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Driving with Mild Cognitive Impairment or Dementia: Cognitive Test Performance and Proxy Report of Daily Life Function in Older Women

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Abstract

OBJECTIVES—To investigate associations between proxy report of cognitive and functional limitations and cognitive performance and current or former driving status in older women with mild cognitive impairment (MCI) and all-cause dementia.

DESIGN—Cross-sectional data analysis of retrospectively identified older women with adjudicated MCI and all-cause dementia in the Women's Health Initiative Memory Study—Epidemiology of Cognitive Health Outcomes (WHIMS-ECHO).

SETTING—Academic medical center.

PARTICIPANTS—Women (mean age ± standard deviation 83.7 ± 3.5) adjudicated with MCI or dementia during Year 1, 2, 3, or 4 of the WHIMS-ECHO follow-up period (N = 385).

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MEASUREMENTS—The telephone-administered cognitive battery included tests of attention, verbal learning and memory, verbal fluency, executive function, working memory, and global cognitive function plus self-report measures of depressive symptomatology. The Dementia Questionnaire (DQ) was administered to a knowledgeable proxy (family member, friend).

RESULTS—Sixty percent of women with MCI and 40% of those with dementia are current drivers. Proxy reports of functional limitations in instrumental activities of daily living (IADLs) are associated with current driving status in women with MCI, whereas performance-based cognitive tests are not. In women with dementia, proxy reports of functional limitations in IADLs and performance-based cognitive tests are associated with current driving status, as expected.

CONCLUSION—These findings have clinical implications for the importance of evaluating driving concurrently with other instrumental functional abilities in MCI and dementia. Additional work is needed to determine whether proxy report of cognitive and functional impairments should help guide referrals for driving assessment and rehabilitation or counseling for driving transition.

Keywords

aging; driving; instrumental activities of daily living; mild cognitive impairment; dementia

Driving is a complex daily life activity that, similar to other instrumental activities of daily living (IADLs), reflects age- and disease-related cognitive declines.[1-3] Although a growing body of recent research on driving and cognitive impairment in older adults demonstrates that older adults with cognitive impairment are less-safe drivers than cognitively normal older adults, little is known about the current or former driving status of cognitively impaired older adults.[4] Older women, in particular, may out-live their safe-driving ability by 10 and 4 years longer than men,[5] because their lifespan is longer. Dementia, which in women aged 85 and older has been reported to be as prevalent as 30%, may exacerbate age-related decline in driving ability.[6] There is a correspondingly greater risk of motor vehicle crashes for all drivers with dementia[7-9] although this has not been studied specifically in women. Further understanding of driving patterns of women with cognitive impairment is of public health interest.

There is a paucity of research on driving retirement[4] in older adults with mild cognitive impairment (MCI) and dementia. Findings from the literature on MCI and driving on driving performance are inconclusive with regard to driver safety,[10] whereas there is good evidence that older drivers with dementia eventually become unsafe.[1,4,11] Poorer globally rated driving performance on a road test has been reported in individuals with MCI (n = 46) than controls (n = 59). It was concluded that the driving performance of the sample with MCI was “less than optimal, but not at the level of frank impairment.” In one study, 20% to 30% of older adults with Alzheimer’s type dementia self-reported being current drivers,[4] but little is known about driving prevalence in older adults with MCI.

Educational resources include the American Medical Association Physician’s Guide to Assessing and Counseling Older Drivers[12] and the AARP online resources and driver safety courses. Occupational therapists who specialize in driver assessment and intervention to extend safe driving,[13,14] typically through physician referral, provide supportive assistance

to older drivers. Older adults may not know the best way to transition from driving to using other transportation because of a lack of referral pathways between doctors and driver rehabilitation specialists, inadequate education by healthcare providers to clients and their families, and a lack of public policies that promote accessible transportation alternatives for older adults. Finally, it is unclear whether family members of older adults with cognitive impairment are aware of unsafe driving or know how to address the issue of driving transition effectively.[15-18]

Proxy reports of the driving status of older adults with adjudicated mild cognitive impairment (MCI) and probable dementia in the Women's Health Initiative Memory Study (WHIMS) were examined. Specifically, women's current driving status, proxy reports of cognitive and functional limitations, and neurocognitive test performance were examined in the context of their demographic and health status. It was hypothesized that, although many women with dementia would have ceased driving because of cognitive limitations, a significant proportion of them would be currently driving. It was also estimated that a significantly larger percentage of women with MCI than dementia would be current drivers. Based on prior reports of the reliability and validity of the Dementia Questionnaire (DQ)[19] and comparisons of the reliability of proxy, self-report, and performance-based measures of functional status in normal aging[20] and MCI,[1,21,22] it was estimated that proxy reports of cognitive and functional limitations might predict the driving status of women with cognitive impairment.

METHODS

Participants

Dementia-free women aged 65 to 79 who participated in the Women's Health Initiative (WHI) Hormone Therapy (HT) clinical trials[23] were recruited to participate in the Women's Health Initiative Memory Study (WHIMS) from 1996 to 1999 (N = 7,479).[24] WHIMS was an ancillary study conducted to examine the effect of estrogen alone or in combination with a progestin on global cognitive function and dementia incidence in postmenopausal women.[25-28] The WHI HT trials were stopped early because of an unfavorable risk to benefit ratio,[29,30] ending the randomized controlled trial, but WHIMS participants continued to be assessed using the full protocol with clinic-based cognitive assessments until 2008, when they were switched to an annual, validated telephone-based cognitive assessment [WHIMS-Epidemiology of Cognitive Health Outcomes (ECHO)]. These analyses included 2,893 women with a mean age of 82.3 ± 3.6 who underwent at least one telephone-based cognitive assessment.

Measures

The telephone-administered cognitive battery includes measures of global cognitive function, long-term memory, attention and working memory, verbal fluency, executive function, and depressive symptomatology.[31] If women score less than 30 on the modified Telephone Interview for Cognitive Status (TICSm),[32,33] the DQ,[19] a structured interview that assesses dementia-related cognitive and behavioral status and relevant medical history, is administered to a proxy who is knowledgeable about the participant's health status. Two

independent expert adjudicators centrally adjudicate cognitive performance, proxy responses, and all prior WHIMS data using Petersen's criteria for MCI[34] and Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, criteria for dementia[35] into one of three groups [no cognitive impairment, mild cognitive impairment (MCI), probable dementia] without further subclassification.[24]

Cognitive Test Battery—The modified TICS-m,[36,37] a widely used measure of global cognitive functioning modeled after the Mini-Mental State Examination[38] is a 16-item instrument with scores ranging from 0 to 50 that assesses orientation (0–9 points), attention and concentration (0–2 points), short-delay free recall (0–10 points), mental calculation (0–5 points), naming (0–4 points), repetition (0–2 points), social knowledge (0–4 points), praxis (0–2 points), opposites (0–2 points), and long-delay free recall (0–10 points);

The East Boston Memory Test (EBMT) is a measure of immediate and delayed verbal memory (0–12 points).[39]

The Oral Trail-Making Test is a modified version of the original Trail-Making Test (TMT),[40,41] a measure of attention (Part A) and executive function (Part B), scored as time in seconds.

Verbal Fluency—Animals, a measure of verbal fluency,[42] is scored as the number of uniquely and spontaneously named animals in 1 minute.

The Digit Span forward and backward subtests of the Wechsler Adult Intelligence Scale—Revised[43] measure attention and working memory and are scored as the number of correct responses. Depressive symptomatology was assessed using the 15-item Geriatric Depression Scale.[44]

Dementia Questionnaire—The DQ is a semistructured interview comprising items that measure six domains: memory and cognition, expression (language), daily functioning, recognition of problems (insight), other medical and psychiatric difficulties, and education and demographic data.[19] Compared with the results of antemortem clinical examinations, the DQ was shown to be sensitive to the presence of dementia (92.8% sensitivity), discriminate dementia from other neurological disorders causing functional impairment (89.5% specificity), and have high interrater reliability ($\kappa = 0.96$).[45] Items from the memory and cognition, daily functioning, medical contacts, and other information domains were included: Did (Does) the subject have any problems with memory? Remembering people's names? Recognizing familiar faces? Finding way about indoors? Finding way on familiar streets? Remembering a short list of items? Did (Does) the subject have any trouble with household tasks? Handling money (e.g., balancing checkbook, making change, paying bills, writing checks)? Grasping situations or explanations? Dressing or caring for self (including choosing clothes and tying shoes)? Feeding self (including cutting meat and buttering bread)? Getting out of bed and into a chair? Bathing (including getting in and out of a shower or tub and washing independently)? Ever receive medications for memory problems?

Driving Status Outcome—The primary outcome for these analyses was driving status of women who ever drove according to the proxy report on the DQ from the following items: Did she ever drive (yes/no), Did she ever stop driving (yes/no), Why did she stop driving? (gets lost or confused, poor eyesight, illness, bad coordination, slow reaction time, bad reflexes, frequent accidents, fear or nervous driving, other cognitive problems, other). For participants whose driving status was currently driving (e.g., ever drive = yes and ever stop driving = no), proxies were asked whether the participant was having any problems driving. If the proxy reported yes, he or she was queried further about the types of problems (same as above). Former drivers were those whose proxy reported ever stop driving, yes, and included the same reasons reported above for stopping driving.

Demographic Characteristics and Health Status—Demographic and health status characteristics included current age, race and ethnicity, education, annual family income, self-reported hypertension (defined as taking pills for treatment), self-reported diabetes mellitus type II, coronary artery disease (myocardial infarction, angina pectoris, revascularization procedure), adjudicated stroke (ischemic and hemorrhagic), Parkinson's disease, visual impairment (cataracts, glaucoma, macular degeneration), and osteoarthritis. Health conditions were ascertained at baseline and during follow-up before the date that cognitive impairment was determined.

Statistical Analysis

Demographic and health status characteristics of women with any cognitive impairment (MCI or probable dementia) adjudicated using their most-recent cognitive assessment were compared according to driving status (currently driving or ceased driving) using the *t*-test or Wilcoxon rank-sum test for continuous variables and the chi-square test or Fisher exact test for categorical variables. The frequency of proxy-reported driving problems on the DQ in women with any cognitive impairment was reported according to driving status using the chi-square test or Fisher exact test, as was the frequency of cognitive and functional status deficits. The odds ratios (ORs) for current driving in participants with MCI or dementia according to demographic characteristics, health status, proxy report of cognitive or functional status from the DQ, and cognitive test performance were independently calculated using multiple logistic regression analyses. To further identify cognitive and functional status predictors of current driving status in women with cognitive impairment, ORs were calculated for current driving in participants with MCI or dementia using multiple logistic regression with backward elimination, with all variables with $P < .25$ entered as covariates into an initial model and then covariates with the highest *P*-values eliminated sequentially until all of the remaining covariates had $P < .20$. All OR models were adjusted for age, race, education, and depressive symptomatology. All analyses were conducted using SAS version 9.4 (SAS Institute, Inc., Cary, NC). All *P*-values were set at an alpha level of .05.

RESULTS

Women adjudicated with MCI or probable dementia during Year 1, 2, 3, or 4 of the WHIMS ECHO follow-up period were included in all analyses (N = 385). The mean time interval was 2.6 ± 2.4 months between the cognitive battery and the DQ, 6.3 ± 3.4 months between

the DQ and adjudication, and 9.0 ± 4.6 overall. The frequency (percentage) of contact that the proxy reported was 77 (20.0%) lived together, 139 (36.1%) had daily contact, 87 (22.6%) had contact three or more times per week, and 82 (21.3%) had contact less than three times per week. Regarding the most-frequent type of contact, 123 (32.0%) reported mostly in-person contact, 64 (16.6%) reported mostly telephone contact, and 198 (51.4%) reported both types. Demographic factors, HT use, disease, depressive symptomatology, type of cognitive impairment, cognitive test scores, and proxy report of trouble driving of women with any cognitive impairment (MCI or probable dementia combined) were compared according to driving status (currently driving or ceased driving) (Table 1). Current drivers with any cognitive impairment were younger (83.1 ± 3.1 vs 84.3 ± 3.9, $P < .001$). Current and former drivers had similar percentages of women according to race ($P = .07$), level of education ($P = .70$), annual family income ($P = .96$), disease status (hypertension, hyperlipidemia, diabetes mellitus, coronary artery disease, Parkinson's disease, visual impairment, or arthritis (all $P > .20$), and history of stroke ($P = .09$). Current drivers self-reported fewer depressive symptoms than former drivers median [(interquartile range (IQR)] 1(0.5–3) vs 3 (1–5). A higher percentage of current drivers had MCI (120, 60.0%) than dementia (80, 40.0%), whereas the opposite pattern held in former drivers MCI (58, 31.4%) or dementia (127, 68.6%) ($P < .001$). Women currently driving had significantly better global cognition according to the TICSm median (IQR) 27 (25–29) vs 25 (22–28) ($P < .001$), EBMT long delay median (IQR) 7 (3–8) vs 5 (0–8) ($P < .002$), TMT-A (seconds) median (IQR) 11 (9–12) vs 11 (9–14) ($P < .01$), verbal fluency—animals median (IQR) 12 (10–15) vs 11 (8–14) ($P < .006$), and Digit Span forward median (IQR) 6 (5–8) vs 7 (6–8) ($P < .02$) but not EBMT immediate recall, TMT-B (seconds) or Digit Span backward (all $P > .10$). Proxies reported that a lower percentage of current drivers had trouble driving (25.0%) than of former drivers (97.8%) ($P < .001$).

Women with any cognitive impairment (MCI and probable dementia combined) were compared according to driving status on frequency of driving problems that their proxy reported on the DQ (Table 2). Current women drivers with any cognitive impairment were less likely to get lost, have frequent accidents, display fearfulness when driving, display bad coordination, have other cognitive problems, have poor eyesight, or be ill (all $P < .01$).

Women with any cognitive impairment were compared according to driving status on frequency of functional limitations that their proxy reported on the DQ (Table 3). A lower percentage of current women drivers with cognitive impairment received medications for memory problems and had problems remembering people's names, recognizing familiar faces, finding their way about indoors, finding their way on familiar streets, remembering a short list of items, performing household tasks, handling money, grasping situations or explanations, dressing or caring for themselves, feeding themselves, getting out of bed and into a chair, and bathing (all $P < .01$).

Table 4 presents ORs for current driving status separately for women with MCI and those with probable dementia, adjusting for age, race, education, and depressive symptoms using multiple logistic regression. Their demographic characteristics, general health status, proxy-reported functional limitations from the DQ, and the cognitive test battery were compared. In women with MCI, factors significantly associated with lower odds of continuing to drive

were older age (OR = 0.87, 95% confidence interval (CI) = 0.79–0.96, $P = .006$), performing household tasks (OR = 0.30, 95% CI = 0.15–0.62, $P = .001$), grasping situations (OR = 0.44, 95% CI = 0.21–0.89, $P = .02$), dressing or caring for oneself (OR = 0.06, 95% CI = 0.01–1.30, $P < .001$), and bathing (OR = 0.20, 95% CI = 0.08–0.49, $P < .001$). No cognitive tests were significant (all $P > .10$).

A different pattern emerged in women with probable dementia (Table 4). Factors significantly associated with lower odds of continuing to drive in these women were remembering names (OR = 0.46, 95% CI = 0.25–0.83, $P = .01$), recognizing faces (OR = 0.36, 95% CI = 0.15–0.90, $P = .03$), finding way on familiar streets (OR = 0.45, 95% CI = 0.24–0.84, $P = .01$), handling money (OR = 0.44, 95% CI = 0.22–0.85, $P = .02$), dressing or caring for oneself (OR = 0.32, 95% CI = 0.13–0.75, $P = .002$), bathing (OR = 0.27, 95% CI = 0.13–0.58, $P < .001$), and taking medications for memory problems (OR = 0.42, 95% CI = 0.21–0.81, $P = .003$). Better scores on TICSm (OR = 1.17, 95% CI = 1.07–1.27, $P < .001$), EBMT long delay (OR = 1.11, 95% CI = 1.02–1.21, $P = .02$), TMT-A (seconds) (OR = 1.10, 95% CI = 1.01–1.19, $P = .02$), and verbal fluency—animals (OR = 1.14, 95% CI = 1.05–1.22, $P = .001$) were associated with greater odds of continuing to drive.

Table 5 presents ORs for current driving status separately for women with MCI and those with probable dementia, adjusting for age, race, education, and depressive symptoms using multiple logistic regression with backward elimination in two models: functional limitations and cognitive tests. In MCI Model 1, lower odds of continuing to drive were significantly associated with functional limitations in household tasks (OR = 0.32, 95% CI = 0.12–0.85), grasping situations (OR = 0.30, 95% CI = 0.12–0.80), and dressing or caring for oneself (OR = 0.06, 95% CI = 0.01–0.67) (all $P = .02$), as well as taking medications for memory problems (OR = 0.12, 95% CI = 0.03–0.53, $P = .004$). In probable dementia Model 1, lower odds of continuing to drive were significantly associated with functional limitations in handling money (OR = 0.34, 95% CI = 0.13–0.86, $P = .02$) and taking medications for memory problems (OR = 0.32, 95% CI = 0.14–0.74, $P = .008$).

In MCI Model 2, none of the cognitive tests were significantly associated with odds of continuing to drive, whereas in probable dementia Model 2, the TICSm was significantly associated (OR = 1.14, 95% CI = 1.03–1.26, $P = .01$). Better scores on Digit Span forward were associated with slightly lower odds of continuing to drive (OR = 0.84, 95% CI = 0.73–0.97, $P = .02$), probably because women with dementia had scores similar to those of women with MCI on this measure (Table 1).

DISCUSSION

This study examined proxy reports of driving status and cognitive and functional limitations, as well as cognitive performance data, of women with adjudicated MCI and probable dementia in WHIMS. A notable finding of this study was that 40% of women with dementia and 60% of women with MCI were current drivers. This is higher than some prior reports of driving status in women in the United States with Alzheimer's type dementia (20–30%),[4,46] although prevalence data on driving, dementia, and sex are sparse. In the United States, many individuals of both sexes retain their licenses into late life, although men and women

aged 80 and older account for only 1.5% to 2% of all drivers, and there are more women than men currently driving in this older age group[47] Driving prevalence in older adults with MCI and dementia is underresearched and deserves further investigation.

In women with MCI (after adjusting for important confounds), proxy-reported other functional limitations were associated with lower odds of continuing to drive, whereas proxy-reported cognitive limitations and cognitive test performance were not. Women with MCI who had difficulty in proxy-reported IADLs (household tasks, grasping situations) and ADLs (dressing and caring for oneself, bathing) were less likely to be current drivers; this finding held in backward elimination models. This pattern of findings demonstrates that proxy-reported difficulty in other IADLs is associated with driving status and that perhaps basic changes in self-care may be cues to family and friends that cognitive changes are occurring. It is also consistent with reports that self-reported limitations in IADLs are associated with lower odds of current driving in women without cognitive impairment.[48] It is probably difficult to disentangle the meaning of proxy-reported changes in basic self-care items that measure dressing or caring for oneself in persons with MCI, because these changes could be subtle. Similarly, grasping situations that occur in the context of performing a daily life task could reflect a decline in ability to understand what to do in an unfamiliar situation (e.g., using automated checkout at the grocery store for the first time). An alternative explanation for these findings is that subtle changes in cognitive function may not be as predictive of driving behavior as other IADLs function in MCI, although one observational study cannot confirm this. An interesting topic for future research is the construct validity of proxy measures of functional status. The current study found that proxy-reported functional status (e.g., other IADLs) is associated with driving status in women with MCI.

In contrast, in women with probable dementia, proxy-reported functional limitations and proxy-reported and performance-based cognitive limitations were associated with lower odds of continuing to drive. Women with dementia who had difficulty in proxy-reported IADLs (e.g., handling money) and ADLs (e.g., dressing or caring for oneself, bathing) were less likely to be currently driving. Although causal links between IADLs could not be established in this study, prior studies have found a correlation between self-reported performance on complex IADLs such as financial management and driving.[20] Proxy-reported cognitive limitations involving memory and orientation (e.g., recognizing faces, remembering names, finding way on familiar streets) were also associated with lower odds of continuing to drive. Problems with facial recognition and finding way about familiar locations are hallmarks of dementia.[49] Women with dementia who performed better on tests of global cognition, verbal fluency, long-term memory, and attention were more likely to be current drivers, as expected. In separate backward elimination models controlling for age, race, education, and depressive symptomatology, proxy-reported functional limitations (handling money) were the best predictor of current driving status, followed by finding way on familiar streets. In the cognitive performance model, global cognitive function was the best predictor of current driving status, followed by short-term memory.

Older age was the only factor associated with lower odds of driving, and only in women with MCI; all other demographic and health status factors were nonsignificant predictors of

continued driving in MCI and probable dementia. Proxies were in agreement that overall, current drivers had less trouble driving than individuals who had stopped driving. In addition, proxy reports on the DQ of driver problems (getting lost, having frequent accidents, displaying fearfulness when driving, displaying bad coordination, having other cognitive problems, poor eyesight, illness) were in the expected direction according to driving status, validating that individuals who have stopped driving had a greater frequency of driving problems. A limitation of the study is that the DQ was used to determine case status, limiting the assumption that these women are representative of all older women with MCI and dementia, although the cognitive data (the cutpoint on the global cognitive screening measure and the individual cognitive tests) are used as primary classification tools in the adjudication process. Although there are also limitations with self-report and proxy-reported measures, proxy reports of IADL limitations, including driving, may aid physician referral for performance-based driving assessments and evaluation by driver rehabilitation specialists such as occupational therapists.

In conclusion, a significant proportion of women with MCI and probable dementia are current drivers. When proxy reports of cognitive and functional limitations were compared with cognitive performance in women with MCI and dementia, proxy reports of other IADL and ADL limitations were associated with driving status in women with MCI, whereas all types of measures (proxy report of functional and cognitive limitations and performance-based cognitive testing) were associated with driving status in dementia. In the absence of sensitive computerized cognitive tasks, proxy reports of other functional limitations may be associated with continued driving ability in MCI and thus could prompt a discussion regarding driving transition, whereas a broader range of measurement tools may be descriptive of continued driving ability in dementia. It has not been established that drivers with MCI are unsafe. These findings have clinical implications for driving referral and assessment, in particular for choosing the type of assessment tool based on the severity of cognitive impairment. This study demonstrates the value of triangulating results obtained through multiple methods of report to ensure accurate assessment, of using proxy report of functional limitations such as driving in physician referral to driver rehabilitation specialists and of evaluating driving behavior within the context of overall daily-life function. Future work is needed to determine whether proxy report of cognitive and functional impairments including driving can guide referrals to driver rehabilitation or counseling for driving transition.

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Table 1

Demographic and Health-Related Characteristics of Women with Any Cognitive Impairment (Mild Cognitive Impairment (MCI) and Probable Dementia Combined) According to Driving Status (N = 385)

Characteristic	Current Drivers, n = 200	Former Drivers, n = 185	*P*-Value
Age, mean ± standard deviation	83.1 ± 3.1	84.3 ± 3.9	<.001
Race, n (%)			
Caucasian	172 (86.0)	170 (91.9)	
African American	17 (8.5)	13 (7.0)	
Other	11 (5.5)	2 (1.1)	.07
Education, n (%)			
>High school	138 (69.0)	131 (70.8)	
≤High school	56 (31.0)	54 (29.2)	.70
Annual family income, $, n (%)			
<20,000	45 (25.6)	45 (25.6)	
20,000–49,999	106 (57.6)	99 (56.3)	
≥50,000	33 (17.9)	32 (18.2)	.96
Hormone therapy use, n (%)	97 (48.5%)	93 (50.3%)	.69
Hypertension, n (%)	145 (72.5)	137 (74.1)	.73
Hyperlipidemia, n (%)	78 (39.6)	73 (40.6)	.85
Diabetes mellitus, n (%)	37 (18.5)	35 (18.9)	.92
Coronary artery disease, n (%)	37 (18.5)	38 (20.5)	.61
History of stroke, n (%)	8 (4.0)	15 (8.1)	.09
Parkinson's disease, n (%)	0 (0.0)	1 (0.6)	.48
Visual impairment, n (%)	156 (78.0)	148 (81.3)	.42
Arthritis, n (%)	153 (76.5)	149 (81.0)	.28
Geriatric Depression Scale score, median (IQR)	1 (0.5–3)	3 (1–5)	.004
Type of cognitive impairment			
MCI	120 (60.0)	58 (31.4)	
Probable dementia	80 (40.0)	127 (68.6)	<.001
Cognitive test score, median (IQR)			
Modified Telephone Interview for Cognitive Status	27 (25–29)	25 (22–28)	<.001
East Boston Memory Test			
Immediate recall	8 (7–9)	8 (6–9)	.75
Long delay	7 (3–8)	5 (0–8)	.002
Trail-Making Test, seconds			
Part A	11 (9–12)	11 (9–14)	.01
Part B	80.5 (44.5–300)	93 (46–300)	.16
Animal Fluency	12 (10–15)	11 (8–14)	.006
Digit Span forward	6 (5–8)	7 (6–8)	.02

Characteristic	Current Drivers, n = 200	Former Drivers, n = 185	*P*-Value
Digit Span backward	5 (4–6)	5 (3–6)	.70
Proxy report of trouble driving, n (%)	50 (25.0)	181 (97.8)	<.001

IQR = interquartile range.

P-values based on *t*-test or Wilcoxon rank-sum test for continuous variables; chi-square test or Fisher exact test for categorical variables.

Table 2

Driving Problems in Women with Any Cognitive Impairment (Mild Cognitive Impairment and Probable Dementia Combined) According to Proxy-Reported Driving Status on Dementia Questionnaire

	Current Drivers, n = 199	Former Drivers, n = 181	
Driving Problem	**n (%)**		**P-Value**
Gets lost	17 (8.5)	38 (21.0)	<.001
Frequent accidents	1 (0.5)	26 (14.4)	<.001
Fearfulness	3 (1.5)	20 (11.1)	<.001
Bad coordination	9 (4.5)	23 (12.7)	.008
Other cognitive problems	0 (0.0)	6 (3.3)	.01
Poor eyesight	7 (3.5)	26 (14.4)	<.001
Illness	1 (0.5)	10 (5.5)	.007

P-value based on chi-square test or Fisher exact test.

Table 3

Cognitive and Functional Deficits in Women with Any Cognitive Impairment (Mild Cognitive Impairment and Probable Dementia Combined) According to Proxy-Reported Driving Status on Dementia Questionnaire

Question	Current Drivers, n = 199	Former Drivers, n = 181	*P*-Value
Did (does) the subject have any problems with:			
Memory?	170 (85.4)	157 (84.9)	.88
Remembering people's names?	79 (40.1)	98 (53.0)	.01
Recognizing familiar faces?	14 (7.1)	34 (19.0)	<.001
Finding way about indoors?	6 (3.1)	20 (11.1)	.006
Finding way on familiar streets?	45 (23.4)	78 (46.7)	<.001
Remembering a short list of items?	77 (45.8)	105 (64.0)	<.001
Household tasks?	75 (37.9)	114 (63.0)	<.001
Handling money?	71 (37.6)	115 (64.3)	<.001
Grasping situations or explanations?	77 (38.9)	99 (54.7)	.003
Dressing of caring for self?	10 (5.1)	46 (25.1)	<.001
Feeding self?	1 (0.5)	16 (8.7)	.0001
Getting out of bed and into a chair?	34 (17.2)	52 (28.6)	.005
Bathing?	22 (11.4)	69 (38.6)	<.001
Did she ever receive medications for memory problems?	27 (15.3)	65 (37.1)	<.001

P-value based on chi-square test.

Table 4

Odds of Current Driving in Women with Mild Cognitive Impairment (MCI) or Probable Dementia, Adjusted for Age, Race, Education, and Depressive Symptomatology Using Multiple Logistic Regression

	MCI, n = 178		Probable Dementia, n = 207	
Characteristic	**aOR (95% CI)**	***P*-Value**	**aOR (95% CI)**	***P*-Value**
Demographic				
Age	0.87 (0.79–0.96)	.006	0.93 (0.86–1.01)	.10
Nonwhite	1.33 (0.46–3.88)	.60	2.12 (0.81–5.58)	.13
≤High school education	1.10 (0.54–2.24)	.79	1.05 (0.55–2.02)	.89
Annual family income, $ (reference < 20,000)		.86		.61
20,000–49,999	1.02 (0.45–2.33)		1.44 (0.64–3.20)	
≥50,000	0.80 (0.28–2.31)		1.62 (0.58–4.51)	
General health status				
History of stroke	0.94 (0.16–5.45)	.94	0.47 (0.14–1.60)	.23
History of diabetes mellitus	1.19 (0.44–3.19)	.73	0.83 (0.41–1.69)	.61
History of arthritis	0.54 (0.23–1.28)	.16	0.84 (0.40–1.75)	.64
Dementia Questionnaire items				
Memory and cognition				
Remembering names	1.42 (0.67–3.03)	.35	0.46 (0.25–0.83)	.01
Recognizing faces	0.40 (0.12–1.32)	.13	0.36 (0.15–0.90)	.03
Finding way indoors	0.13 (0.01–1.41)	.09	0.40 (0.14–1.18)	.10
Finding way on familiar streets	0.56 (0.22–1.46)	.24	0.45 (0.24–0.84)	.01
Remembering short list	0.68 (0.31–1.50)	.34	0.65 (0.33–1.31)	.23
Daily functioning				
Household tasks	0.30 (0.15–0.62)	.001	0.70 (0.37–1.33)	.27
Handling money	0.60 (0.26–1.38)	.23	0.44 (0.22–0.85)	.02
Grasping situations	0.44 (0.21–0.89)	.02	0.95 (0.52–1.74)	.86
Dressing or caring for self	0.06 (0.01–0.30)	<.001	0.32 (0.13–0.75)	.002
Getting out of bed into a chair	0.79 (0.32–1.95)	.61	0.74 (0.37–1.49)	.40

Characteristic	MCI, n = 178		Probable Dementia, n = 207	
	aOR (95% CI)	*P*-Value	aOR (95% CI)	*P*-Value
Bathing	0.20 (0.08–0.49)	<.001	0.27 (0.13–0.58)	<.001
Medications for memory problems	0.34 (0.11–1.05)	.06	0.42 (0.21–0.81)	.003
Cognitive tests				
Modified Telephone Interview for Cognitive Status	0.98 (0.87–1.11)	.79	1.17 (1.07–1.27)	<.001
East Boston Memory Test				
Immediate recall	0.88 (0.74–1.04)	.14	1.07 (0.93–1.22)	.35
Long delay	1.03 (0.93–1.13)	.62	1.11 (1.02–1.21)	.02
Trail-Making Test, seconds[a]				
Part A	1.01 (0.92–1.11)	.80	1.10 (1.01–1.19)	.02
Part B	1.00 (0.996–1.002)	.36	1.00 (0.999–1.004)	.12
Animal fluency	0.97 (0.90–1.05)	.43	1.14 (1.05–1.22)	.001
Digit Span forward	0.94 (0.79–1.11)	.45	0.91 (0.81–1.03)	.14
Digit Span backward	1.01 (0.87–1.17)	.92	1.03 (0.92–1.16)	.62

aOR = adjusted odds ratio; CI = confidence interval.

[a]Scores were subtracted from 0 so that higher scores indicate better performance.

Table 5

Odds of Current Driving in Women with Mild Cognitive Impairment (MCI) or Probable Dementia Adjusted for Age, Race, Education, and Depressive Symptomatology Using Multiple Logistic Regression with Backward Elimination

	MCI, n = 178		Probable Dementia, n = 207	
Model	**aOR (95% CI)**	***P*-Value**	**aOR (95% CI)**	***P*-Value**
1: Dementia Questionnaire items				
Remembering names	–	–	0.49 (0.22–1.08)	.08
Finding way on familiar streets	0.42 (0.11–1.55)	.19	0.50 (0.23–1.12)	.09
Household tasks	0.32 (0.12–0.85)	.02	–	–
Handling money	–	–	0.34 (0.13–0.86)	.02
Grasping situations	0.30 (0.12–0.80)	.02	–	–
Dressing or caring for self	0.06 (0.01–0.67)	.02	–	–
Bathing	0.44 (0.13–1.50)	.19	0.44 (0.16–1.18)	.10
Medications for memory problems	0.12 (0.03–0.53)	.004	0.32 (0.14–0.74)	.008
2: Cognitive tests				
Modified Telephone Interview for Cognitive Status	–	–	1.14 (1.03–1.26)	.01
East Boston Memory Test				
Immediate recall	0.88 (0.74–1.04)	.14	–	–
Long delay	–	–	1.07 (0.97–1.17)	.19
Trail-Making Test Part A, seconds[a]	–	–	1.08 (0.98–1.19)	.11
Animal fluency	–	–	1.07 (0.98–1.17)	.12
Digit Span forward	–	–	0.84 (0.73–0.97)	.02

aOR = adjusted odds ratio; CI = confidence interval.

All variables with $P < .25$ from Table 4 were entered as covariates into an initial model, then covariates with the highest *P*-values were eliminated sequentially until all of the remaining covariates had $P < .20$; age, race, education, and depression score were forced to remain in all models.

[a]Scores were subtracted from 0 so that higher score indicate better performance.