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# Mild Cognitive Impairment and Susceptibility to Scams in Old Age

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#### **Abstract**

**Background**—Falling victim to financial scams can have a significant impact upon social and financial wellbeing and independence. A large proportion of scam victims are older adults, but whether older victims with mild cognitive impairment (MCI) are at higher risk remains unknown.

**Objective**—We tested the hypothesis that older persons with MCI exhibit greater susceptibility to scams compared to those without cognitive impairment.

**Methods**—Seven hundred and thirty older adults without dementia were recruited from the Rush Memory and Aging Project, a community-based epidemiologic study of aging. Participants completed a five-item self-report measure of susceptibility to scams, a battery of cognitive measures, and clinical diagnostic evaluations.

**Results**—In models adjusted for age, education, and gender, the presence of MCI was associated with greater susceptibility to scams (B = 0.125, SE = 0.063, p-value = 0.047). Further, in analyses of the role of specific cognitive systems in susceptibility to scams among persons with MCI (n = 144), the level of performance in two systems, episodic memory and perceptual speed abilities, were associated with susceptibility.

**Conclusions**—Adults with MCI may be more susceptible to scams in old age than older persons with normal cognition. Lower abilities in specific cognitive systems, particularly perceptual speed and episodic memory, may contribute to greater susceptibility to scams in those with MCI.

#### **Keywords**

Cognition; episodic memory;	mild cognitive impairmen	nt; processing speed; scam

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#### INTRODUCTION

Older adults are at high risk for financial and other scams [1, 2], deceptive or fraudulent schemes designed for monetary gain. Since older adults often rely on savings or funds accrued over a lifetime and have limited employment opportunities, the effects of falling victim to a scam can be devastating for maintaining independence and wellbeing in old age [3]. The societal costs of the scamming of older adults are far-reaching, resulting in estimated losses to the U.S. economy of approximately 3 billion dollars annually [2]. The problem of scams among older adults is considered such a threat to the wellbeing of the aging U.S. society that several new federal departments and organizations have been created and tasked with protecting the financial interests of older adults (http://www.consumerfinance.gov/older-americans/). However, to date, relatively little is known about which older persons are more likely to fall victim to scam. A greater understanding of the factors that impact susceptibility to scams in old age is an urgent and important public health concern.

We recently demonstrated that lower cognitive function is associated with greater susceptibility to scams among non-demented older adults [4], and that susceptibility to scams is a consequence of subtle cognitive decline even among non-cognitively impaired older adults [5]. We therefore hypothesized that older adults with mild cognitive impairment (MCI) would show greater susceptibility to scams when compared to older adults with no cognitive impairment (NCI). Our aim in this study was to extend our previous findings to the clinical context, as awareness of the specific vulnerability of persons with MCI to scams has direct clinical and public health implications. MCI is generally believed to have little to no impact upon functional activities of daily living. Thus, a greater susceptibility to scams in MCI could imply that the diagnosis affects a broader range of behaviors with direct relevance to wellbeing and independence than is generally thought. Investigating this susceptibility in MCI has relevance to clinicians who diagnose and treat persons with overt cognitive impairment, as well as family members and caregivers who assist and support persons with MCI. In analyses that controlled for age, education, and gender, we examined this hypothesis using data from the Rush Memory and Aging Project, a community-based epidemiologic study of old age. In additional analyses, we investigated how the overall severity and specific type of cognitive impairment impacted susceptibility to scams among older adults with MCI.

#### **MATERIALS AND METHODS**

#### **Participants**

Participants came from the Rush Memory and Aging Project, a community-based epidemiologic study of aging and dementia [6]. This study recruits participants from local residential facilities, including retirement homes, senior housing facilities, and community organizations in and around the greater Chicago metropolitan area. Participants undergo detailed annual clinical evaluations as previously described [6]. All human participant procedures were approved by the Institutional Review Board of Rush University Medical Center.

The Rush Memory and Aging Project began in 1997, and enrollment is ongoing. A financial and health decision-making and susceptibility to scams sub-study was added in 2010. At the time of these analyses, 1,671 participants had completed the baseline evaluation for the parent study; of those, 564 died, 83 refused further participation in the parent project before they were able to complete the baseline susceptibility to scams 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 remaining 926 potentially eligible persons, 802 (86.6%) completed the susceptibility to scams baseline, 71 had not yet completed the susceptibility to scams assessment, and 53 refused the susceptibility to scams assessment. Of the 802 participants who had completed the susceptibility to scams 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 by a clinician with expertise in aging as previously described [6]. First, an experienced neuropsychologist with expertise in Alzheimer's disease (AD) and blinded to participant age, gender, and race reviewed all results of cognitive measures and rendered a clinical judgment as to cognitive impairment after reviewing data on education, sensory deficits, and motor deficits. Second, a physician with expertise in the diagnosis of AD reviewed all available participant information (brain scan, medical history, cognitive data, neurological exam) and rendered a clinical judgment as to whether the information was consistent with dementia according to NINCDS/ADRDA criteria [7]. Third, participants determined to have cognitive impairment but not dementia were classified as having MCI. We have previously shown that persons who meet these criteria are at a substantially increased risk of developing AD [8, 45] and represent an intermediate group between persons without cognitive impairment and those with dementia in terms of brain pathology indices [9]. Our characterization of MCI resembles the condition otherwise known as "Cognitive Impaired Not Demented" (CIND; [10, 44, 46]) and has been used in multiple prior publications [11–19].

#### Assessment of susceptibility to scams

For assessment of susceptibility to scams, participants rated their agreement with five statements in accordance with a 7-point Likert scale (strongly disagree to strongly agree). The five statements included in the measure have been previously published [4] and address topics such as suspiciousness of claims that seem too good to be true, being targeted by conartists, and telemarketing behaviors. The items are:

- 1. I answer the phone whenever it rings, even if I do not know who is calling.
- **2.** I have difficulty ending a phone call, even if the caller is a telemarketer, someone I do not know, or someone I did not wish to call me.
- **3.** If something sounds too good to be true, it usually is.
- **4.** Persons over the age of 65 are often targeted by con-artists.
- 5. If a telemarketer calls me, I usually listen to what they have to say.

The statements were based in part on findings of the AARP and the Financial Industry Regulatory Authority Risk Meter, a measure of poor and risky financial decision making that is used in many finance studies [1, 20]. The average of ratings across the five items (with items 1, 2, and 5 reverse coded) results in a total score, and higher scores indicate more susceptibility to scams. The intraclass correlation coefficient for the measure was 0.63 [4], and we previously demonstrated that responses to this measure were associated with factors commonly believed to correlate with susceptibility to scams, such as lower cognitive function, lower financial literacy, lower psychological wellbeing, and older age [4].

#### Assessment of cognition

A battery of 21 cognitive measures was administered by technicians trained by a boardcertified clinical neuropsychologist. Measures of cognitive function assessed a broad range of cognitive functions [6, 21]. Two of the 21 tests, the Complex Ideational Material [40] and the Mini-Mental Status Examination [43], 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 described [22]. A composite score for the 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 described [22]. Episodic memory measures included Word List Memory, Word List Recall, and Word List Recognition from the procedures established by the CERAD [31]; immediate and delayed recall of Logical Memory Story A[32] and the East Boston Story [33]. Semantic memory measures included Verbal Fluency [31], which involved generating exemplars from two semantic categories (animals; fruits and vegetables) in separate 1-min trials; a 15-item version [31] of the Boston Naming Test [34], and the National Adult Reading Test [41]. Working memory measures included the Digit Span subtests (forward and backward) of the Wechsler Memory Scale-Revised [32] and Digit Ordering [35]. Measures of perceptual speed included the oral version of the Symbol Digit Modalities Test [36], Number Comparison [37], Stroop Color Naming [42], and Stroop Word Reading [42]. Measures of visuospatial ability included Judgment of Line Orientation [38] and Standard Progressive Matrices [39].

#### Statistical analyses

Descriptive and bivariate statistics were used to characterize persons with MCI and those without cognitive impairment. 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, the Satterthwaite variance estimate was used instead of the Pooled variance estimate. Linear regression models were then performed to examine the associations between MCI and susceptibility to scams using NCI persons as the reference group. All models included terms to control for the potentially confounding effects of age, education, and gender. Finally, a series of linear regression models were conducted only in MCI individuals to explore the associations between global cognitive function and five specific cognitive systems (episodic memory, semantic memory, working memory, perceptual speed,

and visuospatial ability) with susceptibility to scams. Analyses were conducted in SAS version 9.3 software.

#### **RESULTS**

#### **Descriptive statistics**

The mean age of the overall sample was 81.8 years (SD = 7.6; range: 58.8–100.8), the mean education was 15.2 years (SD = 3.1; range: 0–28), 75.8% were women, and a significant majority (91.9%) was White. As shown in Table 1, bivariate analyses showed that participants with MCI were generally older and showed greater susceptibility to scam compared to persons with NCI. As would be expected, those with MCI exhibited lower functioning in all five systems of cognitive function and on a measure of overall cognitive function.

#### Relation of MCI to susceptibility to scams

First, to examine whether MCI diagnosis was associated with greater susceptibility to scams, we conducted a set of linear regression models that examined the relation of MCI with susceptibility to scams; these and all subsequent analyses controlled for the potentially confounding effects of age, education, and gender. As shown in Table 2, the presence of MCI was associated with greater susceptibility to scams. The effect of MCI on susceptibility to scams was equivalent to the effect of more than 5 additional years of age. There were no interactions between MCI and age, education, or gender.

#### Relation of cognitive impairment with susceptibility to scams

Since we observed that the diagnosis of MCI was associated with greater susceptibility to scams, we next wanted to test whether the severity of cognitive impairment was associated with differences in susceptibility to scams within persons with MCI. Results from linear regression models adjusted for age, gender, and education examining the relation between global cognition and susceptibility to scams in those with MCI are presented in Table 3. Results indicated that more severe cognitive impairment was related to a greater level of susceptibility to scams among individuals with MCI.

To determine whether the effect of cognitive function on susceptibility to scams was of a diffuse nature or was driven by specific cognitive systems in those with MCI, we conducted separate linear regression analyses to investigate the associations between five specific cognitive systems (episodic memory, semantic memory, working memory, perceptual speed, and visuospatial ability) and susceptibility to scams. Episodic memory and perceptual speed were associated with susceptibility to scams in older adults with MCI. The association between semantic memory abilities and susceptibility to scams showed a trend towards significance (Table 3).

#### **DISCUSSION**

In more than 700 community-based older adults without dementia, we found that the presence of MCI was associated with greater susceptibility to scams in models adjusted for

age, education, and gender. Furthermore, among older adults with MCI, the severity of overall cognitive impairment was associated with susceptibility to scams, as well as the specific cognitive systems of episodic memory and perceptual speed. Altogether, our results suggest that MCI may increase susceptibility to scam in old age, and declines in specific cognitive systems might play a role in this association.

This work makes two important contributions to the literature. The first contribution is the primary observation that the presence of MCI is associated with greater susceptibility to scams. We have shown in previous work that MCI is associated with poorer financial and healthcare decision making [23] and poorer financial and health literacy [24]. We have also shown poorer financial and healthcare decision making and susceptibility to scams are a consequence of subtle cognitive decline even among non-cognitively impaired older adults [5]. Whereas our previous work examined the full range of cognitive function among nondemented older adults [4], the focus on MCI specifically in this study increases the relevance of this work to clinicians who diagnose and treat persons with overt cognitive impairment, and our results suggest that MCI affects a broader range of behaviors than generally thought. It is widely recognized that persons with MCI have cognitive deficits that are associated with a substantial increase in the risk of developing dementia, but the present study shows that older persons with MCI also are more vulnerable to scams, suggesting that they may be vulnerable to other adverse outcomes (e.g., scam victimization, financial abuse). MCI often is viewed as a condition with little to no effects upon functional abilities [e.g., 25]; however, it appears that MCI may impair higher order abilities not captured by commonly used measures of basic activities of daily living (ADL) and instrumental ADL (IADL) [26, 27], in particular behaviors related to maintenance of financial wellbeing and independence. This suggests a need to develop a more nuanced approach to assessment of IADLs for use in clinical and research settings and that assessment of more complex aspects of daily living may aid in the early identification of MCI. New strategies are needed to protect and maintain MCI patients' financial wellbeing and independence, and greater care and attention to implementing financial protections may help persons with MCI make better financial judgments and avoid monetary pitfalls. For example, persons with MCI might elect to implement tighter controls on where fund disbursements are directed or how withdrawals are processed and approved after diagnosis. In particular, they may wish to designate a durable power of attorney for financial affairs. Education programs that do not rely heavily on cognitive abilities could be developed that might warn older persons in the early stages of cognitive impairment about the risks of greater susceptibility to scams. Passive monitoring systems that send out electronic text or phone call alerts when major transactions or withdrawals occur might be implemented as additional safeguards. Email companies could develop a software application that trolls for scams and quarantines such emails. These financial protections and safeguards might therefore aid older adults with MCI in maintaining their financial independence and wellbeing for as long as possible.

The second contribution of the present study is the discovery that decrements in episodic memory and perceptual speed in particular are associated with susceptibility to scams among persons with MCI. In prior work, we observed episodic memory, semantic memory, perceptual speed, and working memory systems correlate with susceptibility to scams in older adults without dementia (both with MCI and normal cognition) [4]. This work

suggests that impairment in episodic memory and perceptual speed abilities may be particularly important when considering susceptibility to scams in old age. Episodic memory abilities have long been described as the set of abilities that allow for encoding and recall of information [28], and impairment of episodic memory is considered the hallmark of AD [29]. Older adults with episodic memory difficulties may not be able to efficiently or effectively encode or recall the signs of a potential scam. Episodic memory impairments may also provide opportunities for scammers to maliciously fill gaps in memory with information that may ultimately benefit scammers. Perceptual speed refers to the ability to make time-efficient mental comparisons and selections between potential competing choices. If older adults with MCI are not able to cognitively process in a time-efficient manner, then they may be less able to fully understand and evaluate potential choices, particularly if time-pressured. Older adults with MCI might therefore feel inclined to rely more on simpler heuristics, such as "gut instincts" [30], or may feel pressured to make a rash choice, which could consequently result in greater susceptibility to scams. Future studies are also needed to examine the role of executive functions (e.g., problem solving, judgment, reasoning) in susceptibility to scams since these abilities were not addressed in a comprehensive manner by our battery of cognitive measures. Tests of reasoning or judgment may be particularly important for susceptibility to scams. Further, measures of social cognition may also prove to be sensitive to susceptibility to scams in old age.

Strengths of the study include the use of a well-characterized and large community-based cohort, standardized diagnostic classification, and incorporation of a broad battery of cognitive measures that allowed for global and system-specific considerations. The results of this study support the notion that MCI is associated with greater susceptibility to scams, and for this reason, the recruitment of additional protections and safeguards for persons with MCI may be prudent in order to maintain independence and wellbeing for as long as possible. These results are particularly relevant for family members and loved ones of those with MCI as the costs of falling victim to scams often are displaced upon others relationally close to the victim. Future research is needed to determine what role neuropathological biomarkers of dementia and other age-related disorders might play in susceptibility to scams in older adults with MCI. Weaknesses of the current study included the cross-sectional nature of the analyses and the selected nature of study participants.

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Table 1

Descriptive statistics by group

	MCI	NCI	t or $\chi^2$	p-Value
n (%)	144 (20%)	586 (80%)		
mean age (SD)	84.255 (6.135)	81.078 (7.838)	t = -5.25	< 0.001
mean education (SD)	15.403 (3.009)	15.171 (3.091)	t = -0.81	0.417
gender (% female)	100 (69%)	453 (77%)	$X^2 = 3.89$	0.049
race (% White)	134 (93%)	549 (94%)	$X^2 = 0.25$	0.616
Episodic memory z-score mean (SD)	-0.424 (0.656)	0.531 (0.518)	t = 16.25	< 0.001
Semantic memory z-score mean (SD)	-0.147 (0.625)	0.348 (0.552)	t = 9.31	< 0.001
Working memory z-score mean (SD)	-0.240 (0.679)	0.239 (0.689)	t = 7.49	< 0.001
Perceptual speed z-score mean (SD)	-0.347 (0.750)	0.256 (0.755)	t = 8.56	< 0.001
Visuospatial ability z-score mean (SD)	-0.137 (0.880)	0.314 (0.643)	t = 6.89	< 0.001
Global cognitive z-score mean (SD)	-0.306 (0.431)	0.376 (0.440)	t = 16.71	< 0.001
Susceptibility to scams mean (SD)	3.021 (0.696)	2.815 (0.696)	t = -3.18	0.002

n, sample size; SD, standard deviation; MCI, mild cognitive impairment; NCI, non-cognitively impaired.

Table 2

Relation of MCI to susceptibility to scams

Variable	Model Term	Estimate (Standar	rd Error, p Value)
		Model 1	Model 2
Susceptibility to scams	age	0.027 (0.003,<0.001)	0.026 (0.003,<0.001)
	education	-0.022 (0.008, 0.007)	-0.023 (0.008, 0.005)
	male	0.067 (0.059, 0.249)	0.061 (0.059, 0.300)
	MCI		0.125 (0.063, 0.047)

Model 1 indicates a linear regression model of the terms age in years, years of education, and gender (male coded as 1, female coded as 0) with the outcome of susceptibility to scams. Model indicates a linear regression model of the terms age in years, years of education, gender (male coded as 1, female coded as 0), and MCI status (MCI coded as 1 and non-cognitive impaired coded as 0).

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Table 3

Relation of specific cognitive function measures to susceptibility to scams among individuals with MCI

Factor	Cognitive System Estimate Standard Error p Value R <sup>2</sup> Change	Estimate	Standard Error	p Value	R <sup>2</sup> Change
	Global cognition	-0.341	0.152	0.026	0.020
Susceptibility to scams	Episodic memory	-0.199	0.093	0.034	0.017
	Semantic memory	-0.173	0.107	0.107	I
	Working memory	0.022	0.091	0.812	I
	Perceptual speed	-0.163	0.081	0.047	0.013
	Visuospatial ability	-0.002	0.077	0.985	ı

Estimated from separate linear regression models adjusted for age, gender, and education.

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