and decreased general life satisfaction than the HC group (hypothesis 2, Figure 1). Finally, we hypothesize that within the pMCI group, response inhibition will predict physical activity and episodic memory will predict general life satisfaction, and the interaction of the two cognitive variables will predict both functional variables (hypothesis 3, Figure 2).

CHAPTER TWO

METHOD

Participants

Participants included in this study are a subsample from the Human Connectome Project-Aging (HCP-A) database (https://www.humanconnectome.org/study/hcp-lifespan-aging). The HCP-Aging study used a matched protocol across four acquisition sites (Washington University St. Louis, University of Minnesota, Massachusetts General Hospital and University of California, Los Angeles, with Oxford University contributing to the data analysis efforts). HCP-A aimed to recruit a sample representative of the US population according to the US Census Bureau's 2015 projections of gender, race, and ethnicity for three age bands. For detailed recruiting and screening processes for the HCP-A study see Bookheimer et. al. (2019). Briefly, healthy participants were recruited in three age cohorts: Mature (34-64), Old (65-79), and Oldest Old (80 and above). Exclusion criteria were diagnosis of a major psychiatric disorder, neurologic disorder, or history of severe depression that required more than 12 months of treatment. An additional screening measure, the Telephone Interview for Cognitive Status modified (TICS-M), was used to exclude anyone over the age of 60 who scored below the healthy cutoff score of 30 (Bookheimer et al., 2019).

For the current study, additional exclusion criteria will include those with insufficient data and MoCA scores outside of the allotted ranges for the two groups (i.e., 18-23 for pMCI and 26-31 for HC). The HCP-A study utilized a "liberal threshold" for including participants, which has led to the inclusion of those with mild to moderate cognitive deficits (Bookheimer et al.,

2019). The current study will include 79 older adults with MoCA scores between 18 and 23, which is consistent with pMCI based on sensitivity and specificity evidence produce by Illardi et al. (2023). 79 individually matched healthy control participants (MoCA score at or above 26) will be selected from the remaining sample based on age, sex, education, race, and ethnicity using the R Studio package "MatchIt" (Ho et al., 2011). Each pair was determined to be a "good" match based on standard mean difference, variability ratio, and an empirical cumulative distribution function (eCDF) mean. Characteristics of the final sample of 158 are shown by group (HC vs pMCI) in Table 1 and metrics regarding individual matching are listed in Table 2.

Procedures

For the HCP-A study, an initial phone interview was conducted to screen for exclusionary factors. After providing written informed consent, participants completed the MoCA and an MRI contraindication questionnaire before proceeding with the rest of the data acquisition. All data was collected in one day during an 8-10-hour baseline visit. A complete list of procedures and measures can be found elsewhere (Bookheimer et al., 2019). All participants included in this study will have undergone structural imaging (e.g., T1), task-based functional imaging (i.e., visuomotor task, Go/No-go task, and Face-Name Task), neuropsychological testing, vital signs, and completed self-report assessments and demographic questionnaires.

The current study utilized a subset of the measures from the HCP-A dataset, including self-reports and performance data from tasks completed during functional MRI. Specifically, this study utilized data from the Go/No-go Task (GNG), Face Name Task (FNT), systolic sitting blood pressure (BP), International Physical Activity Questionnaire (IPAQ) and the PROMIS General Life Satisfaction (GLS).

Measures

Go/No-go Task (GNG)

GNG is a measure of inhibitory control that was performed during functional MRI (Langenecker et al., 2007). The in-scanner task consisted of 2 runs of 4 minutes each (total of 8 min), during which participants were instructed to press a key whenever they saw a shape ('go' shapes), except for two specific shapes ('no-go' shapes). There was a total of 24 No-go's and 68 Go's per run. This task captures the variability of inhibitory control when response inhibition demands are high (No-go trials) compared to freely responding with a motor action (Go). The GNG task is widely used in assessing inhibitory control, particularly within neuroimaging, due to its ability to produce differentiated neural activation patterns that depend on response inhibition demands (Simmonds, Pekar, & Mostofsky, 2008). Thus, neuroimaging studies provide evidence that the task reliably demonstrates a neurocognitive distinction between response inhibitory processes and motor control (Smith et al., 2013). The current study utilized the No-go false alarm (GNG FA) behavioral data as a measure of impulsivity, in that the more responses a subject provides during no-go items, the more disinhibited and impulsive they are considered.

Face-Name Task (FNT)

The Face Name Task measures episodic memory during encoding and delayed recall (Amariglio et al., 2012; Atri et al., 2011). The duration of each run in the scanner was 8 seconds of countdown and 268 seconds of task. During those 268 seconds, the encoding phase was 22 seconds, the distractor phase was 20 seconds, and the recall phase was 22 seconds. There was a total of 4 blocks, each consisting of 5 faces, for a total of 20 face/name pairs. During the encoding phase, participants saw face/name pairs and responded with a button press once they had memorized the name that matches each face, for a total of 5 faces. Following encoding, they

are given a distractor GNG task for 20 seconds (this distractor GNG task is different from the measure used in the proposed study). During the recall phase, participants are presented with a face and asked to respond with a button press if they recalled the associated name. Outside of the scanner immediately following the task, participants are given a recognition test of the faces and names to check for accuracy during the recall phase. Preliminary results of the HCP-A study demonstrate that the FNT significantly activates neural patterns congruent with episodic memory and differentiates between activation during encoding and recall (Bookheimer et al., 2019). The current study utilized the recognition accuracy (FNT RA) variable from the behavioral data as a measure of episodic memory accuracy, and the reaction time to encoding (FNT Encoding RT) and recall (FNT Recall RT) as exploratory validity checks. Because the primary behavioral measure, FNT RA, is limited in determining learning and recall, we utilized the in-scanner reaction times for each task (i.e., encoding and recall), as validity checks.

International Physical Activity Questionnaire (IPAQ)

The IPAQ was developed to measure cross-national physical activity and inactivity across a comprehensive set of domains (e.g., work-related activity, transport-related activity, domestic and garden activities, and leisure time) (Craig et. Al., 2003; Fogelholm et al., 2006). The HCP-A study used the short form version of the IPAQ. Participants were asked to rate different levels of activity (i.e., vigorous, moderate, walking) and sitting in terms of days per week, hours per day, and minutes per day. This questionnaire has demonstrated reliability and validity across 12 countries, including the US (Craig et. al., 2003). The current study plans to measure the volume of activity by weighting each type of activity by its energy requirements defined in METS (multiples of the resting metabolic rate). The scores of MET-minutes for each

level of activity were summed for a total score which will be a dependent measure in the current study.

PROMIS General Life Satisfaction (GLS)

The PROMIS GLS measures subjective cognitions and judgments about one's life (Vaughan, Mulcahy, & Fitzgerald, 2020). It is comprised of 5-items on a 7-point Likert scale from 1 (Strongly disagree) to 7 (strongly agree). T-scores are calculated from the total raw scores, where a score of 50 is the mean t-score of a normed data set of Americans (Vaughan, Mulcahy, & Fitzgerald, 2020). The current study used the T-score produced by the PROMIS GLS Computer Adaptive Test as a dependent measure in analyses of cognitive impairment in groups of pMCI and HC.

Blood pressure (BP)

Sitting systolic blood pressure has been found to be an accurate predictor of cardiovascular problems, which are closely related to levels of physical activity (Kokkinos et al., 2009). We utilized sitting systolic blood pressure as a covariate in the physical activity analyses due to concerns about whether possible factors of cardiovascular health may impact cognitive aging.

Exploratory variables

Exploratory analyses were conducted using alternate variables that are more clinically relevant and widely used in the assessment of MCI, including the Trail Making Test A & B (Trails A, Trails B), and the Rey Auditory Verbal Learning Test, Short Delay Recall (RAVLT). Trails A is a measure of processing speed and attention in which participants must draw a line connecting numbers in order as fast as they can and the time to complete the task is the resulting measure of processing speed (Sánchez-Cubillo et al., 2009). Trails B is a measure of cognitive

flexibility (i.e., processing speed and executive functioning) in which participants must draw a line connecting numbers and letters in order, alternating between number and letter, as fast as they can and the time to complete the task is the resulting measure of cognitive flexibility (Sánchez-Cubillo et al., 2009). We used the time to complete Trails B as a measure of cognitive flexibility (i.e., executive functioning and processing speed). RAVLT is a measure of verbal learning and memory in which a participant hears a word list and has 5 trials to learn the list, then there is a short delay during which they receive a distractor list to learn and then are asked to freely recall the first list (i.e., short delay recall), and the accuracy of this short delay recall of the word list is the measure used in the current analyses for verbal memory (Dias et al., 2021; Xu et al., 2018).

Analytic Plan

Data were analyzed with R Studio software (Version 2023.06.0+421). Means and standard deviations were computed for all study variables (Table 3). All variables were examined for assumptions of parametric statistics and other quality control (e.g., outliers, normality). Variables that did not meet the assumptions of parametric statistics were transformed or adjusted for outliers. In all statistical analyses with physical activity as the dependent variable, sitting systolic blood pressure was covaried to control for individual cardiovascular differences (Crichton et al., 2014; Strandberg & Pitkala 2003).

To examine hypothesis 1, the differences in cognitive functioning between the pMCI and HC groups were compared for the two cognitive tasks (i.e., GNG and FNT). For the GNG data, an independent samples t-test was utilized to compare GNG FA counts between groups. We predicted that the pMCI group would be more impulsive, as assessed by significantly more GNG FAs, than the HC group. In addition, an independent samples t-test was conducted using the FNT

RA variable to examine the second part of hypothesis 1, that the pMCI group was predicted to exhibit more impaired episodic memory than the HC group. Follow-up independent samples t-test were conducted using reaction time during encoding and recall tasks as exploratory validity checks.

Power analyses were conducted using G-Power 3.1. In examining the group differences in inhibitory control and episodic memory, power analyses for the independent samples t-test revealed that assuming statistical power of .80, a two-tailed alpha level of .05, a sample of 158 participants (79 per group) yields a capacity to detect a small to medium effect size of d = .45 (Cohen, 1992).

These power analyses do not consider that the independent groups are individually matched on multiple variables which has been shown in literature to increase power to detect larger effect sizes due to decreased extraneous variance (Martin et al., 1993). Therefore, they are considered a substantial underestimate of the study's actual power. Studies of similar samples sizes assessing the differences of inhibitory control and episodic memory between pMCI and HC groups found medium to large effect sizes (Dwolatzky et al., 2003; Nordhal et al., 2005; Johns et al., 2012). Thus, the analysis should be sufficiently powered, given that these effects are lower than the effect sizes expected from the literature.

Regressions were conducted to test the second hypothesis, that the greater cognitive deficits in the pMCI group would be more associated with the variance in the functional variables than in the HC group (Figure 1). In assessing how impulsivity (i.e., GNG FAs) affects physical activity and general life satisfaction, two regressions were run for each dependent variable, where GNG FA count is the independent variable, and compared on the group level. The interaction of group on the prediction of impulsivity to physical activity (i.e., IPAQ) and life

satisfaction (i.e., GLS) was assessed through the regressions as well. In assessing how impaired episodic memory (i.e., FNT RA) affects physical activity and general life satisfaction, two regressions were run for each dependent variable, where FNT RA is the independent variable, and compared on the group level. The interaction of group on the prediction of episodic memory to physical activity and life satisfaction was assessed through the regressions as well. The two regressions of FNT were repeated using reaction time during encoding (i.e., FNT Encoding RT) and recall (i.e., FNT Recall RT) tasks as exploratory validity checks.

Power analyses were conducted using G-Power 3.1. In examining how inhibitory control and episodic memory predicts physical activity and general life satisfaction, and if group adds to this prediction, power analyses revealed that assuming statistical power of .80, a two-tailed alpha level of .05, a sample of 158 participants (79 per group), and 4 predictors, yields a capacity to detect a small effect size of $f^2 = .08$ (Selya et al., 2012). These power analyses do not consider that the independent groups are individually matched on multiple variables which has been shown in literature to increase power to detect larger effect sizes due to decreased extraneous variance. Studies of similar samples sizes assessing cognitive deficits and their relationship with functional variables, such as physical activity and general life satisfaction, in samples of pMCI subjects found small to medium effect sizes (Chang et al., 2020; Ren et al., 2017). Therefore, they are considered a substantial underestimate of the study's actual power. Thus, the analysis should be sufficiently powered, given that these effects are lower than the effect sizes expected from the literature.

Lastly, in examining hypothesis 3, cognitive deficits within the pMCI group (i.e., inhibitory control or episodic memory) were examined in relation to which one more uniquely predicts physical activity and general life satisfaction, as well as if the interaction of the two

cognitive measures significantly predicts the functional variables (Figure 2). Collinearity between the two cognitive measures were checked. To determine any change in predictive validity of physical activity and life satisfaction between the cognitive measures, we conducted a hierarchical multiple regression. This involved six steps per dependent variable, (1) regressing GNG FA performance onto physical activity or life satisfaction, (2) adding in FNT RA performance to detect any increase in predictive utility, (3-4) repeating this process with FNT RA performance first predicting the dependent measure, then adding in GNG FA performance to detect an increase in predictive utility, (5) comparing the increases in prediction to assess the stronger predictive variable, and finally (6) examining whether both GNG FA and FNT RA performance together are the best predictor of physical activity and life satisfaction.

Power analyses for hypothesis 3 were conducted using G-Power 3.1. In examining steps 1-5, power analyses revealed that assuming statistical power of .80, a two-tailed alpha level of .025 (to account for two comparisons), a sample of 79 participants, 1 tested predictor and 3 total predictors, yields a capacity to detect a small effect size of $f^2 = .05$ (Selya et al., 2012). These power analyses are corrected for multiple comparisons. In examining step 6 of the hierarchical regression, power analyses revealed that assuming statistical power of .80, a two-tailed alpha level of .05, a sample of 79 participants, 3 predictors, yields a capacity to detect a small to medium effect size of $f^2 = .10$ (Selya et al., 2012). These power analyses do not consider that the independent groups are individually matched on multiple variables which has been shown in literature to increase power to detect larger effect sizes due to decreased extraneous variance. Therefore, they are considered a substantial underestimate of the study's actual power. Studies of similar samples sizes assessing the relationships between inhibitory control and memory deficits with functional variables found small effect sizes (Zhang et al., 2007; Farias et al., 2017). Thus,

the analysis should be sufficiently powered, given that these effects are lower than the effect sizes expected from the literature.

CHAPTER 3

RESULTS

Quality Control

Data distributions were inspected for normality and individual outliers. Transformation types, when indicated, were determined by examining whether a Logarithm or Square Root transformation would produce the best fit for normality. A winsorize transformation was used when the variable distribution included outliers but was otherwise normal. Logarithmic transformations accounting for zeros were performed to reduced skewed data for FNT Recognition Accuracy and GNG No-go False Alarms. Square Root transformations were performed to reduce skewness for the IPAQ variable. Finally, a winsorize transformation was performed for BP to account for an outlier. The rest of the variables used in the a-prior determined analyses did not require transformations (i.e., GLS, FNT Encoding RT, FNT Recall RT). Additional data used in exploratory analyses were winsorized to account for outliers (i.e., Trails A, Trails B, RAVLT), and social economic status (SES) was logarithmic transformed then winsorize transformed. Demographic characteristics are presented in Table 1. Descriptive characteristics of the primary variables after transformations, if applicable, are presented in Table 3. Bivariate zero-order correlations between group, MoCA, cognitive performance, blood pressure, physical activity, and general life satisfaction were generally in the hypothesized directions (Table 4). Bivariate zero-order correlations of exploratory variables are presented in Table 5.

Hypothesis 1: Group Differences

Hypothesis testing.

To examine Hypothesis 1, that the pMCI group would demonstrate worse performance on the two cognitive tasks (i.e., GNG FA and FNT RA) compared to the HC group, we conducted one-tail independent samples t-tests. In line with our hypothesis, they revealed a significant difference between groups on GNG FA count in the expected direction, with the pMCI group performing more impulsively ($t(152.17) = -1.26$, $p = .05$). The effect size, Cohen's d, was found to be 0.26, indicating a small effect size. The 95% confidence interval for the mean difference ranged from -Inf to 0.002. Based on the results, we reject the null hypothesis and conclude that there is a statistically significant difference in the mean scores between pMCI and HC on GNG FA. The pMCI group exhibited significantly more GNG FAs compared to the HC group. This finding suggests that a group of probable MCI, determined by conservative cutoffs of a brief cognitive screener (i.e., MoCA), demonstrated significant inhibitory control deficits beyond what would be expected of their individually matched peers (i.e., age, education, sex, race, and ethnicity).

Also, in line with our hypothesis, the one-tail independent samples t-test revealed a significant difference between groups on FNT RA in the expected direction, with the pMCI group correctly recognizing fewer face-name pairs ($t(85.78) = 13.72$, $p < .001$). The effect size, Cohen's d, was found to be -0.22, indicating a small effect size. The 95% confidence interval for the mean difference ranged from 3.81 to Inf. Based on the results, we reject the null hypothesis and conclude that there is a statistically significant difference in the mean scores between pMCI and HC groups on FNT RA. The pMCI group exhibited significantly lower FNT RA compared to HC. This finding suggests that a group of probable MCI, determined by conservative cutoffs

of a brief cognitive screener (i.e., MoCA), demonstrated significant episodic memory deficits beyond what would be expected of their individually matched peers (i.e., age, education, sex, race, and ethnicity).

Validity Checks.

Follow-up t-tests were conducted using FNT Encoding RT and FNT Recall RT, which are closely related to FNT Recognition Accuracy used in hypothesis testing, to examine convergent validity and due to limitations of the FNT Recognition Accuracy measure (i.e., not depicting learning or free recall of the episodic memories).

A one-tail independent samples t-test revealed a non-significant difference between groups on Encoding RT in the expected direction, (t (146.07) = -0.09, p = .465). The effect size, Cohen's d, was found to be 0.01, indicating a very small effect size. The 95% confidence interval for the mean difference ranged from -Inf to 200.18. Based on the results, we fail to reject the null hypothesis and conclude that there is no statistically significant difference in the mean scores between pMCI and HC on FNT Encoding RT. pMCI had slower Encoding RT compared to HC, but this difference was not detected as statistically significant. This finding suggests that the pMCI group demonstrated similar RT on an episodic memory encoding task compared to the HC group and does not indirectly support the validity of the FNT RA findings as expected.

A one-tail independent samples t-test revealed a significant difference between groups on Recall RT in the expected direction, with the pMCI group taking more time to recall face-name pairs (t (155.36) = -2.09, p = .019). The effect size, Cohen's d, was found to be 0.33, indicating a small effect size. The 95% confidence interval for the mean difference ranged from -Inf to -38.26. Based on the results, we reject the null hypothesis and conclude that there is a statistically significant difference in the mean scores between pMCI and HC on FNT Recall RT. pMCI group

exhibited significantly slower Recall RT compared to HC. This finding suggests that the pMCI group demonstrated slower reaction times on a task of episodic memory recall compared to the HC group, supporting its intended purpose of validating group differences in the FNT RA measure.

Hypothesis 2: Prediction of Physical Activity and General Life Satisfaction

Hypothesis testing.

GNG FA Impulsivity

To examine hypothesis 2, that the greater cognitive deficits in the pMCI group will better predict variance in physical function, assessed using the IPAQ, and general life satisfaction, using the GLS, than in the HC group, we conducted multiple regressions. The first regression model of GNG FA significantly predicted the dependent variable of IPAQ, when covarying for BP and Group (adjusted $R^2 = 0.04$, $F(4, 153) = 2.52$, $p = .022$), indicating that 6% of the variability in IPAQ was explained by the model. However, GNG FA did not exhibit a significant contribution to this effect, revealing that BP was the only contributor. Specifically, regression coefficients indicated that GNG FA ($\beta = 4.21$, $SE = 3.88$, $t(152) = 1.09$, $p = .140$), Group ($\beta = 5.08$, $SE = 7.54$, $t(153) = 0.67$, $p = .251$), and the interaction of GNG FA x Group ($\beta = -4.80$, $SE = 5.07$, $t(152) = -0.95$, $p = .173$) were not significantly associated with IPAQ, while BP ($\beta = -0.22$, $SE = 0.08$, $t(152) = -2.84$, $p < .01$) was significantly associated with IPAQ. GNG FA and Group exhibited positive relationships with IPAQ, while BP and the interaction term were inversely related. Based on the results, we fail to reject the null hypothesis and conclude that neither GNG FA, Group, nor their interaction significantly predict IPAQ. There was only a statistically significant relationship between BP and IPAQ. This finding suggests that BP

(inversely), and not impulsivity, group, or the difference in impulsivity by group, predicts physical activity in the current sample.

The second regression model of GNG FA did not significantly predict the dependent variable of GLS when covarying for Group (adjusted $R^2 = -0.02$, $F(3, 154) = 0.17$, $p = .458$), indicating that the variability in GLS between groups was not explained by the model. Regression coefficients indicated that GNG FA ($\beta = -0.06$, $SE = 2.58$, $t(153) = .-0.2$, $p = .491$), Group ($\beta = -2.56$, $SE = 5.04$, $t(153) = -0.51$, $p = .306$) and the interaction of GNG FA x Group ($\beta = 1.18$, $SE = 3.39$, $t(153) = 0.35$, $p = .365$) were not significantly associated with GLS. GNG FA and Group had negative relationships with GLS. The interaction term had a positive relationship with GLS. Based on the results, we fail to reject the null hypothesis and conclude that GNG FA, Group, nor the interaction between the two predicts GLS. This finding suggests that impulsivity does not significantly predict concurrent general life satisfaction.

FNT RA Episodic Memory

The first regression model of FNT RA significantly predicted the dependent variable of IPAQ, when covarying for BP and Group (adjusted $R^2 = 0.05$, $F(4, 153) = 2.93$, $p < .05$), indicating that 5% of the variability in IPAQ was explained by the model. However, neither FNT RA, Group, nor the interaction of the two exhibited significant contributions to this effect, revealing that BP was the only significant contributor. Regression coefficients indicated that FNT RA ($\beta = -0.09$, $SE = 0.64$, $t(152) = -0.14$, $p = .443$) and Group ($\beta = 5.14$, $SE = 6.28$, $t(152) = 0.82$, $p = .208$) were not significant. FNT RA x Group ($\beta = -4.72$, $SE = 2.99$, $t(152) = -1.58$, $p = .058$) was nearly significantly associated with IPAQ, while BP ($\beta = -0.24$, $SE = 0.08$, $t(152) = -3.04$, $p < .01$) was significantly associated with IPAQ. FNT RA, BP, and the interaction term had negative relationships with IPAQ, while Group has a positive relationship with IPAQ. Based on

the results, we fail to reject the null hypothesis and conclude that FNT RA, Group, and the interaction of the two do not predict IPAQ. As previously seen, BP is the only variable that predicts IPAQ. This finding suggests that episodic memory recognition accuracy does not predict physical activity in the current sample.

The second regression model of FNT RA did not significantly predict the dependent variable of GLS when covarying for Group (adjusted $R^2 = -0.01$, $F(3, 154) = 0.55$, $p = .326$), indicating that the variability in GLS between groups was not explained by the model. Regression coefficients indicated that FNT RA ($\beta = 0.30$, $SE = 0.43$, $t(153) = 0.70$, $p = .241$) , Group ($\beta = 3.58$, $SE = 4.11$, $t(153) = 0.87$, $p = .193$) and the interaction of FNT RA x Group ($\beta = -2.16$, $SE = 1.97$, $t(153) = -1.08$, $p = .142$) were not significantly associated with GLS. FNT RA and Group had positive relationships with GLS. The interaction term had a negative relationship with GLS. Based on the results, we fail to reject the null hypothesis and conclude that FNT RA, Group, and the interaction of the two do not predict GLS. This finding suggests that episodic memory recognition accuracy does not predict general life satisfaction in the current sample.

Validity Checks

Follow-up regressions were conducted using FNT Encoding RT and FNT Recall RT, closely related to FNT Recognition Accuracy used in hypothesis testing to examine convergent validity and due to limitations of the FNT Recognition Accuracy measure (i.e., not depicting learning or free recall of the episodic memories).

The first regression model of FNT Encoding RT significantly predicted the dependent variable of IPAQ, when covarying for BP and Group (adjusted $R^2 = 0.05$, $F(4, 153) = 3.22$, $p < .01$), indicating that 5% of the variability in IPAQ was explained by the model. However, neither FNT Encoding RT, Group, or the interaction of the two exhibited significant contributions to this

effect, revealing that BP was the only contributor. Regression coefficients indicated that FNT Encoding RT ($\beta = 0.00$, SE = 0.00, $t(152) = 0.54$, $p = .294$), Group ($\beta = 14.95$, SE = 5.40, $t(152) = -0.92$, $p = .181$), and the interaction of FNT Encoding RT x Group ($\beta = 0.00$, SE = 0.00, $t(152) = 0.72$, $p = .238$) were not significantly associated with IPAQ. While BP ($\beta = -0.22$, SE = 0.08, $t(152) = -2.79$, $p < .01$) was significantly associated with IPAQ. FNT Encoding RT and the interaction term had positive relationships with IPAQ, while BP and Group had negative relationships with IPAQ. Based on the results, we fail to reject the null hypothesis and conclude that FNT Encoding RT, Group, or the interaction of the two do not predict IPAQ. This finding suggests that encoding RT of an episodic memory does not predict GLS.

The second regression model of FNT Encoding RT did not significantly predict the dependent variable of GLS (adjusted $R^2 = -0.00$, $F(3, 154) = 0.97$, $p = .204$), indicating that the variability in GLS between groups was not explained by the model. Regression coefficients indicated that FNT Encoding RT ($\beta = 0.00$, SE = 0.00, $t(153) = 1.62$, $p = .054$) was nearly significantly associated with GLS, however, Group ($\beta = 2.95$, SE = 3.59, $t(153) = 0.82$, $p = .207$) and the interaction of FNT Encoding RT x Group ($\beta = -0.00$, SE = 0.00, $t(153) = -1.19$, $p = .118$) were not significantly associated with GLS. Encoding RT and Group had positive relationships with GLS. The interaction term had a negative relationship with GLS. Based on the results, we fail to reject the null hypothesis and conclude that FNT Encoding RT, Group, nor the interaction of the two predicts GLS. This finding suggests that encoding RT of an episodic memory does not predict general life satisfaction.

The first regression model of FNT Recall RT significantly predicted the dependent variable of IPAQ, when covarying for BP (adjusted $R^2 = 0.04$, $F(4, 153) = 2.56$, $p < .05$), indicating that 4% of the variability in IPAQ was explained by the model. However, FNT Recall

RT, Group, nor the interaction of the two exhibited significant contributions to this effect, revealing that BP was the only contributor. Regression coefficients indicated that FNT Recall RT ($\beta = 0.00$, SE = 0.00, $t(152) = 0.95$, $p = .172$), Group ($\beta = -0.51$, SE = 6.74, $t(152) = -0.08$, $p = .470$), and the interaction of FNT Recall RT x Group ($\beta = -0.00$, SE = 0.00, $t(152) = -0.23$, $p = .411$) was not significantly associated with IPAQ. While BP ($\beta = -0.23$, SE = 0.08, $t(152) = -2.90$, $p < .01$) was significantly associated with IPAQ. FNT Recall RT had a positive relationship with IPAQ. BP, Group, and the interaction term had negative relationships with IPAQ. Based on the results, we fail to reject the null hypothesis and conclude that FNT Recall RT, Group, nor the interaction of the two predicts IPAQ. As seen in previous results, BP alone does significantly predict IPAQ. These findings suggest that recall RT of an episodic memory task does not predict physical activity in the current sample.

The second regression model of FNT Recall RT did not significantly predict the dependent variable of GLS (adjusted $R^2 = -0.01$, $F(3, 154) = 0.46$, $p = .354$), indicating that the variability in GLS between groups was not explained by the model. Regression coefficients indicated that FNT Recall RT ($\beta = 0.00$, SE = 0.00, $t(153) = 0.63$, $p = .266$), Group ($\beta = 3.58$, SE = 4.49, $t(153) = 0.80$, $p = .213$) and the interaction of FNT Recall RT x Group ($\beta = -0.00$, SE = 0.00, $t(153) = -1.05$, $p = .149$) were not significantly associated with GLS. Recall RT and Group had positive relationships with GLS. The interaction term had a negative relationship with GLS. Based on the results, we fail to reject the null hypothesis and conclude that FNT Recall RT, Group, nor the interaction of the two predicts GLS. This finding suggests that a task of episodic memory recall RT does not significantly predict general life satisfaction in the current sample.

Hypothesis 3

Hypothesis testing.

Hypothesis 3 was that impulsivity (i.e., GNG FA) will better predict physical activity (i.e., IPAQ) and impaired episodic memory (i.e., FNT RA) will better predict general life satisfaction (i.e., GLS), but the interaction of the two cognitive variables will best predict both functional variables.

Physical Activity (IPAQ)

In examining which cognitive task best predicts physical activity, a hierarchical regression analysis was conducted to examine the relationship between variables GNG FA and FNT RA and the dependent variable IPAQ. The study also aimed to determine whether including an interaction term between GNG FA and FNT RA significantly improves the model fit. Three hierarchical regression models were fitted: Model 1 included the predictor GNG FA; Model 2 added the second predictor FNT RA; and Model 3 incorporated an interaction term between predictors GNG FA and FNT RA.

The first two models were not statistically significant (Model 1: $R^2 = 0.00$, $p = .294$, Model 2: $R^2 = 0.02$, $p = .246$). The null hypothesis (H0) posits that the addition of predictor variable FNT RA does not improve the model fit compared to the first model. The alternative hypothesis (HA) suggests that there is a significant improvement in model fit. The change in R-squared (ΔR^2) between the two models was 0.01, corresponding to a nearly statistically significant improvement in model fit with the addition of FNT RA ($F (1, 78) = 2.34$, $p = .064$). Even though the overall model fit is not significant, this strong effect suggests that including FNT RA in the regression model may explain additional variability in the dependent variable IPAQ, beyond what was accounted for by the GNG FA variable included in the first model.

Although Model 3 was also not statistically significant ($R^2 = 0.04$, $p = .273$), the change in R-squared (ΔR^2) between Model 2 and Model 3 revealed a significant improvement in model fit with the addition of the interaction term ($\Delta R^2 = 0.02$, $F(1, 78) = 3.74$, $p < .05$). This indicates that the interaction between predictors GNG FA and FNT RA explains an additional 2% of the variability in the dependent variable IPAQ, beyond what was accounted for by the variables included in Models 1 and 2. The findings support the significance of the interaction term in predicting the dependent variable IPAQ. We reversed the order of the cognitive variables as planned and found no difference in the pattern of significance. This underscores the importance of considering the interaction effect between GNG FA and FNT RA in understanding the relationship between the predictor variables and the dependent variable.

General Life Satisfaction (GLS)

In examining which cognitive task best predicts quality of life, a hierarchical regression analysis with three models was conducted to examine the relationship between variables GNG FA and FNT RA and the dependent variable GLS. The study also aimed to determine whether including an interaction term between GNG FA and FNT RA significantly improves the model fit. The first two models were not statistically significant (Model 1: $R^2 = 0.00$, $p = .302$, Model 2: $R^2 = 0.02$, $p = .271$). The change in R-squared (ΔR^2) between the two models was 0.01, corresponding to a nearly statistically significant improvement in model fit with the addition of FNT RA ($F(1, 78) = 1.99$, $p = .081$). This suggests that including FNT RA in the regression model does not explain additional variability in the dependent variable GLS, beyond what was accounted for by the GNG FA variable included in the first model. Model 3 was also not significant ($R^2 = 0.03$, $p = .243$). The change in R-squared (ΔR^2) between Model 2 and Model 3 revealed a nearly significant improvement in model fit with the addition of the interaction term

($\Delta R^2 = 0.02$, $F(1, 78) = 2.54$, $p = .057$). This indicates that the interaction between predictors GNG FA and FNT RA may explain additional variability in the dependent variable GLS, beyond what was accounted for by the variables included in Models 1 and 2. We reversed the order of the cognitive variables as planned and found no difference in the pattern of significance. The findings suggest that accuracy on an episodic memory recognition task does not predict general life satisfaction in the current sample.

Validity checks.

Follow-up hierarchical regressions including 3 models each were conducted using FNT Encoding RT and FNT Recall RT, closely related to FNT Recognition Accuracy used in hypothesis testing to examine convergent validity and due to limitations of the FNT Recognition Accuracy measure (i.e., not depicting learning or free recall of the episodic memories).

IPAQ – *FNT Encoding RT*: The first model revealed the same results as above, that GNG FA does not predict IPAQ ($R^2 = 0.00$, $p = .294$). The second model with the addition of FNT Encoding RT revealed a significant main effect (ME) of FNT Encoding RT ($p < .05$), and R^2 was nearly significant ($p = .09$). Change from model 1 to model 2 was significant ($R^2 = 0.04$, $F = 6.75$, $p < .01$). Model 3 not significant ($R^2 = 0.05$, $p = .304$). Change from model 2 to model 3 not significant ($R^2 = 0.00$, $F = 0.29$, $p = .295$).

IPAQ - *FNT Recall RT*: The first model revealed non-significant results, GNG FA does not predict IPAQ ($R^2 = 0.00$, $p = .294$). The 2nd model with the addition of FNT Recall RT was also not significant ($R^2 = 0.00$, $p = .416$). Change from model 1 to model 2 was not significant ($R^2 = 0.00$, $F = 0.16$, $p = .325$). Model 3, with the interaction of GNG FA and FNT Recall RT, was not significant ($R^2 = 0.00$, $p = .474$). Change from model 2 to model 3 not significant ($R^2 =$

0.00, F = 0.01, p = .471). These findings suggest that neither addition of FNT Encoding RT nor FNT Recall significantly added to the prediction IPAQ.

GLS – *FNT Encoding RT*: Model 1 was not significant (R^2 = 0.00, p = .302). Model 2 with the addition of FNT Encoding RT was also not significant (R^2 = 0.00, p = .426). Change from model 1 to model 2 was also not significant (R^2 = 0.00, F = 0.11, p = .372). Model 3 with the interaction of GNG FA and FNT Encoding RT was not significant (R^2 = 0.03, p = .295). However, change from model 2 to model 3 was significant (R^2 = 0.02, F = 3.31, p < .05).

GLS - *FNT Recall RT*: Model 1 was not significant (R^2 = 0.00, p = .302). Model 2 with the addition of FNT Recall RT was not significant (R^2 = 0.01, p = .300). The change from model 1 to model 2 was nearly significant (R^2 = 0.01, F = 1.60, p = .104). Model 3 with the interaction of GNG FA and FNT Recall RT was not significant (R^2 = 0.02, p = .301). However, the change from model 2 to model 3 was nearly significant (R^2 = 0.01, F = 1.70, p = .097). These findings suggest that neither the addition of FNT Encoding RT nor Recall RT added to the prediction of GLS with GNG FA.

Exploratory Analyses

Exploratory analyses were conducted to determine whether observed group differences may have confounded primary analyses. Zero order bivariate correlations (Table 5) were inspected to determine whether any of the sample characteristic variables exhibited significant correlations with the Group variable to signify possible group differences and thus possible impact on group analyses. Social economic status (SES) was not included in the zero order bivariate correlations due to insufficient data; however, separate analyses were conducted on a subset of the sample to determine group differences. Of the exploratory variables, Race, Trails A, Trails B and RAVLT were the only variables that were identified to be significantly correlated

with Group and therefore, were the only new variables included in follow up analyses regarding potential confounds.

Social Economic Status (SES)

To determine whether observed group differences in social economic status (SES) affected the above findings, we repeated the analyses from hypothesis 1 with the variable SES. This SES variable was defined as household income divided by number of primary household residents. However, due to insufficient data within the pMCI group, the sample size for that group was reduced from 79 to 55 and their matched HC were removed from their respective group, resulting in an overall sample size of 110. Quality control revealed skewness and kurtosis that did not fit assumptions of normality, so the variable was transformed using a logarithmic transformation and then a winsorize transformation to account for extreme outliers even after the logarithmic transformation. A two-tailed independent samples t-tests revealed no significant difference between groups in SES ($t = 0.70$, $df = 104.77$, $p = .483$). The effect size, Cohen's d, was found to be -0.13, indicating a small effect size. The 95% confidence interval for the mean difference ranged from -0.16 to 0.34. Due to this finding, we did not repeat analyses from hypothesis 2 or hypothesis 3.

Race

As seen in the sample demographics, even after matching, the prevalence of White subjects unexpectedly differed significantly between groups. Therefore, we converted Race to a binary post-hoc covariate (i.e., White or Non-White). We repeated the main analyses with Race as a covariate to determine whether this group difference may have confounded our findings. A two-tail independent samples t-test revealed a significant difference between groups on this binary variable of Race ($t = -2.05$, $df = 153.76$, $p < .05$). The effect size, Cohen's d, was found to

be 0.19, indicating a small effect size. The 95% confidence interval for the mean difference ranged from -0.30 to -0.01. Based on the results, it is possible that there is a group difference, with the pMCI group having a higher prevalence of White subjects, so we decided to further investigate the possible impact this had on hypothesis 2 and 3.

The regressions from hypothesis 2 repeated using Race as a covariate and revealed similar results in overall model significance in that the FNT RA models continued to significantly predict IPAQ (adjusted $R^2 = 0.05$, $F = 2.57$, $p < .05$); however, after adding Race as a covariate, the GNG FA overall model did not continue to significantly predict IPAQ (adjusted $R^2 = 0.04$, $F = 2.18$, $p = .059$). The GNG FA and FNT RA models continued to not significantly predict GLS ($p > .05$). In the models predicting IPAQ with the FNT validation measures, the FNT Encoding overall model continued to significantly predict IPAQ (adjusted $R^2 = 0.05$, $F = 2.80$, $p < .05$); however, the FNT Recall RT overall model did not continue to predict IPAQ (adjusted $R^2 = 0.04$, $F = 2.22$, $p = .055$). The FNT Encoding and Recall RT models continued to not significantly predict GLS ($p > .05$). Regression coefficients for Race were not significant in any of the models predicting IPAQ or GLS ($p > 0.05$). Although the results from the IPAQ models with GNG FA and FNT Recall RT exceeded the threshold for significance with the addition of the Race covariate, the acute change in effect sizes were small. These findings suggest that our results from prior analyses were similar to the results when Race is added as a covariate.

The regressions from hypothesis 3 were repeated using Race as the first predictor variable and revealed similar results. Model 1 included just Race as the only predictor of either IPAQ or GLS, model 2 added GNG FA as a predictor to the model, model 3 added FNT RA as a third predictor to the model, and model 4 included all 3 predictor variables and the interaction

term of GNG FA x FNT RA. In predicting IPAQ, all four models revealed non-significant results ($p > 0.05$). Change in R^2 was non-significant ($p > .05$) between all models. These results are similar to those found in the previous analyses without Race as a covariate, which suggests that adding Race to the models predicting physical activity does not significantly change our initial findings. In predicting GLS, all four models revealed non-significant results ($p > 0.05$), which is similar to previous findings. These results are similar to those found in the previous analyses without Race as a covariate, which suggests that adding Race to the models predicting general life satisfaction does not significantly change our initial findings.

The FNT validation regressions from hypothesis 3 were also repeated using Race as the first predictor and revealed similar results in predicting IPAQ and GLS. All four models using FNT Encoding RT as the memory variable did not significantly predict IPAQ ($p > 0.05$). These results are similar to those found in previous analyses without Race as a covariate, which suggests that adding Race to the models predicting physical activity does not significantly change our initial findings. All four models using FNT Recall RT as the memory variable did not significantly predict IPAQ ($p > 0.05$). These results are similar to those found in previous analyses without Race as a covariate, which suggests that adding Race to the models predicting physical activity does not significantly change our initial findings. All four models using FNT Encoding RT as the memory variable did not significantly predict GLS ($p > 0.05$). These results are similar to those found in the previous analyses without Race as a covariate, which suggests that adding Race to the models predicting general life satisfaction does not significantly change our initial findings. All four models using FNT Recall RT as the memory variable did not significantly predict GLS ($p > 0.05$). These results are similar to those found in the previous

analyses without Race as a covariate, which suggests that adding Race to the models predicting general life satisfaction does not significantly change our initial findings.

Clinical measures

To determine if the non-significant results in the a priori determined analyses could be due to the use of non-standardized or normed in-scanner cognitive tasks that are more research oriented, we chose to conduct analyses from hypothesis 1 and 2 using more clinically relevant measures in assessing MCI, including Trails A, Trails B, and RAVLT.

A one-tail independent samples t-test revealed a significant difference between groups on Trails A performance in the expected direction, with the pMCI group demonstrating slower processing speed, ($t(152.39) = -4.99$, $p < .001$). The effect size, Cohen's d, was found to be 0.79, indicating a medium to large effect size. The 95% confidence interval for the mean difference ranged from -Inf to -5.15. A one-tail independent samples t-test revealed a significant difference between groups on Trails B performance in the expected direction, with the pMCI group demonstrating slower processing speed requiring executive functioning, ($t(112.11) = -8.74$, $p < .001$). The effect size, Cohen's d, was found to be 1.39, indicating a large effect size. The 95% confidence interval for the mean difference ranged from -Inf to -34.86. A one-tail independent samples t-test using revealed a significant difference between groups on RAVLT performance in the expected direction, with the pMCI group demonstrating worse delayed memory, ($t(155.99) = 3.96$, $p < .001$). The effect size, Cohen's d, was found to be -0.63, indicating a medium effect size. The 95% confidence interval for the mean difference ranged from 4.62 to Inf. The results suggest that there is a statistically significant difference in the mean scores between pMCI and HC on Trails A, Trails B, and RAVLT. pMCI performed worse on all three measures, as expected.

The first regression model including Trails A significantly predicted the dependent variable of IPAQ, when covarying for BP and Group (adjusted $R^2 = 0.03$, $F(4, 153) = 2.42$, $p < .05$), indicating that 3% of the variability in IPAQ was explained by the model. However, Trails A, Group, nor the interaction of the two exhibited a significant contribution to this effect, revealing that BP was the only contributor. Regression coefficients indicated that Trails A ($\beta = 0.01$, $SE = 0.18$, $t(152) = 4.45$, $p = .488$), Group ($\beta = -7.0$, $SE = 8.35$, $t(152) = -0.84$, $p = .202$), and the interaction of Trails A x Group ($\beta = 0.15$, $SE = 0.25$, $t(152) = 0.63$, $p = .266$). While BP ($\beta = -0.23$, $SE = 0.08$, $t(152) = -2.92$, $p < .01$) was significantly associated with IPAQ. The second regression model of Trails A did not significantly predict the dependent variable of GLS covarying Group (adjusted $R^2 = -0.00$, $F (3, 154) = 0.80$, $p = .248$), indicating that the variability in GLS between groups was not explained by the model. The results suggest that basic processing speed does not significantly predict IPAQ or GLS in either group.

The first regression model of Trails B significantly predicted the dependent variable of IPAQ, when covarying for BP and Group (adjusted $R^2 = 0.05$, $F (4, 153) = 2.94$, $p < .05$), indicating that 5% of the variability in IPAQ was explained by the model. However, Trails B, Group, nor the interaction of the two exhibited a significant contribution to this effect, revealing that BP was the only contributor. Regression coefficients indicated that Trails B ($\beta = -0.01$, $SE = 0.07$, $t(152) = -0.10$, $p = .459$) and the interaction of Trails B x Group ($\beta = 0.09$, $SE = 0.09$, $t(152) = 1.08$, $p = .142$) were not significantly associated with IPAQ. Group ($\beta = -10.62$, $SE = 7.32$, $t(152) = -1.45$, $p = .075$) was nearly significantly associated with IPAQ and BP ($\beta = -0.24$, $SE = 0.08$, $t(152) = -3.02$, $p < .01$) was significantly associated with IPAQ. The second regression model of Trails B did not significantly predict the dependent variable of GLS covarying Group (adjusted $R^2 = -0.01$, $F (3, 154) = 0.55$, $p = .324$), indicating that the variability

in GLS between groups was not explained by Trails B. The results suggest that a task of cognitive flexibility (i.e., executive function and processing speed) dos not significantly predict IPAQ or GLS in either group.

The first regression model of RAVLT significantly predicted the dependent variable of IPAQ, when covarying for BP and Group (adjusted $R^2 = 0.04$, $F(4, 153) = 2.50$, $p < .05$), indicating that 4% of the variability in IPAQ was explained by the model. However, RAVLT, Group, nor the interaction of the two exhibited a significant contribution to this effect, revealing that BP was the only contributor. Regression coefficients indicated that RAVLT ($\beta = -0.01$, $SE = 0.14$, $t(152) = -0.05$, $p = .479$), Group ($\beta = 5.63$, $SE = 10.78$, $t(152) = 0.52$, $p = .301$), and the interaction of RAVLT x Group ($\beta = -0.14$, $SE = 0.20$, $t(152) = -0.73$, $p = .233$) were not significantly associated with IPAQ. While BP ($\beta = -0.23$, $SE = 0.08$, $t(152) = -2.94$, $p < .01$) was significantly associated with IPAQ. The second regression model of RAVLT did not significantly predict the dependent variable of GLS covarying Group (adjusted $R^2 = -0.00$, $F(3, 154) = 0.98$, $p = .203$), indicating that the variability in GLS between groups was not explained by RAVLT. The results suggest that a task of delayed memory does not significantly predict IPAQ or GLS.

Blood Pressure

In examining the results of the main analyses, BP seems to be driving a substantial amount of the significance in predicting the dependent variables. Therefore, in attempting to better understand the role of BP in our analyses, we conducted the same analyses from hypothesis 1 and 2 using just BP. We found a statistically significant group difference between HC and pMCI, in that pMCI group had higher BP ($t(153.42) = -1.97$, $p < .05$). The effect size,

Cohen's d, was found to be 0.31, indicating a medium effect size. The 95% confidence interval for the mean difference ranged from -Inf to -0.80.

The regression models revealed that BP does predict IPAQ when covarying for group. The first regression model of BP significantly predicted the dependent variable of IPAQ, when covarying for Group (adjusted $R^2 = 0.05$, $F(3, 154) = 3.99$, $p < .01$), indicating that 5% of the variability in IPAQ was explained by the model. Regression coefficients indicated that Group ($\beta = -36.58$, $SE = 20.55$, $t(152) = -1.78$, $p = .077$) and the interaction of BP x Group ($\beta = 0.27$, $SE = 0.15$, $t(152) = 1.72$, $p = .087$) were nearly significantly associated with IPAQ, while BP ($\beta = -0.37$, $SE = 0.12$, $t(152) = -3.17$, $p < .01$) was significantly associated with IPAQ. Group and BP had negative relationships with IPAQ, while the interaction of Group x BP had a positive relationship. When these regressions were repeated on each group separately, the pMCI group model was not significant ($p > .05$), but the HC group model was significant (adjusted $R^2 = 0.12$, $F(1, 77) = 12.06$, $p < .001$). Based on the results, we conclude that BP does significantly predict IPAQ, but only in the HC group. This suggests that lower levels of BP are significant predictors of higher levels of physical activity.

The second regression model of BP did not significantly predict the dependent variable of GLS ($p > .05$), indicating that the variability in GLS between groups was not explained by the model. However, the ME of BP was nearly significantly associated with GLS ($\beta = 0.13$, $SE = 0.08$, $t(152) = 1.69$, $p = .094$). When these regressions were repeated on each group separately, the pMCI group model was not significant ($p > .05$), but the HC group model was significant (adjusted $R^2 = 0.02$, $F(1, 77) = 2.79$, $p < .05$). Based on the results, we conclude that BP does significantly predict GLS, but only in the HC group. This suggests that lower levels of BP are significant predictors of higher levels of life satisfaction.

CHAPTER 4

DISCUSSION

In the current study, we utilized a sample of "healthy" subjects from the HCP-Aging project and identified those who have probable MCI, based on a screening measure (i.e., MoCA) with conservative cutoffs of 23 and below. We then matched healthy controls (i.e., MoCA scores 26 and above) based on age, sex, race, ethnicity, and education. We tested the associations among impulsivity, episodic memory, physical activity, and general life satisfaction in these samples. Specifically, we evaluated whether group differences in cognitive functioning (i.e., GNG FA, FNT RA) would predict concurrent assessments of function typically used in outcomes research (i.e., IPAQ, GLS), as well as whether either cognitive domain better predicted the functional better than the other.

There were three main findings of this study. The first was evidence of significant group differences on both cognitive tasks, with the pMCI group performing worse, as expected. Second, the cognitive tasks did not significantly predict physical functioning or general life satisfaction; however, lower BP was found to significantly predict higher physical activity in the HC group. Third, the cognitive tasks did not significantly predict the functional dependent variables (i.e., IPAQ, GLS) in a hierarchical regression. However, it was determined that their predictive utility for physical activity depended upon the level of the other (i.e., obscured by a statistical interaction). Below we discuss these findings in greater detail, connecting them with the extant literature, and discuss limitations and future directions.

Specific hypotheses and integration of findings

The first hypothesis that participants in the pMCI group would show greater impairments in cognitive functioning compared to the HC group was supported. The pMCI group demonstrated significantly worse performance on tasks requiring inhibitory processing and episodic memory accuracy. It was concluded that this finding supports the validity of our pMCI operational definition. As is well known in the MCI literature, it is common for groups with MCI to demonstrate deficits in episodic memory and inhibitory processes beyond what would be expected with the typical aging processes (Collie et al., 2001; Dwolatzky et al., 2003; Geda et al., 2014; Golimstok et al., 2013; Nordhal et al., 2005). Within these two measures of cognition, the pMCI group demonstrated a larger effect size in association with episodic memory accuracy compared to HC. Although function in both domains appear to be implicated, these findings raise the possibility of stronger amnestic profile than a dysexecutive one within this pMCI group that may impact external validity. Of the two subtypes of MCI, the amnestic profile or MCIa is typically characterized by predominate memory specific impairments, especially in relation to episodic memory, which is more frequently early associated with AD (Clark et al., 2013; Fleisher et al., 2007; Jungwirth et al., 2012; Libon et al., 2010; Marra et al., 2011; Whitwell et al., 2008).

The FNT RT measures were examined to explore convergent validity. They showed that, while Encoding RT between groups did not differ, their Recall RT did significantly differ. This suggests that the groups learned the information at similar rates, but that the pMCI group required more time to recall previously learned information. These results are consistent with the extant literature, which predominantly reports that MCI groups show significantly slower reaction times compared to healthy control groups (Andriuta et al., 2019). The literature also

posits that groups of individuals with clinically presenting MCI, exhibit a slower learning rate, particularly of associative memories (Wang et al., 2013).

One possible reason why our findings replicate prior retrieval but not the encoding effects could be that our pMCI group, as operationally defined, may not be as cognitively impaired as a clinically diagnosed MCI group (i.e., valid grouping, but with smaller effect sizes than a clinical sample). Nevertheless, because the pMCI group in the current study was operationally defined based on a clinically validated screening measure (i.e., MoCA) from a subject pool of "healthy controls", this partial replication, along with support for our first set of hypotheses, underscore the clinical utility of this screening measure for early detection in typical health care settings. Earlier detection of such cognitive deficits that are associated with underlying disease processes (e.g., AD) enables earlier treatment and remediation. The ability to catch disease processes earlier has been shown to have greater impacts on slowing the disease process, even preventing further decline, avoiding secondary emotional problems and caregiver burden (Leifer, B.P. 2003; Sherman et al., 2017).

The second hypothesis that the significant cognitive differences in the pMCI group compared to the HC group would lead to better predictive associations with the IPAQ and GLS functional dependent variables was not supported by our findings. Neither impulsivity, as measured by GNG FA, or episodic memory, as measured by FNT RA, significantly predicted measures of physical activity or general life satisfaction. In attempting to determine why some of the overall models were found to be significant or nearly significant, we looked to the main effects within the models. These results revealed that, while the main effects of impulsivity and episodic memory were not significant predictors of physical activity and general life satisfaction, BP was the main driver for the significant or nearly significant models of physical activity. In

attempting to better understand this implication, we repeated prior analyses using just BP, which revealed a significant effect of BP in the HC group and not in the pMCI group. This suggests that, while the cognitive tasks of impulsivity and episodic memory did not predict functional dependent variables, lower BP predicts higher physical activity in a group that does not exhibit deficits in these domains. In terms of the BP findings, the literature shows that increased physical activity is a major contributor to maintaining healthy levels of blood pressure (Kokkinos et al., 2009). The literature also suggests that typically, individuals with clinical MCI show abnormal levels of BP whether that's hypertension (i.e., high BP) or hypotension (i.e., low BP) (Hestad et al., 2020).

The extant literature posits a significant positive relationship between physical activity and cognition, so much so that physical activity has become a major lifestyle focus of cognitive rehabilitation of individuals with MCI and dementia (Falck et al., 2017; Laurin et al., 2001; Lautenschlager et al., 2022). The extent literature also presents evidence of a strong positive relationship between general life satisfaction and cognition, particularly as a strong risk factor of the progression from MCI to dementia (Mank et al., 2022; Peitch et al., 2016; Zhu et al., 2022). Therefore, the findings from our second set of hypotheses also suggests that our sample of probable MCI were not cognitively impaired enough to exhibit predicted relationships with physical activity or general life satisfaction. This conclusion is consistent with the parent study determining all participants to be "healthy" and the current study grouping based on a screening measure. In addition, we found that group differences in the functional dependent variables revealed no significant group differences.

The main regressions of hypothesis 2 were repeated replacing episodic memory accuracy with episodic memory RT to explore convergent validity. These revealed significant main effects

in predicting physical activity, but not general life satisfaction. However, neither of the interactions between group and RT were significant. The FNT Encoding RT significant ME in predicting physical activity, but not when group was involved suggests that the measure itself might be a good predictor of IPAQ because as discussed previously, there were no significant group differences for this measure, so it is within expectations for the group variable to diminish the significance of this relationship. The findings from the FNT Recall RT suggest that this measure might also be a good predictor of IPAQ; however, the groups within the current sample may not have differed enough on their RT in the task to significantly add to this relationship. Extant literature provides evidence for a positive relationship between reaction time and physical activity, so it is possible that what is being accounted for in these findings is this relationship between reaction time and physical activity (Hunter, Thompson, & Adamns 2001).

The third hypothesis that impulsivity deficits would better predict physical activity and episodic memory deficits would better predict general life satisfaction in the pMCI group was not supported. All three models of the hierarchical regressions for both physical activity and general life satisfaction were not significant. However, in the physical activity regressions, the change in R^2 from adding the interaction of both cognitive measures did significantly improve the model fit. These findings are consistent with extant literature that suggests considering multiple domains of cognition, not only in determining clinical presence of MCI, but also in predicting functional dependent variables (Glynn et al., 2021; Gurja et al., 2022). To better understand these findings, we repeated the analyses in the HC group. In predicting physical activity, none of the models were significant. In predicting general life satisfaction, only the interaction term of both cognitive measures significantly improved the model fit. These findings continue to underscore the importance of considering multiple domains in assessing relationships

between cognition and functional dependent variables. We also repeated these analyses using all subjects, without controlling for group, to determine if sample size was an issue in finding effects. All models for both physical activity and general life satisfaction were not significant. These findings suggest that the difficulties in seeing effects might not have been due to sample size issues.

Additional exploratory analyses were conducted to determine if SES or Race may have confounded the results. There was no significant difference between groups on SES, suggesting that this was likely not a confounding variable in the previous analyses. Nevertheless, this was examined because extant literature suggests a significant relationship between low SES and cognitive decline beyond what is expected (e.g., MCI, dementia), and that higher SES has been shown to be one of the many protective factors against progression of cognitive decline (Fernández-Blázquez et al., 2021; Koster et al., 2005). While there was a significant difference between groups on the binary variable of Race (i.e., White vs Non-White), repeated regressions with Race as a covariate did not change the pattern of results seen in the main analyses. This suggests that Race was likely not a confounding variable in the previous analyses.

Finally, we repeated hypothesis 1 and 2 with three different reliable and valid clinical cognitive measures (i.e., Trails A & B, RAVLT), to explore whether the cognitive measures used in the main analyses were just not clinically sensitive or specific enough. All three measures were significantly different between groups, specifically, the pMCI group performed worse. However, none of the measures significantly predicted IPAQ or GLS when hypothesis 2 analyses were repeated. These results suggest that while the pMCI group continues to perform worse on cognitive measures, even when using traditionally clinical measures, their cognitive functioning does not predict these functional dependent variables of physical activity and general life

satisfaction. This further supports our conclusions that the pMCI group may not be experiencing enough deficit to drive an association between cognition functioning and functional dependent variables. This also suggests that the results from our main findings are likely not due to a limitation of using fMRI cognitive paradigms instead of traditional clinical measures.

Limitations

Despite a strong methodological data collection and individual matching procedure, there were some limitations that should be considered. In consideration of the current study's findings, several limitations are important to note. First, the sample size was limited which could have impacted our findings. While we conducted exploratory analyses to determine if sample size was an issue for the hierarchical regressions showing that even with double the sample size results continued to show non-significance, the doubled samples size could still have been too small to detect effects. Second, while the pMCI group was determined based on a widely used and well validated clinical screening measure (i.e., MoCA) that has been shown to be sensitive and specific, clinical MCI is ideally determined utilizing a full neuropsychological battery and interview. In best clinical practice, the MoCA is not used alone for diagnostic purposes, but requires follow-up with more in depth evaluation. It is likely that while the MoCA was able to pick up on group differences in cognition behaviorally, the deficits seen in the pMCI group may not have been strong enough that would concur a clinical determination of the syndrome as they were not exhibiting functional deficits. This could explain, at least in part, why the cognitive differences between groups did not produce the predicted significant associations with the functional dependent variables. Third, the main cognitive measures (i.e., GNG and FNT) are widely used in research, particularly in fMRI research, but are not standard clinical measures with population norms used in the determination of MCI. In addition, the GNG task is meant to

be an oddball task; however, the task used in the current study produces included more NoGo runs than typically administered in a clinical setting (e.g., Conner's Continuous Performance Test), which might undermine the oddball task (Folsom & Levin, 2021; Shaked et al., 2019). As such, these measures may not have been the most sensitive or specific behavioral markers of impairment in individuals with probable MCI. This limitation is important in considering the findings that showed limited significant associations of cognitive performance predicting functional dependent variables of physical activity and general life satisfaction. With this in mind, we did conduct the main analyses using well validated clinical measures of similar domains which showed similar findings as the imaging paradigms. Lastly, the functional dependent variables of physical activity and general life satisfaction were likely not the best dependent measures for assessing group differences because the group differences in the variables were non-significant. Combined with the first and second limitation, it is likely that the group differences in both cognitive function and functional dependent variables were not strong enough to determine significant results from our analyses.

Conclusions and future directions

Despite these limitations, the current study's findings contribute to the extant literature and considerations for future research. Using a cross-sectional, between subjects design, we examined the effects of cognitive functioning, in terms of impulsivity and episodic memory, differences between a group of probable MCI individuals and a group of healthy individuals, as well as investigating the associations between cognitive functioning and functional dependent variables of physical activity and general life satisfaction. In conclusion, the findings of the current study highlight the importance of utilizing sensitive and specific screening measure to detect cognitive deficits early on and the relationship between high blood pressure and high

levels of physical activity in healthy individuals. Group differences in cognitive functioning across both behavioral fMRI paradigms and standard clinical measures illustrate the significance of evaluating individuals' cognitive functioning earlier in life, especially those who present as "healthy". Future investigation would benefit from including a third group of clinically determined MCI individuals to compare to pMCI and HC. Additionally, future investigation should examine neurological markers of cognitive impairment in the pMCI group compared to the HC group, as the extant literature suggests that brain-based changes appear earlier in the disease processes than behavioral changes (Sperling et al., 2011). This would be important to examine in relation to the cognitive measures because it could provide insight as to how the disease progresses and presents in earlier stage pMCI individuals. Overall, having a better understanding of areas of early decline in the MCI/dementia disease process would be beneficial in progressing techniques and recommendations for early intervention.

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TABLES

Table 1

Sample characteristics by group after individually matching age, sex, education, race, and ethnicity.

	HC (n=79)	pMCI (n=79)	T / $\chi 2$	Significance (p)
Mean Age (SD)	62.46 (14.42)	65.67 (16.46)	1.30	.19
Female (%)	46.84	41.77	0.41	.52
Mean Education (SD)	16.95 (2.58)	16.59 (2.28)	0.93	.35
Race (%)				
American Indian/Alaska Native	0.00	1.27	1.00	.32
Asian	5.06	3.80	0.15	.70
Black or African American	13.92	24.05	2.62	.11
More than one	1.27	2.53	0.33	.56
Unknown or not reported	5.06	8.86	0.88	.35
White	74.68	59.49	4.10	**.04**
Ethnic Group (%)				
Hispanic or Latino	13.92	18.99	0.73	.39
Not Hispanic or Latino	84.81	79.75	0.69	.41
Unknown or not reported	1.27	1.27	0.00	1.00
Mean MoCA total score (SD)	27.77 (1.29)	21.92 (1.06)	31.14	**<.01**

Table 2

Summary of balance matched variables before and after matching.

	Standard Mean Difference	Variability Ratio	eCDF mean
		Un-Matched Data	
Distance	0.98	3.10	0.30
Age	0.70	1.59	0.21
Sex			
Female	-0.39	-	0.20
Male	0.39	-	0.20
Education	-0.58	1.31	0.11
Race			
American Indian/Alaska Native	0.11	-	0.01
Asian	-0.31	-	0.06
Black or African American	0.32	-	0.14
More than one race	-0.15	-	0.02
Unknown or not reported	0.26	-	0.07
White	-0.29	-	0.14
Ethnic Group			
Hispanic or Latino	0.25	-	0.10
Not Hispanic or Latino	-0.26	-	0.11
Unknown or not reported	0.08	-	0.01
		Matched Data	
Distance	0.41	2.22	0.06
Age	0.20	1.30	0.05
Sex			
Female	-0.10	-	0.05
Male	0.10	-	0.05
Education	-0.16	0.78	0.05
Race			
American Indian/Alaska Native	0.11	-	0.01
Asian	-0.07	-	0.01
Black or African American	0.24	-	0.10
More than one race	0.08	-	0.01
Unknown or not reported	0.13	-	0.03
White	-0.31	-	0.15
Ethnic Group			
Hispanic or Latino	0.13	-	0.05
Not Hispanic or Latino	-0.13	-	0.05
Unknown or not reported	0.00	-	0.00

Table 3

Summary of variables used in analyses.

Variable	HC (n=79)	pMCI (n=79)	T	P-value
MoCA	27.77 (1.29)	21.92 (1.06)	31.13	**< .001**
FNT RA	5.81 (2.74)	1.47 (0.61)	13.72	**< .001**
GNG FA	1.35 (0.46)	1.48 (0.54)	-1.26	**.05**
Encoding RT	1485 (689.80)	1496 (900.80)	-0.09	.47
Recall RT	1291 (534.4)	1475 (569.80)	-2.09	**< .05**
IPAQ	21.75 (15.36)	19.24 (16.47)	0.99	.16
GLS	49.34 (10.64)	48.51 (10.12)	0.51	.31
BP	129.40 (14.92)	134.50 (17)	-1.97	**< .05**
SES*	10.23 (0.72)	10.14 (0.60)	0.70	.48
Race** (% White)	74.68	59.49	-2.05	**< .05**
Trails A	28.26 (8.92)	35.96 (10.42)	-4.99	**< .001**
Trails B	61.33 (18.92)	104.30 (39.43)	-8.74	**< .001**
RAVLT	57.57 (12.56)	49.63 (12.64)	3.96	**< .001**

Note: MoCA (Montreal Cognitive Assessment), FNT RA (FNT Recognition Accuracy), GNG FA (GNG False Alarms), Encoding RT (FNT Encoding RT), Recall RT (FNT Recall RT), IPAQ (International Physical Activity Questionnaire), GLS (PROMIS General Life Satisfaction), BP (Systolic sitting blood pressure), SES (Social Economic Status), Trails A (Trail Making Test A), Trails B (Trail Making Test B), RAVLT (Rey Auditory Verbal Learning Test, Short Delay)

*SES: based on smaller sample of 55 HC and 55 pMCI.

**Race: % White, based on White and Non-White coding.

Table 4

Bivariate zero order correlations of the data used in the primary analyses.

	Group	MoCA	GLS	Encoding RT	Recall RT	FNT RA	GNG FA	IPAQ	BP
Group	1								
MoCA	-0.93***	1							
GLS	-0.04	-0.02	1						
Encoding RT	0.01	-0.03	0.09	1					
Recall RT	0.17*	-0.17*	-0.02	0.30***	1				
FNT RA	-0.74***	0.65***	0.06	0.06	-0.01	1			
GNG FA	0.13	-0.14	0.02	-0.05	-0.02	-0.08	1		
IPAQ	-0.08	0.06	-0.01	0.14	0.05	0.03	-0.00	1	
BP	0.15	-0.15	0.12	0.00	0.14	-0.10	0.18*	-0.23**	1

Note: Group (Healthy Controls-0, MCI-1), MoCA (Montreal Cognitive Assessment), GLS (PROMIS General Life Satisfaction), Encoding RT (FNT Encoding RT), Recall RT (FNT Recall RT), FNT RA (FNT Recognition Accuracy), GNG FA (GNG False Alarms), IPAQ (International Physical Activity Questionnaire), BP (Systolic sitting blood pressure).

*p < .05, **p < .01, ***p < .001

Table 5

Bivariate zero order correlations of the data used in the exploratory analyses.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Group	1												
2. MoCA	-0.93***	1											
3. GLS	-0.04	-0.02	1										
4. Encoding RT	0.01	-0.03	0.09	1									
5. Recall RT	0.17*	-0.17*	-0.02	0.30***	1								
6. Race	0.16*	-0.18*	-0.09	0.05	0.04	1							
7. FNT RA	-0.74***	0.65***	0.06	0.06	-0.01	-0.14	1						
8. GNG Fa	0.13	-0.14	0.02	-0.05	-0.02	0.14	-0.08	1					
9. IPAQ	-0.08	0.06	-0.01	0.14	0.05	-0.07	0.03	-0.00	1				
10. BP	0.15	-0.15	0.12	0.00	0.14	-0.05	-0.10	0.18*	-0.23**	1			
11. Trails A	0.32***	-0.32***	-0.06	0.10	0.30***	0.08	-0.22**	0.21**	-0.01	0.18*	1		
12, Trails B	0.52***	-0.53***	0.06	0.07	0.40***	0.23**	-0.35***	0.17*	0.01	0.22**	0.59***	1	
13. RAVLT	-0.29***	0.34***	-0.11	-0.11	-0.28***	-0.16	0.23**	-0.17*	0.01	-0.22**	-0.29***	-0.40***	1

Note: Group (Healthy Controls-0, MCI-1), MoCA (Montreal Cognitive Assessment), GLS (PROMIS General Life Satisfaction), Encoding RT (FNT Encoding RT), Recall RT (FNT Recall RT), Race (based on White vs Non-White coding), FNT RA (FNT Recognition Accuracy), GNG FA (GNG False Alarms), IPAQ (International Physical Activity Questionnaire), BP (Systolic sitting blood pressure), Trails A (Trail Making Test A), Trails B (Trail Making Test B), RAVLT (Rey Auditory Verbal Learning Test, Short Delay)

*p < .05, **p < .01, ***p < .001

FIGURES

Figure 1

Hypothesis 2. Lower cognitive performance will predict worse functional variables (physical activity and life satisfaction). This relationship will be stronger for those in the MCI group than in the HC group.

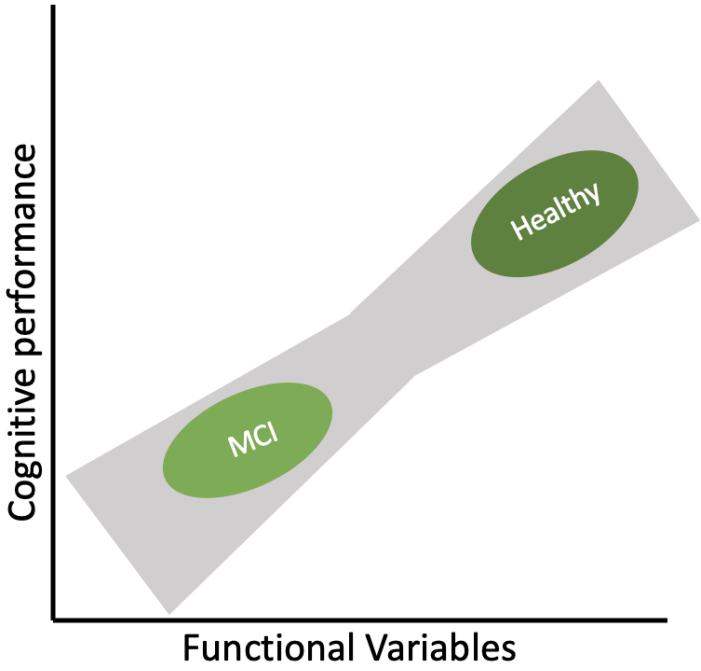

Figure 2

Hypothesis 3. One cognitive domain will better predict functional variables than the other, in a stepwise regression. The interaction of the two cognitive domains will be the best predictor of functional variables.