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Walking, public transit, and transitions to non-driving among US Medicare enrollees

Kellia J. Hansmann [a,b,*], W. Ryan Powell [c,d], Ronald Gangnon [e,f], Stephanie Robert [g], Carolyn McAndrews [h]

[a] VA Advanced Fellowship in Women's Health, William S. Middleton Veterans Hospital, Madison, WI, USA
[b] Department of Family Medicine and Community Health, University of Wisconsin School of Medicine and Public Health, Madison, WI, USA
[c] Division of Geriatrics and Gerontology, Department of Medicine, University of Wisconsin School of Medicine and Public Health, Madison, WI, USA
[d] University of Wisconsin Center for Health Disparities Research (CHDR), University of Wisconsin School of Medicine and Public Health, Madison, WI, USA
[e] Department of Population Health Sciences, University of Wisconsin School of Medicine and Public Health, Madison, WI, USA
[f] Department of Biostatistics and Medical Informatics, University of Wisconsin School of Medicine and Public Health, Madison, WI, USA
[g] University of Wisconsin Sandra Rosenbaum School of Social Work, Madison, WI, USA
[h] Department of Planning and Landscape Architecture, University of Wisconsin, Madison, WI, USA

A R T I C L E I N F O

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A B S T R A C T

Background: Many older adults rely on private vehicles for their mobility and may continue to drive when they are advised to stop. Walking and public transit can fulfill mobility needs in some contexts, but in the U.S. these options may not adequately substitute for driving when older adults reduce or stop driving. We examined whether baseline walking or taking public transit was associated with reductions in older adults' driving after a three-year period in the United States.
Methods: We analyzed National Health and Aging Trends Study data from community-dwelling older drivers in 2015 (n = 4574). We used weighted logistic regression to estimate associations between older drivers' walking and use of public transit in 2015 and changes in their driving behavior three years later—avoiding more driving conditions, driving less often, or not driving at all. We also examined associations between neighborhood walkability and driving behavior change three years later.
Results: There were no statistically significant associations between walking or taking public transit in 2015 and the adjusted odds of driving behavior change three years later. However, older drivers living in the most walkable neighborhoods in 2015 had greater adjusted odds of avoiding more driving conditions compared to those in the least walkable neighborhoods (adjusted Odds Ratio (aOR) = 1.66; 95 % Confidence Interval (95 % CI): 1.23-2.25). Living in the most walkable neighborhoods compared to the least walkable neighborhoods was also associated with an increased odds of no longer driving in 2018 (aOR = 1.56; 95 % CI: 1.04–2.36).
Discussion: The walkability of one's neighborhood area—shorter distances between blocks, diverse land uses, and proximity to transit stops—is associated with driving behavior changes over time for older drivers. This work can inform programs and policies designed to connect older adults with alternative transportation options to driving.

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* Corresponding author. 610 N Whitney Way, Suite 200, Madison, WI, 53705, USA.
E-mail address: kellia.hansmann@fammed.wisc.edu (K.J. Hansmann).

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1. Introduction

Mobility is important for healthy aging because it connects us to the sustaining and enriching resources needed to live meaningful and dignified lives (Hansmann and Razon, 2023; Karner et al., 2020; Kerschner and Silverstein, 2018). In many industrialized countries, driving a private vehicle is the primary mode of transportation for older adults (Donoghue et al., 2019; Gormley and O'Neill, 2019; O'Hern and Oxley, 2015). In the United States specifically, driving is the primary travel mode that people use to access activities beyond their immediate neighborhoods (Shen et al., 2017; Webber et al., 2010). This means that people who reduce or stop driving may suffer a loss of mobility (Huisingh et al., 2017), a common experience for older drivers (Dickerson et al., 2019). Older drivers are at increased risk for chronic health conditions, medication use, and functional limitations that decrease driving safety (Dickerson et al., 2007). With increasing age, older drivers are at greater risk for both vehicle crashes and serious injury from crashes (Cicchino and McCartt, 2015). The common need for a transition to non-driving places importance on acceptable alternative transportation options necessary to maintain mobility.

In the United States, at least 70 % of adults ages 65 and older get around by driving or by getting rides from their family and friends or other ride services even as they transition to non-driving (Choi et al., 2012; Shen et al., 2017). Essentially, during and after the transition to non-driving, many older adults rely on their *social capital*—friends, family, and social cohesiveness—to maintain their mobility (Musselwhite and Scott, 2019). This can pose disparate challenges for older drivers whose social network may not have the time or resources to provide rides (Koumoutzis et al., 2022), and be a particular source of widening disparities for older drivers with limited social capital prior to driving cessation.

Prior research shows that older drivers also depend on *infrastructure capital*—the walkability, transportation services, and types of destinations in their community—when social capital cannot meet their mobility needs (Musselwhite and Scott, 2019). Indeed, older adults are more likely to meet their mobility needs by walking or taking public transit if they live in areas with high indicators of walkability and proximity to public transit stops (Hansmann et al., 2024a). Specific built environment characteristics known to support older adults' walking include shorter distances to travel, greater variety of destinations, green spaces, and crosswalks with countdown timers (Ozbilen et al., 2022). Conversely, poor walking infrastructure, such as living in an area with cracked or broken sidewalks, has been associated with lower odds of older adults taking public transit (Gimie et al., 2022). Beyond driving and mobility outcomes, previous research has identified positive associations between higher quality neighborhood infrastructure and increased odds of health-related outcomes including physical activity and measures of cognitive function (Finlay et al., 2021).

The relationship between infrastructure capital and the transition to non-driving has been explored in previous research, often as part of broader assessments of alternative transportation options and travel behavior. Individual, interpersonal, environmental, and policy-level factors were all associated with older drivers' planning for driving cessation among a small cohort of older drivers in Australia (Schofield et al., 2024). In a cross-sectional analysis of older drivers in the United States, research identified associations between multiple forms of alternative transportation including rides from others – the most common – as well as taking a train or bus and the odds of driving restriction (Jones et al., 2018).

However, previous research exploring associations between infrastructure capital and the transition to non-driving has been cross sectional in design or draws from relatively small samples, limiting the ability to draw causal inferences and inform policy change. Moreover, no study we know of has examined epidemiological trends in both the presence and use of infrastructure capital in predicting changes in driving behavior. In this study, we fill gaps in prior research by using nationally representative, longitudinal data to understand whether both the use and presence of infrastructure capital (the walkability of and public transit availability within neighborhoods) are associated with changes in driving behaviors at three-year follow up, among older drivers in the U.S. We used data from the National Health and Aging Trends Study (NHATS), which included measures of the self-reported travel behavior of older drivers in 2015 (e.g., walking, taking public transit, and driving behaviors). We combined these individual-level travel behavior data from the NHATS with neighborhood-level data from the National Walkability Index (Thomas and Zeller, 2021), which includes measures of distances between intersections, variety of destinations, and proximity to transit stops, to characterize the walkability and availability of public transit in respondents' neighborhoods. We investigated the association between walking, taking public transit, or living in a more walkable neighborhood with the odds of changing driving behavior (i.e., avoiding certain driving conditions, driving less often, or not driving at all) at three-year follow up.

2. Methods

2.1. Dataset/study population

We used data collected as part of the National Health and Aging Trend Study (NHATS). The NHATS conducts interviews annually with a nationally representative cohort of Medicare enrollees who were ages 65 years and older starting in 2015 (n = 8038). NHATS uses a three-stage sampling design based on geographic divisions (e.g., counties, ZIP codes) that intentionally over-samples for the oldest age group and Black non-Hispanic identity (Montaquila et al., 2012). The weighted interview response rate in 2015 was 72.1 % (Freedman and Kasper, 2019).

Our analytic sample included NHATS participants who were current drivers in 2015, excluding participants who reported they had not driven in the month prior to the 2015 interview (n = 1930). We also excluded participants who required a proxy respondent to complete the 2015 interview (n = 38) because reasons for requiring a proxy (e.g., the participant had dementia that prevented them from answering the questions on their own) are expected to be independent risk factors for changes in driving behavior and would therefore be potential confounders in our analyses (Carr and O'Neill, 2015). By the 2018 follow up interview, 159 participants had moved out of a community setting, 369 participants had died, and 1011 participants had been lost to follow up. We excluded participants from our longitudinal analyses if they had moved out of the community setting or died for a final analytic sample of 4574 participants who were current drivers in 2015.

A local university Institutional Review Board deemed this study exempt from review due to the minimal risks associated with using de-identified, publicly available data and geographic data consistent with the parent study's data use agreement.

2.2. Outcomes: driving behavior change

We evaluated driving behavior change between the 2015 and 2018 interviews by assessing three outcomes: avoiding more driving conditions (i.e., avoiding driving at night, avoiding driving alone, avoiding driving in bad weather, or avoiding driving on highways), decreasing the frequency of driving (i.e., number of days per week they drive), or no longer driving to get places outside their home in 2018 (Appendix Table 1). We identified that drivers had increased the number of driving conditions they avoided if they were avoiding more conditions in 2018 than in 2015 or were not driving in 2018. We identified that drivers had decreased their driving frequency if they were driving fewer days per week in 2018 than in 2015—including not driving in 2018. We identified the third outcome, no longer driving in 2018, if participants reported they had not driven in the month prior to the 2018 interview.

2.3. Explanatory variables: infrastructure capital

We identified infrastructure capital use at the 2015 interview based on whether respondents reported 1) ever walking or using a wheelchair to get to places outside their home, or 2) ever taking public transit to get places outside their home in the month prior to their interview (Appendix Table 1).

To understand the presence of infrastructure capital available in participants' neighborhoods, we used data from the Environmental Protection Agency's (EPA) National Walkability Index (NWI) to characterize where participants lived in the 2015 interview (Thomas and Zeller, 2021). The NWI, calculated in 2013 and again in 2021, incorporates variables measuring intersection density, proximity to transit stops, and diversity of land use. A higher NWI score represents a more walkable area. We applied the EPA's established four-category definition to operationalize NWI: least walkable (NWI score of 1–5.75), below average (5.76–10.5), above average (10.51–15.75), and most walkable (15.76–20). We estimated the NWI score for census block groups in 2015 by assuming a linear change in the score over time between 2013 and 2021 and treated each census block group's score as a categorical variable using the EPA definitions described above.

Geographic data for NHATS participants is only available at the census-tract level, but NWI represents information for census block groups—a smaller geographic unit approximating neighborhood boundaries. We treated data from each census block group within a participant's census tract as a unique record that we then weighted in analyses based on the population size of the census block groups from National Historical GIS data from 2015 (Manson et al., 2022).

2.4. Covariates

We included self-reported demographic characteristics from the 2015 interviews as time-invariant variables: age category (in five year increments from 65 to 70 up to 90+), gender (female, male = ref), race and ethnicity (Non-Hispanic Black, Hispanic, Other race/ethnicity, Non-Hispanic White = ref), highest educational attainment (less than high school, high school degree or equivalent, more than high school degree = ref), and total individual income quartile (ref = highest income quartile).

We included self-reported and objective measures of health and functional status in 2015, all of which we treated as time-invariant. Self-reported measures included self-rated health (poor, fair, good, very good, excellent = ref), number of limitations in instrumental activities of daily living (IADLs; laundry, grocery shopping, preparing meals, banking, and taking medications; categorical – help with all, help with at least one but not all, help with none = ref), difficulty with vision even with correction (yes, no = ref), and depressive symptoms based on the Patient-Health Questionnaire-2 (score ranges from 0 to 6, at risk for depression if score$\geq$3, not at risk for depression if score $<$3 = ref) (Löwe et al., 2005). We classified cognitive status from a combination of subjective and objective measures (probable dementia, possible dementia, no dementia = ref) (Kasper et al., 2013).

We included two other neighborhood characteristics as covariates: (1) whether the participant lived in a non-metropolitan area (Rural Urban Continuum Code: 4–9) or metropolitan area (Rural Urban Continuum Code: 1–3) based on their home address in 2015; (2) the Area Deprivation Index (ADI) from 2015 to reflect neighborhood-level disadvantage that might further influence the area-level resources as facilitators or barriers to the transition to non-driving. The ADI reflects 17 measures of neighborhood disadvantage related to income, employment, education, and housing quality captured at the census block group level. A higher ADI percentile represents a more disadvantaged area (Kind and Buckingham, 2018). We treated each census block group's ADI percentile as a categorical variable, dividing ADI percentiles into quintiles (e.g., least disadvantaged = quintile 1). Like the NWI, ADI is measured at the census block group level, so we used the same census block group population-weighted approach to estimate participants' ADI based on their census tract.

2.5. Analysis

When covariates of interest from the NHATS data were missing due to incomplete response we used multiple imputation to make valid inferences from the available data, fully specifying each missing response using all other covariates included in our planned analyses (Reiter et al., 2006). We also used this multiple imputation approach to make valid inferences from the available data in 2015 to account for non-response due to losses to follow up at subsequent annual interviews. With this approach, our analytic sample at the 2018 follow up interview was 4574 participants who had been community-dwelling drivers in 2015. By using a multiple imputation approach as opposed to complete-case analysis, we mitigate the risk of bias created by simply excluding participants with missing values in this large cohort study (Liu and De, 2015).

We described infrastructure capital use and presence, demographic, health/function, driving behavior, socioeconomic, and other neighborhood characteristics in 2015 for our analytic sample. We reported the frequencies of each of these estimated population characteristics with 95 % confidence intervals.

We estimated adjusted logistic regression models to evaluate the associations between walking to get places outside one's home, taking public transit to get places outside one's home in 2015, and walkability category group of the participant's neighborhood in 2015 with the odds of the three driving reduction outcomes in 2018. We used a stepwise approach. These models adjusted for demographic characteristics (i.e., age, gender, race/ethnicity), health and functional status characteristics (i.e., self-rated health, help with IADLs, difficulty with vision, symptoms of depression, and dementia status), driving behavior, socioeconomic characteristics (i.e., education level, income quartile), and neighborhood characteristics (i.e., metropolitan vs. non; ADI), in 2015. We conducted all analyses using SAS software, Version 9.4 (SAS Institute Inc., 2018).

3. Results

3.1. Sample characteristics

Table 1 presents the weighted characteristics of community-dwelling older drivers in the NHATS sample in 2015 who were still alive and community-dwelling in 2018 (unweighted n = 4574). In 2015, half of community-dwelling older drivers reported walking to get places outside their home (53 %) while only a minority of participants reported taking public transit to get places (6 %). The 4574 census tracts that older drivers lived in were made up of 14,944 census block groups. Most of these census block groups were either below average (41 %) or least walkable (28 %) neighborhoods, with the smallest percentage (7 %) of census block groups having National Walkability Index scores indicating the most walkable neighborhoods.

Most community-dwelling older drivers were between 65 and 74 years at the 2015 interview (66 %). Women made up slightly more than half of the community-dwelling older drivers (52 %). Most older drivers self-reported they identified as White and non-Hispanic (85 %), with Black and non-Hispanic (7 %), Hispanic (5 %) and other racial and ethnic groups (3 %) making up the rest of community-dwelling older drivers in 2015.

Community-dwelling older drivers mostly reported having good, very good, or excellent self-rated health (84 %), while very few reported poor health at the 2015 interview (3 %). About half of community-dwelling older drivers reported getting help with at least one IADL (50 %), but very few reported getting help with all IADLs (1 %). Few community-dwelling older drivers reported having difficulty with their vision even when using corrective lenses (3 %) or screened at-risk for depression based on their PHQ-2 scores in 2015 (8 %). Most community-dwelling older drivers were classified as having no dementia (93 %) and very few as having probable dementia (2 %) in 2015.

Older drivers drove frequently, with half of community-dwelling older drivers reporting driving every day (51 %), and only a minority reporting driving one day per week or less (4 %). The average number of conditions drivers avoided in 2015, out of a maximum possible four conditions, was less than one (0.63).

Among community-dwelling older drivers, most had earned more than a high school degree (64 %). Community-dwelling older drivers mostly lived in metropolitan areas, with fewer living in nonmetropolitan areas (19 %). The average ADI percentile of the neighborhoods where community-dwelling older drivers lived was 47.1 (with a range from 1 to 100, 100 being the most disadvantaged neighborhoods).

Most older drivers were still driving in 2018 (93 %) and the most common outcome for avoiding driving behaviors or driving frequency was no change in driving behavior (Table 2).

3.2. Infrastructure capital use and odds of driving reduction

Table 3 demonstrates whether the use of alternative transportation options in 2015 was associated with the adjusted odds of driving behavior change associated with the following behaviors a) avoiding more driving conditions, b) decreasing driving frequency, or c) not driving at three-year follow up. Walking to get places in 2015 was not significantly associated with the adjusted odds of the three driving reduction outcomes (avoiding more driving conditions aOR = 0.92, 95 % CI: 0.77–1.09; decreasing driving frequency aOR = 0.89, 95 % CI: 0.75–1.05; no longer driving aOR = 0.85, 95 % CI: 0.64–1.13). Similarly, taking public transit to get places in 2015 was not significantly associated with the adjusted odds of the three driving reduction outcomes (Table 3).

When adding covariates in a stepwise fashion, we found that unadjusted models and models adjusted only for demographic characteristics showed significant associations between walking to get places in 2015 and lower odds of driving behavior changes in 2018, but that after adding health and functional status covariates, these associations were no longer statistically significant (Appendix Table 2a). We found no statistically significant association between taking public transit in 2015 and odds of driving behavior changes in 2018 in any of the stepwise models (Appendix Table 2b).

Table 1
Weighted Sample Characteristics for community-dwelling Older Drivers in 2015 who were still alive and community-dwelling in 2018 (Return to Results).

	n	% (CI) or *mean (SD)*
Sample *n*	4574	
Population *n*	28,877,998	
Infrastructure Capital (use and presence)		
Walked or used an assistive device	2271	52.7 (50.1–55.3)
Took public transit	268	6.31 (4.65–7.96)
National Walkability Index*(n = 14,944 census block groups within the participants' census tracts)	–	*8.62 (0.23)*
Least walkable	4139	27.8 (23.7–32.0)
Below average	5922	41.3 (37.9–44.6)
Above average	3822	24.0 (20.4–27.7)
Most walkable	1061	6.83 (5.25–8.41)
Demographic		
Age category group, years		
65-69	866	35.8 (34.5–37.1)
70-74	1364	30.1 (28.9–31.4)
75-79	1080	18.6 (17.6–19.5)
80-84	756	10.0 (9.30–10.7)
85-89	385	4.35 (3.90–4.80)
90+	123	1.20 (1.02–1.38)
Female	2408	51.6 (50.0–53.2)
Race, Ethnicity		
White, non-Hispanic	3478	84.6 (82.7–86.6)
Black, non-Hispanic	776	6.85 (5.93–7.76)
Hispanic	202	5.32 (4.08–6.56)
Other	118	3.20 (2.36–4.03)
Health/Function		
Self-rated health		
Excellent	695	18.0 (16.4–19.6)
Very good	1578	36.0 (34.5–37.5)
Good	1551	30.1 (29.3–32.7)
Fair	635	12.4 (11.1–13.6)
Poor	114	2.59 (1.99–3.18)
Has help with IADLs (e.g. preparing meals, etc.)		
No help with IADLs	2302	48.2 (46.6–49.8)
Help with some IADLs	2203	50.4 (48.9–51.9)
Help with all IADLs	70	1.36 (0.95–1.77)
Had difficulty with vision (even with correction)	126	2.54 (2.01–3.07)
At risk for depression	394	8.37 (7.46–9.27)
Dementia status		
No dementia	4158	92.8 (92.1–93.6)
Possible dementia	315	5.67 (5.00–6.35)
Probable dementia	101	1.50 (1.21–1.79)
Driving Behavior		
Number of driving conditions avoided	–	*0.63 (0.02)*
Driving Frequency		
Drove rarely	221	4.04 (3.47–4.61)
Drove some days	749	14.3 (13.2–15.3)
Drove most days	1405	31.0 (29.1–32.8)
Drove every day	2199	50.7 (48.9–52.6)
Socioeconomic		
Highest Education Level		
Less than high school degree	651	11.6 (10.2–12.9)
High school degree or equivalent	1185	24.4 (22.6–26.2)
More than high school degree	2738	64.1 (61.6–66.6)
Household income		
Lowest - Q1	1301	23.7 (21.8–25.6)
Q2	1228	25.0 (23.1–26.8)
Q3	1018	24.3 (22.8–25.9)
Highest - Q4	1027	27.1 (24.3–29.8)
Neighborhood characteristics		
Lived in a nonmetropolitan area	952	19.0 (11.5–26.5)
Area Deprivation Index* (n = 14,944 census block groups within the participants' census tracts; 33 block groups missing ADI)	–	*47.1 (1.59)*
Least disadvantaged - Q1	2794	22.0 (17.0–27.0)
Q2	2829	21.7 (18.5–25.0)
Q3	3132	21.3 (19.1–23.6)
Q4	3260	20.3 (17.4–23.3)
Most disadvantaged - Q4	2896	14.6 (12.4–16.8)

Footnote: We calculated 95 % confidence intervals correcting for the National Health and Aging Trends Study complex survey design and multiple imputation.* National Walkability Index scores and Area Deprivation Index percentiles are reported for the census block groups (n = 14,944) that made up the census tracts in which participants lived.

Table 2
Driving outcomes in 2018 for study cohort (community-dwelling Older Drivers in 2015 who were still alive and community-dwelling in 2018) **(Return** to Results).

Sample *n*	4574	
Population *n*	28,877,998	
Potential Outcomes	n	% (CI)
Still driving in 2018	4084	92.5 (91.6–93.5)
Stopped driving in 2018	490	7.5 (6.5–8.5)
Decreased avoidance in 2018	513	11.3 (9.9–12.8)
No change in avoidance in 2018	2676	63.3 (61.5–65.0)
Increased avoidance in 2018	1385	25.4 (23.8–26.9)
Increased frequency in 2018	494	10.8 (9.8–11.9)
No change in frequency in 2018	2477	57.3 (55.3–59.3)
Decreased frequency in 2018	1603	31.9 (30.0–33.8)

Footnote: We calculated 95 % confidence intervals correcting for the National Health and Aging Trends Study complex survey design and multiple imputation.

Table 3
Odds ratios of driving behavior change in 2018 adjusted for actual transportation use, biopsychosocial factors, and driving behaviors in 2015 (Return to Results).

Outcome variable:		Odds of avoiding more driving conditions	Odds of Decreasing Driving Frequency	Odds of Not Driving
Explanatory variable:	Walked or wheeled (ref = no)	0.92 (0.77–1.09)	0.89 (0.75–1.05)	0.85 (0.64–1.13)
	Took public transit (ref = no)	1.49 (0.98–2.25)	1.05 (0.66–1.66)	1.12 (0.56–2.27)

Footnote. Models are adjusted for the explanatory variable as well as demographics (age category, gender, race, and ethnicity), health status (self-rated health, help with IADLs, difficulty with vision, at risk for depression, dementia classification), driving behaviors (driving frequency and number of driving conditions avoided), socioeconomic status (education, individual income), and neighborhood characteristics (metropolitan vs. nonmetropolitan, Area Deprivation Index) from the 2015 interview. We reported odds ratios with 95 % Confidence Intervals accounting for the NHATS complex survey design and multiple imputation. Odds ratios are statistically significant if they do not cross 1.00, which we identified in bold text in this table if applicable.

3.3. Infrastructure capital presence and odds of driving reduction

As shown in Table 4, in adjusted models, older drivers who lived in the most walkable neighborhoods in 2015 had greater odds of avoiding more driving conditions in 2018 compared to older drivers living in the least walkable neighborhoods (aOR = 1.66, 95 % CI: 1.23–2.25). Similarly, older drivers who lived in the most walkable neighborhoods in 2015 had greater odds of no longer driving in 2018 compared to older drivers living in the least walkable neighborhoods (aOR = 1.56, 95 % CI: 1.04–2.36). Neighborhood

Table 4
Odds ratios of driving behavior change in 2018 adjusted for neighborhood walkability and public transit characteristics, biopsychosocial factors, and driving behaviors in 2015 (Return to Results).

Outcome variable:		Odds of avoiding more driving conditions	Odds of Decreasing Driving Frequency	Odds of No Longer Driving
Explanatory variable:	National Walkability Index (ref = least walkable)			
	Below average	1.13 (0.94–1.35)	0.95 (0.83–1.09)	1.11 (0.83–1.48)
	Above average	**1.39 (1.08–1.79)**	0.96 (0.79–1.16)	1.22 (0.89–1.69)
	Most walkable	**1.66 (1.23–2.25)**	0.93 (0.70–1.22)	**1.56 (1.04–2.36)**

Footnote. Models are adjusted for the explanatory variable as well as demographics (age category, gender, race, and ethnicity), health status (self-rated health, help with IADLs, difficulty with vision, at risk for depression, dementia classification), driving behaviors (driving frequency and number of driving conditions avoided), socioeconomic status (education, individual income), and neighborhood characteristics (metropolitan vs. nonmetropolitan, Area Deprivation Index) from the 2015 interview. We reported odds ratios with 95 % Confidence Intervals accounting for the NHATS complex survey design and multiple imputation. Odds ratios are statistically significant if they do not cross 1.00, which we identified in bold text in this table if applicable.

walkability was not significantly associated with decreasing driving frequency.

When adding covariates in a stepwise fashion, we found that the association between living in the most walkable neighborhood**s** in 2015 and greater odds of avoiding more driving conditions in 2018 was statistically significant in all models (Appendix Table 3).

4. Discussion

We aimed to understand if older drivers' availability of and use of infrastructure capital in their neighborhood was associated with driving behavior change (i.e., avoiding driving in challenging conditions, driving less often, or not driving at all) at three-year follow up, among a nationally representative sample of older drivers in the U.S. in 2015. One of our primary findings was that older drivers who lived in the most walkable neighborhoods in 2015 had greater odds of avoiding more driving conditions and of no longer driving at three-year follow up compared to those who lived in the least walkable neighborhoods. In other words, the availability of infrastructure capital seems to increase the transition to non-driving. However, our second notable finding was that we found no statistically significant associations between walking or taking public transit to get places and the odds of driving behavior change three years later. In other words, while living in a walkable neighborhood was associated with greater avoidance of driving including no longer driving at all, reports of **actually** walking or taking public transit were not associated with changes in driving behavior over a period of three years. We will discuss each of these two findings in turn.

Our major contribution to the literature is our finding that infrastructure capital—represented as neighborhood walkability—is associated with a transition to non-driving. Although prior research has emphasized the importance of social capital to help older travelers cope with reducing driving (Hansmann et al., 2024b), few studies have investigated the potential for infrastructure capital to help older adults transition away from driving over time. One previous study of older drivers in Korea found that drivers living in an area with a metro system were more than twice as likely to stop driving compared to those who lived in an area without one (Moon and Park, 2020). Our nationally representative, longitudinal study provides strong support for the idea that infrastructure capital may help older drivers cope with the emotional and logistical challenges associated with the transition to non-driving.

Previous research has also found associations between neighborhood design and land use characteristics and increased use of active modes of transportation such as walking or taking public transit. For example, older adults are more likely to walk to get to places outside their home if there are clearly marked crosswalks with pedestrian countdown timers and a variety of destinations to visit (Ozbilen et al., 2022). This is consistent with our findings that older adults living in very walkable neighborhoods in 2015 had greater odds of avoiding more driving conditions at follow up. However, the National Walkability Index does not include all the characteristics of infrastructure (e.g., clearly marked crosswalks with pedestrian countdown timers) and land use (e.g., the types of destinations) previously associated with older adults using walking as a form of transportation. Future research is needed to characterize the extent to which these other important infrastructure and land use characteristics affect the association between neighborhood walkability and driving behavior over time.

The second notable finding from our study was that we found no statistically significant associations between walking or taking public transit to get places and the odds of driving behavior change three years later. This is somewhat unexpected given previous findings suggesting older adults who use public transportation and walking as transit modes experience less steep declines in their social participation over time (Latham-Mintus et al., 2022). This may suggest that while neighborhood walkability might facilitate walking or taking public transit for some trips, older drivers may not be able to meet all their mobility needs with infrastructure capital without also driving independently. Furthermore, general measures of walkability like the NWI may not capture the unique needs and preferences of older adults when they are deciding whether to walk somewhere (Gan et al., 2022).

The lack of a significant association between using public transit and driving reduction in our findings may also reflect different cultural attitudes toward taking public transit as an alternative transportation option to driving, as well as its viability (Tao et al., 2019). Indeed, among the NHATS national sample of older drivers in the U.S., only 6 % had taken public transportation in the last month. How older adults use alternative transportation options (e.g. how often they use them, the types of trips they use them for) is likely to influence how older adults evaluate the acceptability of these alternatives as a replacement for driving (Caragata, 2021).

In our study, more than half of older adult drivers reported walking to get places outside their home, yet past walking behavior was not associated with the odds of driving behavior change over three-year follow up. This could be consistent with the idea that older adults who walk to get to some places outside their home may not change their driving behavior until their concerns about driving safety outweigh the perceived benefits of accessing important destinations that are not accessible by walking (Tuokko et al., 2014). Previous research has shown that older adults will choose walking as a mode of transportation if their destination is within a quarter mile (Moayyed, 2022). Further study should investigate the destination choices available to older adults, including both life-sustaining and life-enriching destinations and explore how characteristics of these destinations like distance from one's home influence older adults' travel behavior choices. For example, while it may be feasible to rely on walking to get to a nearby park, it may not be feasible for many older adults to replace driving with walking to important destinations that may be further from home (e.g., the doctor's office, the hairdresser).

One limitation of the present study is that our measure of walking or taking public transit in 2015 did not reflect how often participants had used these modes of transportation. It is possible that older adults who use these alternatives more frequently have greater odds of reducing their driving behavior over time. Similarly, there is no equivalent of the National Walkability Index to reflect the quality of other transportation options such as taxi/rideshare services or paratransit for a nationally representative cohort. Our findings are only able to reflect a subset of transportation options that older adults might use when they are transitioning to non-driving.

Another limitation of our investigation of neighborhood characteristics in this study is that NHATS is only able to provide geographic detail about participants at the census tract level, while NWI and ADI are measured at a smaller geographic level – the census block group. Our approach, using population-weighted averages of these variables for the census block groups in participants' census tracts, provides some information about neighborhood characteristics, however, we are likely unable to detect the full effect of neighborhood characteristics on driving outcomes. For this reason, we advocate for the addition of geographic information specific to participants' census block group, such as NWI or ADI, to be linked to NHATS data such that investigators can maintain participants' confidentiality while allowing for study of the mechanistic relationship between neighborhood characteristics and trends in late-life disability and aging.

5. Conclusion

Transitioning to non-driving without adequate alternative transportation and destination options puts older adults at risk for social isolation and subsequent declines in physical and emotional wellbeing. We strongly advocate for further research to understand how neighborhood characteristics disparately influence older adults' availability and use of alternative transportation options to driving. This work can inform programs and policies designed to connect older adults with alternative transportation options to driving such as investments in age-friendly walking and public transit infrastructure and trip planning services. In clinical contexts, our findings can help clinicians provide more tailored support, informed by an awareness of community infrastructure capital, to older drivers and their care partners as they navigate transitions to non-driving.

CRediT authorship contribution statement

Kellia J. Hansmann: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **W. Ryan Powell:** Writing – review & editing, Methodology. **Ronald Gangnon:** Writing – review & editing, Supervision, Methodology. **Stephanie Robert:** Writing – review & editing, Supervision, Conceptualization. **Carolyn McAndrews:** Writing – review & editing, Supervision, Conceptualization.

Disclosures

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The authors of this manuscript certify that we have no potential conflicts of interest to declare.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix

Appendix Table 1
National Health and Aging Trends Study Interview Questions (Return to Methods)

Questions we used to determine number of driving behaviors avoided in 2015 and 2018:
In the last month did you ever avoid driving: At night? Alone? On busy roads or highways? In the rain or other bad weather? Response options: Yes; No; No, no rain or bad weather (which we coded as "No"); Refused (which we coded as missing); Don't know (which we coded as missing)
Questions we used to determine driving frequency in 2015 and 2018:
In the last month, how often did you drive yourself places? Would you say every day, most days, some days, rarely or never? Response options: Every day; Most days; Some days; Rarely; Never (which we coded in 2018

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Appendix Table 1 (*continued*)

interview as no longer driving); Refused (which we coded as missing); Don't know (which we coded as missing)
Questions we used to determine alternative transportation use in 2015:
In the last month how {else} did you get to places outside your {home/building}? Did you: Walk {or use your}{wheelchair/scooter/wheelchair or scooter}? Take public transportation (the bus, subway, or train)? Response options: Yes; No; Refused (which we coded as missing); Don't Know (which we coded as missing)

Appendix Table 2a

Odds ratios of avoiding more driving conditions in 2018 associated with walking to get places in 2015 adjusted for other characteristics from 2015 data (Return to Results))

	Unadjusted	+ demographics	+ health/function	+ driving behavior	+ SES	+ neighborhood
Infrastructure Capital (use) Walked or wheeled (ref = no)	**0.63 (0.55–0.73)**	**0.75 (0.64–0.88)**	0.89 (0.75–1.05)	0.90 (0.76–1.08)	0.91 (0.76–1.08)	0.92 (0.77–1.09)
Demographics						
Age Category (ref = 65–69 years)						
70–74 years		**1.46 (1.11–1.92)**	**1.53 (1.15–2.03)**	**1.50 (1.13–2.01)**	**1.50 (1.12–2.01)**	**1.50 (1.12–2.01)**
75–79 years		**1.76 (1.35–2.29)**	**1.75 (1.33–2.29)**	**1.73 (1.30–2.28)**	**1.69 (1.27–2.26)**	**1.70 (1.27–2.26)**
80–84 years		**2.84 (2.14–3.77)**	**2.81 (2.09–3.78)**	**2.80 (2.06–3.79)**	**2.70 (1.97–3.70)**	**2.72 (1.99–3.71)**
85–89 years		**3.76 (2.70–5.22)**	**3.82 (2.65–5.50)**	**3.81 (2.61–5.56)**	**3.63 (2.47–5.34)**	**3.64 (2.47–5.35)**
90+ years		**8.89 (5.02–15.7)**	**9.83 (5.48–17.6)**	**9.58 (5.20–17.7)**	**9.26 (5.01–17.1)**	**9.42 (5.14–17.26)**
Gender (ref = man)		**1.68 (1.38–2.05)**	**2.12 (1.68–2.66)**	**1.94 (1.50–2.50)**	**1.89 (1.46–2.44)**	**1.90 (1.47–2.45)**
Race (ref = White, non- Hispanic)						
Black, non- Hispanic		**1.42 (1.11–1.81)**	1.24 (0.97–1.59)	**1.32 (1.03–1.69)**	1.24 (0.98–1.57)	1.19 (0.93–1.52)
Hispanic		**2.67 (1.79–4.00)**	**2.18 (1.49–3.20)**	**2.44 (1.63–3.63)**	**2.26 (1.52–3.37)**	**2.24 (1.48–3.37)**
Other		1.60 (0.99–2.59)	1.35 (0.81–2.26)	1.37 (0.82–2.30)	1.30 (0.77–2.20)	1.31 (0.78–2.21)
Health						
Self-rated health (ref = Excellent)						
Very Good			1.04 (0.76–1.43)	1.01 (0.74–1.38)	1.00 (0.73–1.36)	0.99 (0.73–1.36)
Good			**1.44 (1.09–1.89)**	**1.38 (1.05–1.81)**	**1.33 (1.02–1.74)**	**1.33 (1.02–1.74)**
Fair			**1.91 (1.35–2.70)**	**1.80 (1.30–2.49)**	**1.70 (1.23–2.35)**	**1.69 (1.22–2.33)**
Poor			**4.22 (2.53–7.03)**	**3.93 (2.33–6.62)**	**3.68 (2.13–6.36)**	**3.68 (2.13–6.36)**
Help with IADLs (ref = none)						
Help with some IADLs			**1.40 (1.14–1.72)**	**1.31 (1.07–1.60)**	**1.38 (1.12–1.69)**	**1.38 (1.12–1.70)**
Help with all IADLs			**2.86 (1.64–4.97)**	**2.50 (1.45–4.32)**	**2.57 (1.48–4.45)**	**2.58 (1.49–4.47)**
Difficulty with vision (ref = no)			1.59 (0.99–2.54)	**1.67 (1.01–2.76)**	**1.67 (1.02–2.73)**	**1.68 (1.02–2.76)**
At risk for depression (ref = no)			**1.43 (1.02–1.99)**	**1.42 (1.01–1.99)**	1.38 (0.98–1.95)	1.38 (0.98–1.95)
Dementia classification (ref = no dementia)						
Possible dementia			**1.57 (1.11–2.24)**	**1.57 (1.11–2.23)**	**1.56 (1.12–2.18)**	**1.56 (1.12–2.18)**
Probable dementia			1.70 (0.83–3.49)	1.76 (0.85–3.66)	1.78 (0.88–3.62)	1.79 (0.88–3.65)
Driving Behavior						
Number of avoidance behaviors				0.91 (0.83–1.00)	**0.90 (0.82–0.99)**	**0.90 (0.82–0.99)**
Driving frequency (ref = Every day)						
Rarely				**2.31 (1.58–3.38)**	**2.25 (1.54–3.29)**	**2.27 (1.55–3.33)**
Some days				**1.72 (1.34–2.21)**	**1.70 (1.32–2.18)**	**1.70 (1.32–2.18)**
Most days				**1.44 (1.14–1.82)**	**1.45 (1.15–1.83)**	**1.46 (1.15–1.84)**
Socioeconomic Status						
Education (ref = more than high school)						
Less than high school					0.87 (0.69–1.10)	0.85 (0.67–1.07)

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Appendix Table 2a (*continued*)

	Unadjusted	+ demographics	+ health/function	+ driving behavior	+ SES	+ neighborhood
High school degree or equivalent					0.89 (0.67–1.20)	0.88 (0.66–1.19)
Individual income (ref = highest quartile, Q4)						
Lowest quartile - Q1					**1.46 (1.07–1.99)**	**1.41 (1.04–1.90)**
Q2					1.22 (0.89–1.66)	1.18 (0.87–1.60)
Q3					0.95 (0.67–1.34)	0.93 (0.66–1.30)
Neighborhood Characteristics						
Nonmetropolitan (ref = no)						0.90 (0.70–1.15)
Area Deprivation Index (ref = most disadvantaged, 81–100th percentile)						
Least disadvantaged – 1-20						**0.80 (0.60–1.08)**
21-40						**0.80 (0.60–1.08)**
41-60						**0.93 (0.71–1.21)**
61-80						**0.89 (0.72–1.10)**
Intercept	**0.43 (0.38–0.48)**	**0.17 (0.13–0.23)**	**0.08 (0.05–0.13)**	**0.08 (0.05–0.12)**	**0.07 (0.05–0.12)**	**0.07 (0.03–0.14)**

Footnote. Models are adjusted for the explanatory variable as well as a stepwise progression of demographics (age category, gender, race, and ethnicity), health status (self-rated health, help with IADLs, difficulty with vision, at risk for depression, dementia classification), driving behaviors (driving frequency and number of driving conditions avoided), socioeconomic status (education, individual income), and neighborhood characteristics (metropolitan vs. nonmetropolitan, Area Deprivation Index) from the 2015 interview. We reported odds ratios with 95 % Confidence Intervals accounting for the NHATS complex survey design and multiple imputation. Odds ratios are statistically significant if they do not cross 1.00, which we identified in bold text in this table if applicable. Data for odds of decreasing driving frequency and odds of no longer driving available on request.

Appendix Table 2b

Odds ratios of avoiding more driving conditions in 2018 associated with taking public transit to get places in 2015 adjusted for other characteristics from 2015 data (Return to Results)

	Unadjusted	+ demographics	+ health/function	+ driving behavior	+ SES	+ neighborhood
Infrastructure Capital (use)	1.11 (0.79–1.56)	1.21 (0.85–1.74)	**1.44 (1.00–2.09)**	1.38 (0.95–2.01)	1.44 (0.97–2.14)	1.49 (0.98–2.25)
Took public transit (ref = no)						
Demographics						
Age Category (ref = 65–69 years)						
70–74 years		**1.48 (1.12–1.94)**	**1.54 (1.16–2.04)**	**1.51 (1.13–2.01)**	**1.51 (1.12–2.01)**	**1.50 (1.12–2.01)**
75–79 years		**1.81 (1.39–2.35)**	**1.77 (1.35–2.31)**	**1.74 (1.32–2.31)**	**1.70 (1.27–2.27)**	**1.70 (1.28–2.27)**
80–84 years		**2.93 (2.21–3.88)**	**2.84 (2.11–3.82)**	**2.82 (2.08–3.81)**	**2.70 (1.97–3.70)**	**2.72 (2.00–3.71)**
85–89 years		**3.94 (2.85–5.45)**	**3.94 (2.76–5.62)**	**3.91 (2.70–5.66)**	**3.70 (2.53–5.41)**	**3.72 (2.54–5.43)**
90+ years		**9.53 (5.42–16.8)**	**10.2 (5.70–18.3)**	**9.88 (5.37–18.2)**	**9.48 (5.13–17.5)**	**9.68 (5.29–17.70)**
Gender (ref = man)		**1.77 (1.46–2.14)**	**2.19 (1.76–2.73)**	**2.00 (1.56–2.56)**	**1.94 (1.50–2.50)**	**1.95 (1.52–2.51)**
Race (ref = White, non- Hispanic)						
Black, non- Hispanic		**1.45 (1.14–1.85)**	1.23 (0.96–1.58)	1.31 (1.02–1.68)	1.22 (0.96–1.55)	1.17 (0.91–1.50)
Hispanic		**2.72 (1.82–4.06)**	**2.16 (1.47–3.18)**	**2.42 (1.62–3.62)**	**2.23 (1.49–3.34)**	**2.21 (1.46–3.35)**
Other		1.55 (0.98–2.47)	1.31 (0.79–2.18)	1.33 (0.80–2.22)	1.26 (0.76–2.11)	1.28 (0.77–2.14)
Health						
Self-rated health (ref = Excellent)						
Very Good			1.07 (0.78–1.46)	1.03 (0.76–1.41)	1.02 (0.74–1.39)	1.01 (0.74–1.38)
Good			**1.51 (1.15–1.98)**	**1.44 (1.10–1.88)**	**1.38 (1.06–1.80)**	**1.38 (1.06–1.79)**
Fair			**2.02 (1.44–2.85)**	**1.89 (1.37–2.61)**	**1.77 (1.29–2.44)**	**1.75 (1.28–2.41)**
Poor			**4.50 (2.69–7.54)**	**4.16 (2.45–7.07)**	**3.85 (2.21–6.69)**	**3.85 (2.22–6.67)**
Help with IADLs (ref = none)						
Help with some IADLs			**1.42 (1.15–1.74)**	**1.32 (1.07–1.63)**	**1.40 (1.13–1.73)**	**1.40 (1.13–1.73)**
Help with all IADLs			**2.95 (1.70–5.14)**	**2.58 (1.49–4.46)**	**2.65 (1.53–4.59)**	**2.66 (1.54–4.61)**
Difficulty with vision (ref = no)			**1.62 (1.01–2.57)**	**1.69 (1.03–2.79)**	**1.69 (1.03–2.76)**	**1.70 (1.04–2.79)**
At risk for depression (ref = no)			**1.44 (1.04–2.00)**	**1.43 (1.03–2.00)**	1.39 (0.99–1.95)	1.39 (0.99–1.95)
Dementia classification (ref = no dementia)						
Possible dementia			**1.58 (1.11–2.25)**	**1.58 (1.11–2.23)**	**1.56 (1.12–2.18)**	**1.57 (1.12–2.18)**
Probable dementia			1.72 (0.84–3.53)	1.78 (0.86–3.69)	1.81 (0.89–3.66)	1.82 (0.89–3.70)
Driving Behavior						

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Appendix Table 2b (*continued*)

	Unadjusted	+ demographics	+ health/function	+ driving behavior	+ SES	+ neighborhood
Number of avoidance behaviors				0.91 (0.83–1.01)	**0.90 (0.82–0.99)**	**0.90 (0.82–0.99)**
Driving frequency (ref = Every day)						
Rarely				**2.27 (1.54–3.37)**	**2.20 (1.49–3.26)**	**2.21 (1.49–3.28)**
Some days				**1.72 (1.34–2.21)**	**1.70 (1.32–2.18)**	**1.69 (1.32–2.17)**
Most days				**1.44 (1.14–1.82)**	**1.45 (1.15–1.83)**	**1.45 (1.15–1.84)**
Socioeconomic Status						
Education (ref = more than high school)						
Less than high school					0.88 (0.69–1.11)	0.85 (0.68–1.08)
High school degree or equivalent					0.91 (0.68–1.22)	0.90 (0.67–1.21)
Individual income (ref = Highest quartile, Q4)						
Lowest quartile - Q1					**1.51 (1.10–2.07)**	**1.43 (1.06–1.94)**
Q2					1.27 (0.92–1.74)	1.22 (0.90–1.66)
Q3					0.97 (0.68–1.38)	0.94 (0.67–1.33)
Neighborhood Characteristics						
Nonmetropolitan (ref = no)						0.90 (0.70–1.16)
Area Deprivation Index (ref = most disadvantaged, 81–100th percentile)						
Least disadvantaged – 1-20						**0.77 (0.57–1.03)**
21-40						**0.80 (0.59–1.08)**
41-60						**0.93 (0.71–1.21)**
61-80						**0.89 (0.72–1.10)**
Intercept	**0.34 (0.31–0.37)**	**0.14 (0.11–0.18)**	**0.07 (0.05–0.10)**	**0.07 (0.04–0.10)**	**0.06 (0.04–0.10)**	**0.05 (0.03–0.11)**

Footnote. Models are adjusted for the explanatory variable as well as a stepwise progression of demographics (age category, gender, race, and ethnicity), health status (self-rated health, help with IADLs, difficulty with vision, at risk for depression, dementia classification), driving behaviors (driving frequency and number of driving conditions avoided), socioeconomic status (education, individual income), and neighborhood characteristics (metropolitan vs. nonmetropolitan, Area Deprivation Index) from the 2015 interview. We reported odds ratios with 95 % Confidence Intervals accounting for the NHATS complex survey design and multiple imputation. Odds ratios are statistically significant if they do not cross 1.00, which we identified in bold text in this table if applicable. Data for odds of decreasing driving frequency and odds of no longer driving available on request.

Appendix Table 3

Odds ratios of avoiding more driving conditions in 2018 associated with neighborhood walkability and public transit characteristics in 2015 adjusted for other characteristics from 2015 data (Return to Results)

	Unadjusted	+ demographics	+ health/function	+ driving behavior	+ SES	+ neighborhood
Neighborhood Walkability/Transit						
National Walkability Index (ref = least walkable)						
Below average	1.09 (0.93–1.28)	1.01 (0.86–1.19)	1.07 (0.90–1.27)	1.10 (0.92–1.31)	1.12 (0.93–1.34)	1.13 (0.94–1.35)
Above average	**1.27 (1.02–1.59)**	1.18 (0.93–1.48)	1.27 (1.00–1.62)	**1.32 (1.04–1.68)**	**1.35 (1.05–1.73)**	**1.39 (1.08–1.79)**
Most Walkable	**1.45 (1.14–1.85)**	**1.34 (1.02–1.75)**	**1.47 (1.10–1.95)**	**1.50 (1.14–1.99)**	**1.55 (1.16–2.08)**	**1.66 (1.23–2.25)**
Demographics						
Age Category (ref = 65–69 years)						
70–74 years		**1.48 (1.13–1.95)**	**1.55 (1.17–2.05)**	**1.52 (1.14–2.03)**	**1.51 (1.13–2.03)**	**1.51 (1.12–2.02)**
75–79 years		**1.82 (1.40–2.36)**	**1.78 (1.36–2.33)**	**1.75 (1.32–2.32)**	**1.71 (1.28–2.28)**	**1.71 (1.28–2.28)**
80–84 years		**2.94 (2.21–3.90)**	**2.86 (2.13–3.83)**	**2.83 (2.09–3.82)**	**2.70 (1.98–3.70)**	**2.73 (2.01–3.72)**
85–89 years		**3.91 (2.83–5.41)**	**3.88 (2.71–5.56)**	**3.85 (2.65–5.60)**	**3.62 (2.46–5.33)**	**3.65 (2.48–5.37)**
90+ years		**9.50 (5.36–16.81)**	**10.14 (5.63–18.27)**	**9.82 (5.29–18.23)**	**9.39 (5.04–17.48)**	**9.66 (5.23–17.86)**
Gender (ref = man)		**1.76 (1.45–2.14)**	**2.18 (1.75–2.71)**	**1.99 (1.55–2.55)**	**1.93 (1.50–2.48)**	**1.94 (1.50–2.49)**
Race (ref = White, non- Hispanic)						
Black, non- Hispanic		**1.41 (1.10–1.81)**	1.19 (0.92–1.53)	1.26 (0.98–1.62)	1.17 (0.92–1.49)	1.13 (0.88–1.44)
Hispanic		**2.65 (1.77–3.98)**	**2.09 (1.42–3.09)**	**2.33 (1.56–3.50)**	**2.13 (1.41–3.21)**	**2.13 (1.40–3.23)**
Other		1.52 (0.96–2.39)	1.27 (0.78–2.09)	1.28 (0.78–2.11)	1.21 (0.74–2.00)	1.24 (0.75–2.05)
Health						
Self-rated health (ref = Excellent)						
Very Good			1.06 (0.77–1.45)	1.02 (0.75–1.40)	1.00 (0.73–1.37)	1.00 (0.73–1.36)
Good			**1.50 (1.15–1.97)**	**1.44 (1.09–1.89)**	**1.37 (1.05–1.80)**	**1.36 (1.04–1.78)**
Fair			**2.01 (1.43–2.84)**	**1.89 (1.36–2.61)**	**1.76 (1.27–2.42)**	**1.74 (1.26–2.40)**
Poor			**4.45 (2.66–7.44)**	**4.13 (2.43–6.99)**	**3.78 (2.17–6.57)**	**3.75 (2.16–6.48)**
Help with IADLs (ref = none)						
Help with some IADLs			**1.42 (1.15–1.74)**	**1.32 (1.07–1.63)**	**1.40 (1.13–1.73)**	**1.40 (1.13–1.73)**
Help with all IADLs			**2.87 (1.66–4.97)**	**2.52 (1.47–4.32)**	**2.57 (1.49–4.44)**	**2.57 (1.49–4.44)**
Difficulty with vision (ref = no)			**1.60 (1.00–2.57)**	**1.68 (1.02–2.78)**	**1.68 (1.02–2.75)**	**1.69 (1.03–2.78)**

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Appendix Table 3 (*continued*)

	Unadjusted	+ demographics	+ health/function	+ driving behavior	+ SES	+ neighborhood
At risk for depression (ref = no)			**1.44 (1.04–2.00)**	**1.44 (1.03–2.00)**	1.39 (0.99–1.95)	1.39 (0.99–1.95)
Dementia classification (ref = no dementia)						
Possible dementia			**1.58 (1.11–2.25)**	**1.59 (1.12–2.25)**	**1.56 (1.12–2.18)**	**1.57 (1.13–2.19)**
Probable dementia			1.73 (0.82–3.64)	1.79 (0.84–3.82)	1.81 (0.86–3.78)	1.82 (0.87–3.82)
Driving Behavior						
Number of avoidance behaviors				0.91 (0.83–1.00)	**0.90 (0.82–0.99)**	**0.90 (0.81–0.99)**
Driving frequency (ref = Every day)						
Rarely				**2.32 (1.58–3.40)**	**2.25 (1.54–3.30)**	**2.26 (1.54–3.31)**
Some days				**1.75 (1.36–2.25)**	**1.73 (1.34–2.22)**	**1.72 (1.34–2.21)**
Most days				**1.45 (1.16–1.83)**	**1.46 (1.16–1.84)**	**1.47 (1.17–1.85)**
Socioeconomic Status						
Education (ref = more than high school)						
Less than high school					0.89 (0.71–1.13)	0.86 (0.68–1.08)
High school degree or equivalent					0.92 (0.69–1.24)	0.90 (0.67–1.22)
Individual income (ref = Highest quartile, Q4)						
Lowest quartile - Q1					**1.52 (1.12–2.07)**	**1.43 (1.06–1.92)**
Q2					1.27 (0.93–1.74)	1.21 (0.89–1.64)
Q3					0.97 (0.69–1.38)	0.94 (0.67–1.31)
Neighborhood Characteristics						
Nonmetropolitan (ref = no)						0.97 (0.75–1.26)
Area Deprivation Index (ref = most disadvantaged, 81–100th percentile)						
Least disadvantaged – 1-20						**0.74 (0.56–0.99)**
21-40						0.81 (0.60–1.09)
41-60						0.95 (0.73–1.24)
61-80						0.90 (0.73–1.12)
Intercept	**0.32 (0.20–0.50)**	**0.14 (0.09–0.24)**	**0.06 (0.03–0.12)**	**0.06 (0.03–0.11)**	**0.05 (0.03–0.10)**	**0.04 (0.02–0.09)**

Footnote. Models are adjusted for the explanatory variable as well as a stepwise progression of demographics (age category, gender, race, and ethnicity), health status (self-rated health, help with IADLs, difficulty with vision, at risk for depression, dementia classification), driving behaviors (driving frequency and number of driving conditions avoided), socioeconomic status (education, individual income), and neighborhood characteristics (metropolitan vs. nonmetropolitan, Area Deprivation Index) from the 2015 interview. We reported odds ratios with 95 % Confidence Intervals accounting for the NHATS complex survey design and multiple imputation. Odds ratios are statistically significant if they do not cross 1.00, which we identified in bold text in this table if applicable. Data for odds of decreasing driving frequency and odds of no longer driving available on request.

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