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Mild Cognitive Impairment is Associated with PoorerDecision Making in Community-Based Older Persons

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Abstract

Background/Objectives—Financial and healthcare decision making are important for maintaining wellbeing and independence in old age. We tested the hypothesis that Mild Cognitive Impairment (MCI) is associated with poorer decision making in financial and healthcare matters.

Design—Community-based epidemiologic cohort study.

Setting—Communities throughout Northeastern Illinois.

Participants—Participants were 730 older nondemented persons from the Rush Memory and Aging Project.

Measurements—All participants underwent a detailed clinical evaluation and decision making assessment using a measure that closely approximates materials utilized in real world financial and healthcare settings. This allowed for measurement of total decision making, as well as financial and healthcare decision making. Regression models were used to examine whether the presence of MCI was associated with a lower level of decision making. In subsequent analyses, we explored the relation of specific cognitive systems (i.e., episodic memory, semantic memory, working memory, perceptual speed, and visuospatial ability) with decision making in those with MCI.

Results—Results showed that MCI was associated with lower decision making total scores as well as financial and healthcare scores, respectively, after accounting for the effects of age, education, and sex. The effect of MCI on total decision making was equivalent to the effect of

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more than 10 additional years of age. Additional models showed that when considering multiple cognitive systems, perceptual speed accounted for the most variance in decision making among participants with MCI.

Conclusion—Results suggest that persons with MCI may exhibit poorer financial and healthcare decision making in real world situations, and that perceptual speed may be an important contributor to poorer decision making among persons with MCI.

Keywords

decision making; cognition; mild cognitive impairment; perceptual speed

INTRODUCTION

Decision making is a complex process that involves the ability to generate and evaluate multiple potential alternatives to select an optimal choice. Decision making is of particular relevance to older adults, who face important decisions regarding financial matters such as intergenerational transfers of wealth and appropriation of retirement and pension funds. Older adults also face important decisions regarding healthcare matters such as choosing the best medical insurance plan among multiple competing options and selection of end-of-life medical approaches. These real world decisions can have a significant impact on maintaining independence and wellbeing among older adults themselves and also can have a profound impact on family members, care providers, and society. Further, there is increasing evidence that older persons exhibit poorer decision making compared to younger or middle age adults[1,2], but the reasons why are poorly understood. Because of this, the study of decision making in old age is an important public health issue.

Although it is widely recognized that decision making is impaired in older adults with overt dementia[3,4], relatively little is known about decision making among persons with mild cognitive impairment (MCI), which often represents a preclinical phase of dementia. Prior work has shown that MCI is associated with diminished capacity to complete specific concrete activities related to monetary exchange (e.g., counting money, writing a check[5,6]) and reduced appreciation and understanding of consent materials for medical treatment[7-9]. However, we are not aware of prior studies that have examined whether MCI is associated with poorer decision making on common real world financial and healthcare choices that older persons routinely face and that are critical for maintaining independence and wellbeing in old age. We used data from the Rush Memory and Aging Project, a community-based epidemiologic study of chronic conditions of old age, to test the hypothesis that MCI is associated with reduced financial and healthcare decision making among community-based older persons. We also explored how the severity and type of cognitive impairment affected decision making among those with MCI.

METHODS

Participants

Participants came from the Rush Memory and Aging Project, a clinical-pathologic study of aging and dementia[10]. Participants are from local residential facilities, including retirement homes, senior housing facilities, and community organizations in and around the greater Chicago metropolitan area and undergo detailed annual clinical evaluations[10].

The Rush Memory and Aging Project began in 1997, and enrollment is ongoing. A decisionmaking substudy was added in 2010. At the time of these analyses, 1671 participants had completed the baseline evaluation for the parent study; of those, 564 died and 83 refused further participation in the parent project before they were able to complete the baseline decision making assessment. Of the remaining 1,024potentially eligible persons, 802 completed the decision making baseline, 71 had not yet completed the decision making baseline, 53 refused the decision making assessment, and 98 were not asked to participate due to severe difficulties with language, hearing, vision or understanding, or having moved out of the geographical area. Of the 802 participants who had completed the decision making assessment, 41 had dementia and were excluded, and 31 had missing data in the variables of interest, leaving 730 eligible for these analyses.

Clinical Diagnoses

Diagnoses of dementia were determined in accordance with standard criteria[11]by a clinician with expertise in aging as previously described[10]. Participants with cognitive impairment but no dementia were deemed to have MCI. This diagnosticcharacterization of MCI has been used in multiple prior studies[12,13].Clinicians were shielded from the results of the assessment of decision making in order to examine the relation of decision making to cognition.

Assessment of Financial and Healthcare Decision Making

Decision making was measured using a modified performance based measure specifically designed to represent actual decisions older adults must make for independence and wellbeing[14,15]. The measure included 6 items measuring financial decision making and 6 items measuring healthcare decision making for a total of 12 items; these have been described in detail elsewhere[14,16]. The items involve choosing between mutual funds (financial) and HMOs (healthcare) based on a number of pre-specified preferences. The items are of varying levels of difficulty. The total decisionmaking score is the number of items answeredcorrectly (range = 0–12). In previous research, this measure has been shown to have appropriate psychometric properties including high inter-rater reliability andshort-term temporal stability[14,15].Our group has previously reported performance on the items used here are associated with cognition[17], personality (i.e., risk aversion preferences[16]), financial and healthcare literacy[18], and risk of mortality[19] in older adults without dementia.

Assessment of Cognition—A battery of 21 cognitive performance tests was administered by trained technicians supervised by a board-certified clinical neuropsychologist. Measures of cognitive function assessed a broad range of cognitive abilities[10,20]. Two of the 21 tests, the Mini-Mental Status Examination and the Complex Ideational Material, are used for descriptive and clinical diagnostic purposes only. Raw scores on the remaining 19 tests were converted to z-scores using the mean and standard deviation from the baseline evaluation. A global cognition score was calculated by averaging the z-scores across these 19 measures of cognitive function as previously reported[21]. Episodic memory measures included Word List Memory, Word List Recall and Word List Recognition from the procedures established by the CERAD; and immediate and delayed recall of Logical Memory Story A and the East Boston Story. Semantic memory measures included Verbal Fluency, Boston Naming, subsets of items from Complex Ideational Material, and the National Adult Reading Test. Working memory measures included the Digit Span subtests (forward and backward) of the Wechsler Memory Scale-Revised and Digit Ordering. Measures of perceptual speed included the oral version of the Symbol Digit Modalities Test, Number Comparison, Stroop Color Naming, and Stroop Word Reading. Measures of visuospatial ability included Judgment of Line Orientation and Standard Progressive Matrices. A composite score for five cognitive systems (episodic memory, semantic memory, working memory, perceptual speed, visuospatial ability) was created by averaging the z-scores of all measures within a system, as previously reported[21].

Other Covariates—Age (based on date of birth and date of decision making assessment), sex, and education (years of schooling) were self-reported and included as covariates.

Ethical Statement

All procedureswere conductedin accordance with the ethical rules for human experimentation that are stated in the Declaration of Helsinki and were approved by the Institutional Review Board of Rush University Medical Center.

Statistical Analyses

Descriptive and bivariate statistics characterized the two groups (MCI and non-cognitively impaired). Chi-square tests were used for categorical variables and t-tests were used for continuous variables. For the t-tests, if variances were found to be different between groups, the Satterthwaite variance estimate was reported instead of the Pooled variance estimate. Linear regression models were then performed to examine the associations between MCI and decision making (total, financial, and health); persons without any cognitive impairment were the reference group. All models included terms to control for the potentially confounding effects of age, education, and sex. Next, a series of linear regression models were conducted only in MCI individuals to explore the associations between functioning in global cognition and decision making, and the five cognitive systems (episodic memory, semantic memory, working memory, perceptual speed, and visuospatial ability) and decision making. Analyses were conducted in SAS version 9.3 software.

RESULTS

Descriptive Statistics

The mean age was 81.75 years (SD = 7.63; range: 58.81–100.78), the mean education was 15.22 years (SD = 3.08; range: 0–28), 75.75% were women, and 91.92% were White and non-Hispanic. As shown in Table 1, participants with MCI were older on average and performed lower on global cognition. Participants diagnosed with MCI performed significantly lower on total decision making as well as financial and healthcare decision makingcompared to persons with no cognitive impairment (NCI) in all five systems of cognitive function.An analysis of responses to each individual item on the decision making measure showed that MCI participants scored lower on each item than NCI participants. The difference in performances between groups on each individual item ranged from 7.70% to 16.88% with a mean of 12.87% (SD=3.48%).

Relation of MCI to Decision Making

First, to examine whether MCI was associated with lower decision making, we conducted a set of linear regression models that examined the relation of MCI with decision making; these and all subsequent analyses controlled for age, education, and sex. As shown in Table 2, the presence of MCI was associated with lower total, financial, and healthcare decision making scores. To clarify this effect, the magnitude of the association of MCI on total decision making was equivalent to the effect of more than 10 additional years of age. Interaction terms between MCI and age, education, and sex were included in subsequent models, but no significant interactions were observed.

We conducted additional analyses to further characterize how MCI participants were performing relative to participants without MCI. We first determined the score that represented 1.5 standard deviations below the mean score on the decision making measure among the participants without MCI, and used this cutoff to create binary decision making measures. We next determined the median score on the decision making measure in participants without MCI, and then created a second binary decision making measure using the median split cutoff. The distributions of these binary measures by MCI diagnosis are presented in Table 3. Chi-square statistics revealed that a higher proportion of MCI participants had total decision making scores below each of these cutoffs ($p<0.01$). These associations remained significant in logistic regression models adjusted for age, education, and sex ($p<0.05$). The results of these models are presented in an Appendix (Table A1). These additional models support the notion that MCI is associated with statistically different decision making performances. However, it is unclear whether these statistically lower performances constitute “impaired” performances as normative data are not available for the decision making measure. Nevertheless, we think these differences may have meaningful real world implications with respect to decision making in MCI and suggest that persons with mild forms of cognitive impairment may benefit from strategies to optimize decision making.

Relation of Specific Cognitive Abilities withDecision Making Among Persons with MCI

Given that the clinical diagnosis of MCI was associated with poorerdecision making, we next examined the relation of the severity of cognitive impairment with decision making. Results from a series of linear regression models examining the relation between global cognition and decision making among participants with MCI are presented in Table 4. Global cognition was strongly associated with total, financial, and healthcare decision making, suggesting that the severity of cognitive impairment is related to decision making among individuals with MCI.

We conducted a series of linear regression analyses[27] to investigate whether the association of MCI diagnosis with the decision making measures is mediated by global cognition. Adjusted for age, sex, and education, MCI is significantly associated with a lower level of total decision making, which explains approximately 3% of its variance. This association is greatly attenuated after global cognition is added to the model: MCI status explains virtually none of the variance in total decision making (approximately 0.2%) over and above cognitive function. The results for financial and healthcare decision making are similar. Taken together, these results support the hypothesis that the difference in decision making measures between subjects with and without MCI is largely based on differences in cognitive function rather than other potential differences between the groups. Results of these analyses are presented in Table 5.

Because impairment in specific cognitive systems more so than others might be driving the association with decision making,we next conducted a seriesof linear regression analyses to examine the associations between the level of functionin the five specific cognitive systems (episodic memory, semanticmemory, working memory, perceptual speed, andvisuospatial ability) and decision making among persons with MCI. All 5 cognitive systems were associated with total decision making (Table 4). Semantic memory, working memory, and perceptual speed were associated with financial decision making. Semantic memory, perceptual speed, and visuospatial ability were associated with healthcare decision making. Perceptual speed explained the most variance in decision making, as indicated by an R^2 change approximately double of any other cognitive system measured, but only explained about a quarter of the variance.In order to determine whether a particular cognitive system might be driving the association of cognitive abilities with decision making, linear regression models adjusted for age, education, and sex were conducted among MCI participants that included all cognitive domains. Perceptual speed was the only cognitive domain that remained significant. Results of these additional models are presented in an Appendix (Table A2).

DISCUSSION

In a community-based sample of more than 700 participants free of dementia, we found that MCI was associated with lower performance on a measure of financial and healthcare decision making that closely approximates the real world decisions independently living older persons routinely make. Furthermore, among persons with MCI, poorer decision making was associated with more severe global cognitive impairment. Finally, after considering multiple specific cognitive systems potentially associated with financial and healthcare decision making, perceptual speed accounted for the most variance. Altogether, our results support the notion that older adults with MCI show poorer decision making in financial and healthcare matters that closely reflect real world scenarios of significant importance to the maintenance of independence and wellbeing, and decision making is impacted by the severity and type of cognitive impairment.

MCI has been previously associated with reduced insight into financial abilities[22], reduced self-care in heart failure patients[23], and reduced capacity for research participation[24]. Other studies have investigated MCI's association with impaired capacity to handle specific and concrete aspects of monetary exchange[5,6,22]and consent to medical treatment[7-9]. Our study is unique in the use of a measure that closely approximates more general, common real world choices of significant consequence to independence and wellbeing in older adults by asking questions pertaining to the selection of the best mutual fund to invest in and the selection of the best HMO plan to choose among a number of competing options and considerations. These decisions are particularly relevant to older adults who must successfully navigate a host of complex financial and healthcare issues and thus represent a form of real world decision making not addressed by previous studies of MCI. The assessment of these behaviors that are necessary for successfully navigating the complexities of living in the modern world provides a novel approach to obtaining information critical for the promotion of independence and wellbeing among older adults.

This work makes two significant contributions to the literature. The first contribution is the finding that MCI is associated with lower decision making in financial and healthcare matters that closely simulate real-world choices commonly presented to independently living older adults. Relevant to the current study, our group has previously shown that poorer decision making on this measure is a consequence of cognitive decline among nondemented and even non-cognitively impaired participants[17]. Furthermore, our group has found poorerdecision making among nondemented older adults is associated with increased mortality, and this association is independent of cognition[19]. This study extends our previous work by showing that a diagnosis of MCI is associated with worse decision making ability in financial and healthcare matters important for maintaining independence and wellbeing in old age. Some have conceptualized MCI as a state of cognitive impairment among older persons that has little to no impact upon independent functioning[25]. However, the results of this study suggest that those with MCI may exhibit poorer decision making in domains that have a significant impact upon independence and wellbeing in old age and that are associated with adverse health outcomes in old age[19].People with *poorer* scores on our decision making measure do not necessarily have *impaired*decision making; there are no normative data available for our decision making measure as there are for cognitive measures. Thus, we would not at this time know how to make a determination of clinically relevant impaired decision making that would meet accepted criteria for dementia. The types of functional impairments typically used in dementia evaluations are of much lower complexity involving basic or standard instrumental activities of daily living (IADLs) that are necessary for everyday function. For example, another recent study found that MCI participants had more deficits in IADLs involving high cognitive demand compared to cognitively intact older persons[31].

The second contribution of the present study is the finding that multiple systems of cognitive function may be driving the association between MCI and poorer decision making; however, this may be primarily driven by perceptual speed abilities. Perceptual speed explained about double the variance in decision making than other systems of cognitive abilities, but only accounted for about a quarter of the variance. A couple of observations can be made about this. The first is that the ability to cognitively process multiple aspects of a decision in a rapid manner allows for a greater amount of time to understand and evaluate various aspects about the problem, and ultimately deliberate about an optimal choice. Reductions in perceptual speed can also have an impact on the ability to make mental comparisons and selections between potential choices in a time-efficient or rapid manner. If older adults with MCI are not able to process as rapidly as those without MCI, then this would leave less time to fully understand and evaluate potential choices, particularly if time-pressed. Older adults with MCI might consequently feel inclined torely more on simpler heuristics, previous experience, or "gut instincts" in making choices, which in turn may not lead to the most optimal decisions[26]. Future work is needed to clarify what specific role a decline in perceptual speed might play in this association. The second observation is that cognitive systems only accounted for a portion of the variance in decision making. This suggests that while important, cognition is not the only factor involved in decision making, and based on our results, other factors constitute a substantial portion of the variance associated with decision making. Prior work in this cohort and others has shown that decision making is a complex function of diverse characteristics that includes not only cognitive function, but other factors such as domain specific knowledge[18] and personality traits[16]. We also acknowledge that amyloid burden has been associated with impairment in activities of daily living in MCI[28], and that amyloid burden is particularly observed in the default network[29], which has been "anti-correlated" with explicit cognitive brain networks[30], and for this reason might be difficult to interrogate through cognitive testing. These results underscore the importance of considering factors other than cognition when trying to understand the determinants of poor decision making in old age.

Strengths of this study include the use of a large, well-characterized community-based sample, accurate diagnostic classification, the use of a decision making measure that closely approximates decisions found in real world financial and healthcare settings, and incorporation of a battery of cognitive measures that allowed for global and system-specific considerations. Weaknesses of the present study included the use of a cross-sectional design, the selected nature of study participants, and not observing the actual choices made by participants regarding healthcare and finances in their lives. The results of this study support the notion that MCI is associated with poorer financial and healthcare decision making in matters highly relevant to independence and wellbeing. Future studies are needed to explore whether poor decision making is associated with subsequent adverse cognitive and neuropathological outcomes.

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Table 1

Descriptive statistics by group

	MCI			NCI				
	Number	**(%)**		**Number**	**(%)**		**X^2**	***p*-value**
N	144	(20%)		586	(80%)			
Female sex	100	(69%)		453	(77%)		3.89	0.13
White race	134	(93%)		549	(94%)		0.25	0.70
	Mean	(SD)	range	Mean	(SD)	range	*t*-value	*p*-value
Age	84.26	(6.14)	63.92-96.38	81.08	(7.84)	58.81-100.80	−5.25	<0.01
Education	15.40	(3.01)	10-28	15.17	(3.09)	0-28	−0.81	0.42
Episodic memory z-score	−0.42	(0.66)	−1.97-1.75	0.53	(0.52)	−1.02-1.83	16.25	<0.01
WMS-R Logical Memory – Immediate Recall Ia raw score	8.69	(4.17)	0-20	13.40	(3.98)	3-24	12.58	<0.01
WMS-R Logical Memory – Delayed Recall IIa raw score	6.36	(4.36)	0-23	12.02	(4.25)	1-23	14.23	<0.01
CERAD Word List Memory, Trials 1-3, Immediate Recall raw score	14.60	(4.15)	7-30	19.57	(4.17)	7-30	12.76	<0.01
CERAD Word List Memory, Trials 1-3, Delayed Recall raw score	3.15	(2.34)	0-10	6.47	(1.99)	0-10	15.68	<0.01
CERAD Word List Memory, Trials 1-3, Recognition Memory raw score	8.65	(1.72)	0-10	9.87	(0.37)	7-10	8.49	<0.01
East Boston Memory Test Immediate Recall raw score	8.61	(2.10)	2-12	10.10	(1.76)	0-12	7.83	<0.01
East Boston Memory Test Delayed Recall raw score	7.79	(2.85)	0-12	9.75	(1.97)	0-12	7.83	<0.01
Semantic memory z-score	−0.15	(0.63)	−2.33-1.35	0.35	(0.55)	−2.21-1.79	9.31	<0.01
Boston Naming Test raw score	13.58	(1.36)	9-15	14.23	(1.03)	8-15	5.34	<0.01
Verbal Semantic Fluency raw score	28.55	(9.03)	7-56	36.90	(8.95)	14-70	10.01	<0.01
NART Word Reading raw score	12.11	(3.08)	2-15	12.94	(2.59)	1-15	2.95	<0.01
Working memory z-score	−0.24	(0.68)	−1.83-1.79	0.24	(0.69)	−1.75-2.22	7.49	<0.01
Digit Span Forward raw score	7.72	(1.99)	2-12	8.41	(1.95)	4-12	3.80	<0.01
Digit Span Backward raw score	5.52	(1.79)	1-11	6.54	(1.90)	1-12	5.82	<0.01
Digit Ordering raw score	6.43	(1.59)	2-10	7.57	(1.49)	2-13	8.08	<0.01
Perceptual speed z-score	−0.35	(0.75)	−2.91-1.10	0.26	(0.76)	−2.91-2.38	8.56	<0.01
Symbol Digit raw score	33.38	(10.14)	8-54	41.55	(9.56)	11-77	8.91	<0.01
Number Comparison raw score	21.68	(7.53)	0-48	25.88	(6.77)	0-44	6.47	<0.01
Stroop Color Naming raw score	15.24	(7.75)	0-41	20.63	(7.18)	0-45	7.83	<0.01
Stroop Word Reading raw score	42.42	(14.47)	0-75	49.54	(13.26)	0-80	5.59	<0.01

	MCI			NCI				
	Number	(%)		Number	(%)		X2	*p*-value
Visuospatial ability z-score	−0.14	(0.88)	−2.91-1.27	0.31	(0.64)	−2.53-1.27	6.89	<0.01
Judgment of Line Orientation raw score	9.26	(3.44)	1-15	10.61	(2.88)	0-15	4.28	<0.01
Progressive Matrices raw score	9.68	(2.18)	2-12	10.73	(1.67)	0-12	5.36	<0.01
Global cognitive z-score	−0.31	(0.43)	−1.43-0.87	0.38	(0.44)	−1.19-1.60	16.25	<0.01
Total decision making raw score	6.47	(2.85)	0-12	8.01	(2.71)	0-12	6.06	<0.01
Financial decision making raw score	3.03	(1.44)	0-6	3.73	(1.43)	0-6	5.26	<0.01
Healthcare decision making raw score	3.44	(1.72)	0-6	4.28	(1.55)	0-6	5.7	<0.01

N=sample size, SD=standard deviation, MCI=mild cognitive impairment, NCI=non-cognitively impaired, M=male, F=female, W=white, NW=non-white, WMS-R=Wechsler Memory Scale-Revised, CERAD=Consortium to Establish a Registry for Alzheimer's Disease, NART=National Adult Reading Test, WMS-R Logical Memory – Immediate Recall Ia& Delayed Recall IIa have a possible range of 0-25;CERAD Word List Memory, Trials 1-3, Immediate Recall has a possible range of 0 to 30; CERAD Word List Memory, Trials 1-3, Delayed Recall has a possible range of 0-10; CERAD Word List Memory, Trials 1-3, Recognition Memory has a possible range of 0 to 10; East Boston Memory Test Immediate Recall& Delayed Recall have a possible range of 0 to 12; Boston Naming Test has a possible range of 0 to 15; Verbal Semantic Fluency has a possible range of 0 to 75; NART Word Reading has a possible range of 0 to 15; Digit Span Forward&Digit Span Backward have a possible range of 0 to 12; Digit Ordering has a possible range of 0 to 14; Symbol Digit has a possible range of 0 to 110; Number Comparison has a range of 0 to 48; Stroop Color Naming&Stroop Word Reading have a possible range of 0 to 100; Judgment of Line Orientation has a possible range of 0 to 15; Progressive Matrices has a possible range of 0 to 16; Total decision making has a possible range of 0 to 12; Financial decision making and healthcare decision making have a possible range of 0 to 6.

Table 2

Relation of MCI to decision making, adjusting for age, education, and sex

Variable	Model Term	Model 1	Model 2
		Estimate (Standard Error, *p* Value)	
Total Decision Making	age education male MCI	−0.11 (0.01, <0.01) 0.28 (0.03, <0.01) 0.82 (0.22, <0.01)	−0.10 (0.01, <0.01) 0.28 (0.03, <0.01) 0.89 (0.21, <0.01) −1.35 (0.23, <0.01)
Financial Decision Making	age education male MCI	−0.06 (0.01, <0.01) 0.11 (0.02, <0.01) 0.5 2 (0.12, <0.01)	−0.05 (0.01, <0.01) 0.12 (0.02, <0.01) 0.55 (0.11, <0.01) −0.61 (0.12, <0.01)
Healthcare Decision Making	age education male MCI	−0.06 (0.01, <0.01) 0.16 (0.02, <0.01) 0.30 (0.13,0.02)	−0.05 (0.01, <0.01) 0.16 (0.02, <0.01) 0.34 (0.13,0.01) −0.74 (0.13, <0.01)

Table 3

Categorical Relation of MCI to Decision Making

		Categorical Approach							
		1.5 SD below mean of NCI				Median Split of NCI			
		N Below	**N Above**	**X^2**	**p-value**	**N Below**	**N Above**	**X^2**	**p-value**
Total Decision Making	MCI	24	120	14.00	0.02	106	38	24.22	<0.01
	NCI	40	546			298	288		
Financial Decision Making	MCI	17	127	2.79	0.10	402	184	9.00	<0.01
	NCI	44	542			117	27		
Health Decision Making	MCI	24	120	16.18	<0.01	127	17	12.72	<0.01
	NCI	37	549			435	151		

Table 4

Relation of individualcognitive function measures to decision making among individuals with MCI

Factor	Cognitive System	Estimate	Standard Error	*p* Value	R^2 Change
Total Decision Making	Global cognition	3.20	0.47	<0.01	0.16
	Episodic memory	0.70	0.32	0.03	0.02
	Semantic memory	1.34	0.33	<0.01	0.13
	Working memory	0.65	0.31	0.04	0.02
	Perceptual speed	1.87	0.22	<0.01	0.26
	Visuospatial ability	0.60	0.23	0.01	0.09
Financial Decision Making	Global cognition	1.61	0.25	<0.01	0.14
	Episodic memory	0.30	0.17	0.08	0.01
	Semantic memory	0.69	0.18	<0.01	0.12
	Working memory	0.49	0.16	<0.01	0.04
	Perceptual speed	0.95	0.12	<0.01	0.25
	Visuospatial ability	0.24	0.13	0.06	0.05
Healthcare Decision Making	Global cognition	1.59	0.30	<0.01	0.12
	Episodic memory	0.39	0.20	0.05	0.02
	Semantic memory	0.65	0.21	<0.01	0.09
	Working memory	0.16	0.20	0.41	0.00
	Perceptual speed	0.91	0.15	<0.01	0.17
	Visuospatial ability	0.36	0.15	0.02	0.06

Estimated from separate linear regression models adjusted for age, sex, and education. Change in adjusted R^2 represents the amount of explained variance in the outcome variable associated with the cognitive variableafter accounting for the effects of age, sex, and education.

Table 5

Relation of MCI and global cognition to decision making

Variable	Model Term	Mediation Models			
		Model 1	Model 2	Model 3	Model 4
		Estimate (Standard Error, *p* Value)			
Total Decision Making	age education male MCI global cognition	−0.11 (0.01,<0.01) 0.28 (0.038,<0.01) 0.82 (0.22,<0.01)	−0.10 (0.01,<0.01) 0.28 (0.03,<0.01) 0.89 (0.21,<0.01) −1.35 (0.23,<0.01)	−0.06 (0.01,<0.01) 0.13 (0.03,<0.01) 1.10 (0.19,<0.01) 2.65 (0.17,<0.01)	−0.06 (0.01,<0.01) 0.12 (0.03,<0.01) 1.09 (0.19,<0.01) 0.50 (0.24,0.04) 2.89 (0.21,<0.01)
Financial Decision Making	age education male MCI global cognition	−0.06 (0.04,<0.01) 0.11 (0.02,<0.01) 0.52 (0.12,<0.01)	−0.05 (0.01,<0.01) 0.12 (0.02,<0.01) 0.52 (0.11,<0.01) −0.61 (0.12,<0.01)	−0.03 (0.01,<0.01) 0.05 (0.02,<0.01) 0.64 (0.11,<0.01) 1.21 (0.10,<0.01)	−0.03 (0.01,<0.01) 0.04 (0.02,<0.01) 0.64 (0.11,<0.01) 0.23 (0.14,0.08) 1.32 (0.12,<0.01)
Healthcare Decision Making	age education male MCI global cognition	−0.06 (0.01,<0.01) 0.16 (0.02,<0.01) 0.30 (0.13,0.02)	−0.05 (0.01,<0.01) 0.16 (0.02,<0.01) 0.34 (0.13,<0.01) −0.74 (0.13,<0.01)	−0.03 (0.01,<0.01) 0.08 (0.02,<0.01) 0.45 (0.11,<0.01) 1.44 (0.11,<0.01)	−0.03 (0.01,<0.01) 0.08 (0.02,<0.01) 0.45 (0.11,<0.01) 0.26 (0.15,0.07) 1.57 (0.13,<0.01)