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Self-reported health conditions and related driving reduction in older drivers

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Abstract

We surveyed self-reported lifetime health conditions (using National Health and Aging Trends Study questions) and related driving reduction in a large multi-site older driver cohort (n = 2,990) from the AAA Longitudinal Research on Aging Drivers (LongROAD) Study's baseline assessment. Those reporting reduced driving (n = 337) largely attributed reduction to musculoskeletal (29%), neurologic (13%), and ophthalmologic (10%) conditions. Women reported health condition-related driving reduction more often than men (14% versus 8%, p<.001). Mobility affects well-being; health professionals should consider that health conditions may cause older adults to reduce driving. Gender differences deserve attention in future research and education efforts.

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Keywords

Older drivers; driving safety; health conditions; mobility

Mobility within the community is considered an *instrumental activity of daily living* (IADL), allowing an individual to live independently in the community (Altman, 2014; Roley et al., 2008). Optimal mobility promotes healthy aging by allowing people to access needed goods and services such as groceries and healthcare, to maintain social contacts, and to engage their communities (Satariano et al., 2012). In many areas of the country, travel by car is the only practical transportation option (National Research Council, 2005; Shaheen, Allen, & Liu, 2008). Thus, driving is an IADL that promotes health and independence (Dickerson, Reistetter, Davis, & Monahan, 2011; Dickerson, Reistetter, & Gaudy, 2013).

Many age-related health conditions may impair safe driving ability, including conditions affecting vision, cognition, neck flexibility, lower extremity strength, hearing, and reaction time (American Geriatrics Society & Pomidor, 2016; Choi, Mezuk, & Rebok, 2012; Classen, 2014). Although older drivers are in fewer crashes than their younger counterparts, age-related health conditions and the aging process itself may cause increased frailty in this population, which means older drivers are more likely to be injured in the case of a crash (Bandeen-Roche et al., 2015; Cicchino, 2015).

Many older drivers may reduce their driving (e.g., driving fewer miles or taking fewer trips) for various reasons, including in response to perceived physical, cognitive, or perceptual deficits (Betz & Lowenstein, 2010; Marie Dit Asse, Fabrigoule, Helmer, Laumon, & Lafont, 2014). Along with such perceived conditions, health condition diagnosis may also cause this population to limit their driving (Marshall, 2008). Unfortunately, driving reduction is associated with negative outcomes such as depressive symptoms and decreased life satisfaction (Chihuri et al., 2015; Harrison & Ragland, 2007).

Understanding the causes of driving reduction may help in identifying older adults who will eventually cease driving and may help guide intervention development to prolong safe driving (O'Connor, Edwards, Small, & Andel, 2012). Evidence exists that older adults are more receptive to driving cessation when they can anticipate and plan for this event (Betz, Scott, Jones, & DiGuiseppi, 2016). Health professionals (occupational therapists, physicians, and other providers) play a significant role in such planning by addressing driving safety related to health conditions and medications. Occupational therapists, in particular, play a key role in older driver safety: those with specialized training in driving may conduct comprehensive driving assessments (including a behind-the-wheel portion), while others assess IADLs (Lane et al., 2014). Occupational therapists may also be able to recommend driving rehabilitation services that provide education and assistive devices or driving modifications to help offset the effects of some of these conditions (Lane et al., 2014). Identifying and understanding specific health conditions that influence driving behaviors may help practitioners and families in properly addressing driving reduction and cessation (Betz et al., 2016).

The AAA Longitudinal Research on Aging Drivers (LongROAD) Study offers an opportunity to examine a large multi-site cohort of older drivers in the United States (US). Utilizing these data, we sought to: (1) describe self-reported lifetime prevalence of health conditions among older drivers and (2) examine the effect of these conditions on self-reported driving reductions in the past year.

METHODS

Design and Participants

For this cross-sectional study, we used baseline survey data from the AAA LongROAD Study. An overview of the study and methodology is described in detail elsewhere (Li et al., 2017). The AAA LongROAD Study aims to explore the roles of medical, behavioral, social, technological, and environmental factors in safe driving among older adults. The study enrolled older drivers in sites in five states (Ann Arbor, MI; Baltimore, MD; Cooperstown, NY; Denver, CO; and San Diego, CA). Data collected for the study include: self-reported and objectively-measured health, functioning, and driving behaviors; objective driving data (from a device collecting global positioning, accelerometer measurements, etc.); medical record information, medication history; and state motor vehicle driving records.

For study recruitment, we mailed and emailed invitations to patients registered at primary care clinics affiliated with AAA LongROAD study sites and then called potential participants for additional eligibility screening and recruitment. Inclusion criteria included: being 65–79 years old; possessing a valid driver's license; driving at least once weekly, on average; no significant cognitive impairment (measured by initial medical chart review at some sites and the Six-Item Screener (Callahan, Unverzagt, Hui, Perkins, & Hendrie, 2002) during telephone screening at all sites) that might impede their ability to give fully informed consent; driving a primary vehicle that was a 1996 model or newer 80% or more of the time; having an accessible and unused OBDII port for installation of a study device to monitor driving; living in the study site area ≥10 months per year with no plans to move within five years; and not married to or living with a current LongROAD participant. Eligible and interested individuals scheduled in-person sessions, during which written informed consent was obtained. Each site's respective Institutional Review Board gave study approval.

Measures

During in-person sessions, research staff administered questionnaires about health, functioning, and driving. For this analysis, we utilized baseline variables concerning health conditions and related driving reduction. Research staff asked participants: "Have you decreased your driving due to a health problem in the past 12 months?" Then, using a modified version of the National Health and Aging Trends Study questionnaire (Montaquila, Freedman, Edwards, & Kasper, 2012), research staff asked participants if during their lifetimes they had ever had (or their doctor had ever told them that they had) any of 55 health conditions. Participants who responded "yes" to having decreased their driving in the past 12 months were prompted to answer whether any of the specific conditions they had reported had caused them to reduce driving.

Data Management

We entered all project data (except personally-identifiable information, which was maintained at enrollment sites) into a secure web-based system. Research staff stored and managed data in a relational database using Scientific Information Retrieval (SIR/XS) software at the Data Coordinating Center (DCC) at Columbia University Medical Center. The DCC provided fully de-identified, cleaned datasets for analysis.

Analysis

All 2,990 LongROAD study participants were included in this analysis. We grouped health conditions into categories based on organ system (as shown in Table 2). Any conditions affecting more than one organ system were categorized according to the system most likely to directly affect driving (e.g., for deep vein thrombosis, the musculoskeletal category) based on the Clinician's Guide to Assessing and Counseling Older Drivers and study team discussion (American Geriatrics Society & Pomidor, 2016). We also categorized health conditions affecting multiple organ systems separately if prevalence was high (e.g., cancer). Other, lower frequency conditions affecting more than one organ system were grouped into a "miscellaneous" category.

Our team described demographic, health, and driving characteristics using percentages with 95% confidence intervals (95%CI) for dichotomous variables or medians with interquartile ranges (IQR) for continuous variables. The data met the assumptions for the Pearson's chi-squared test (i.e., the data set is sufficiently large and the variables are categorical and independent in nature), so we utilized this statistical test to compare population characteristics to driving reduction based on health condition group.

RESULTS

Table 1 illustrates participant demographics. Of the 2,990 LongROAD study participants, 41.6% were aged 65–69 years, 34.7% were aged 70–74 years, and 23.7% were aged 75–79 at enrollment. More than half (53.0%) were female; most were White and non-Hispanic. Two-thirds were married, and most had at least a bachelor's degree, owned their home, and had an annual household income ≥$50,000.

For lifetime diagnoses of specific health conditions, the highest proportions reported having ever had or been diagnosed with a total of three (12.3%), four (13.9%), or five (12.8%) conditions. Only 2.0% reported having no conditions, with a maximum of 20 diagnoses reported (median: 5; IQR 3–7; data not shown). According to Table 2, which shows self-reported lifetime health condition groups versus driving reduction in the past year, most participants self-reported musculoskeletal (76.5%) or cardiovascular (64.5) diagnoses.

Table 3 highlights specific self-reported lifetime health conditions versus driving reduction in the past year. Overall, 337 (11.3%) participants reported having decreased their driving for any health condition(s) in the past year (see Table 1). Of the most common self-reported health conditions and problems, participants with 'joint pain or joint swelling' and 'other arthritis' were most likely to report driving reduction (n = 48 and 36, respectively). Among all health categories, musculoskeletal diagnoses were the most common self-reported cause

of driving reduction, affecting 28.5% of those who decreased driving. Some musculoskeletal conditions that were often associated with reported driving reduction included hip and knee replacements (8.8% [17 of 194] and 8.4% [26 of 309] of participants, respectively).

Other commonly cited categories of health conditions among those who reduced their driving were neurologic (15.4%) and ophthalmologic (10.4%) health conditions, followed by cancer (7.7%). Common self-reported diagnoses within the cancer category included breast (19.1%, 5 of 26 reduced driving) and colon (15.4%, 4 of 26) cancers. Some health conditions, although rare, led to higher proportions of reported driving reductions in the past year. For example, 9.1% (2 of 22) of participants reporting a lifetime diagnosis of Parkinson's disease consequently decreased driving in the past year. Other less common conditions reported to cause driving reduction included: traumatic brain injury, affecting 6.8% (4 of 59 reduced driving) of participants; peripheral artery surgery (6.7%, 2 of 30); psychotic disorders (e.g., schizophrenia and bipolar disorder; 5.3%, 1 of 19); and multiple sclerosis (also 5.3%, 1 of 19). Among those reporting driving reduction for health conditions in the past year, 133 participants (39.5%) did not specify conditions that caused them to do so.

Gender influenced both health condition and driving reduction prevalence (see Figures 1 and 2). Women reported more lifetime medical conditions than men (mean: 5.6 vs 5.1; $p < .001$) and were more likely to have ophthalmologic, metabolic, psychologic, musculoskeletal, or respiratory condition diagnoses, while men were more likely to have cancer or cardiovascular condition diagnoses. Women were more likely than men to report having reduced their driving due to a health condition in the past year (14.2% versus 8.0%, $p < .001$; see Table 1), particularly for musculoskeletal or ophthalmologic problems (see Figure 1). Among 1,278 women with musculoskeletal problems, 5.3% reported reducing their driving in the past year due to these conditions; among 1,008 men with musculoskeletal problems, only 2.8% reported such reductions due to these conditions. Similarly, among 830 women with ophthalmologic conditions, 2.9% reported reducing driving in the past year; among the 617 men with ophthalmologic conditions, only 1.6% did so.

DISCUSSION

This cross-sectional study of a large multi-site sample of older drivers yielded three main findings. First, musculoskeletal health conditions were the most prevalent self-reported lifetime diagnoses and were associated with the most reports of driving reductions in the past year. Second, several less common health conditions were also associated with self-reported driving reduction. Finally, in line with prior work, women were more likely than men to report reducing driving due to health conditions (Choi, Adams, & Kahana, 2013; D'Ambrosio, Donorfio, Coughlin, Mohyde, & Meyer, 2008).

Musculoskeletal health conditions (e.g., arthritis), symptoms (joint pain and swelling), and surgeries (hip and knee replacement) were associated with reported driving reduction in this cohort. Such conditions may thus further affect quality of life through reduced mobility (American Geriatrics Society & Pomidor, 2016). Pain medication used for such musculoskeletal conditions may also have confounding effects on reported reduction, as

dizziness or other medication side effects might be the primary factors leading to driving adjustment or reduction (Hetland & Carr, 2014). Physical health conditions have previously been documented to require driving restrictions in some individuals, such as the recommended six weeks after knee and hip replacements (Braitman & McCartt, 2008; Ragland, Satariano, & MacLeod, 2004). Other than musculoskeletal conditions, neurologic and ophthalmologic conditions and cancer also were associated with self-reported driving reduction. Past research supports the role of ophthalmologic conditions in driving reduction (American Geriatrics Society & Pomidor, 2016), and some studies have examined the role of cancer on driving habits (Lyman, McGwin, & Sims, 2001; Ragland, Satariano, & MacLeod, 2005; Yuen, Gillespie, Day, Morgan, & Burik, 2007). Considering that some people reduced driving because of this diagnosis, future research should further consider the types of cancer and the mechanisms that may cause this to occur. Additionally, psychologic conditions like depression and anxiety also caused some driving reduction. Clinicians should keep in mind the potential effects of mental illness on driving habits. Other conditions may result in temporary driving restrictions that may also cause older adults to decrease driving. For example, cardiac valve replacement requires 4 weeks of driving restriction, along with other conditions like seizures (3–12 months), stroke/TIA (varying times), and more (American Geriatrics Society & Pomidor, 2016; Fisk, Owsley, & Pulley, 1997; Krauss, Ampaw, & Krumholz, 2001). Clinicians should be mindful of such driving restriction periods and should counsel their patients accordingly.

Some less prevalent health conditions (e.g., Parkinson’s disease, traumatic brain injury) were also associated with high reported rates of driving reduction. Even considering the low prevalence of these conditions, health professionals like occupational therapists tend to be aware of the effects such neurological conditions have on driving through symptoms like lack of awareness or freezing gait (Crizzle et al., 2013; Hassan, King, & Watt, 2015; Pachana & Petriwskyj, 2006). Clinicians should continue to be cognizant of the increased effects of these conditions on older adult driving habits compared to other conditions. It is also important to consider that the LongROAD cohort contained predominantly active, healthy adults without cognitive problems at enrollment. Therefore, it is possible that some of these conditions are more prevalent in the general population than in the LongROAD cohort (ex: Parkinson’s disease: 1.0% versus 0.7% in this cohort) (Tysnes & Storstein, 2017). Additionally, conditions such as diabetes, arrhythmia, sleep disorders, seizure disorders, and depression were all previously documented to have detrimental effects on driving ability (Binns & Camm, 2002; Cox et al., 2006; Hill et al., 2017; Krumholz, 2009; Tregear, Reston, Schoelles, & Phillips, 2009) and were not associated with high rates of reported driving reduction in our sample. Because factors like already-treated or controlled conditions and better-than-average health in LongROAD participants may have confounded this association, future research should examine the potential relationships between newly-diagnosed health conditions and driving reduction.

Our findings have implications for occupational therapists and other health professionals because understanding the effects of health conditions on older adults’ driving ability and providing them with relevant mobility counseling may help older drivers avoid premature driving reductions or cessation (American Geriatrics Society & Pomidor, 2016). Educating practitioners on health condition-related driving reduction may allow them to better prepare

older adults and their families for the consequences of driving reduction. Furthermore, disseminating information about the condition-specific mechanisms that may cause driving reduction may help these health professionals to effectively plan interventions that may address such consequences. In general, provision of condition-specific guidelines for practitioners, patients, and families might also be helpful in times of temporary changes (e.g., after joint replacement) (Abbas & Waheed, 2011; Pierson, Earles, & Wood, 2003). For example, the *Driving Pathways by Diagnosis Sheets*, which provide driving evaluation and therapy recommendations for conditions such as arthritis, Parkinson's disease, etc. may be a valuable resource for health professionals (Touchinsky, Chew, & Davis, 2014). One study found that although stroke affected driving ability, clinicians were unlikely to counsel stroke patients about driving reduction (Fisk et al., 1997). Also, more general anticipatory guidance about future driving retirement may benefit patients with progressive disorders, such as dementia or Parkinson's disease.

Finally, although female participants reported having roughly equal amounts of lifetime health condition diagnoses as male participants, they reported higher rates of driving reduction due to health conditions. While this may stem, in part, from differences in age of condition onset or specific condition diagnosis, prior work suggests women are more likely than men to visit and consult a doctor about potential health problems and to reduce driving with age (Choi et al., 2013; Xu & Borders, 2003). Higher rates of driving reduction in women might be attributed to lower confidence in driving ability, which could be exacerbated by health condition diagnosis (Charlton et al., 2006; Meng & Siren, 2012; Siren, Hakamies-Blomqvist, & Lindeman, 2004). Alternatively, men may be overconfident or feel pressured to continue driving as part of a traditional provider role (Brabyn, Schneck, Lott, & Haegerström-Portnoy, 2005; Charlton et al., 2006; Molnar et al., 2014). In recognition of this, health education efforts for older drivers should also focus on increasing self-efficacy around driving behaviors. Premature driving reduction and cessation may cause decreased quality of life, but counseling from a knowledgeable health professional, along with proper treatment and referral to specialists, may deter early driving cessation and resulting detrimental effects (Chihuri et al., 2015; Stressel, Hegberg, & Dickerson, 2014). Tools such as the Assessment of Readiness for Mobility Transition may assist clinicians in individualizing mobility transition services for older adults (Meuser, Berg-Weger, Chibnall, Harmon, & Stowe, 2013).

LIMITATIONS

Limitations include that the LongROAD baseline enrollment assessment did not collect data regarding when participants developed health conditions or how soon after the diagnoses they decreased driving. Future studies will have medical record information available and may be able to address some of these questions. In addition, in some cases, a participant may have not reduced driving in the past year due to a diagnosed health condition because the condition was treated or resolved. For example, nearly half of the study population reported having cataracts, but only 2% of participants limited driving as a result; many participants may have had cataract surgery to restore vision, and therefore driving ability. Through the LongROAD cohort's longitudinal follow-up, we may better address temporal relationships between health conditions and driving behaviors.

Some health conditions may have been double-counted among participants who decreased driving, due to co-occurrence. For example, 6% (n = 21) of these participants had some combination of ‘joint pain and swelling,’ ‘rheumatoid arthritis’ and ‘other arthritis.’ Of participants who decreased driving, 39% did not report the health condition associated with driving reduction. Thus, the role of health conditions in driving reduction was not fully characterized with these data. Also, this study’s questions only addressed driving reduction because of health conditions. This study did not assess other forms of self-regulation (e.g., avoidance of certain driving conditions) or the reasons for reductions (e.g., recommendation from someone versus self-regulation); future studies will be able to do this utilizing other questions posed to the LongROAD cohort.

Despite its limitations, this study has many strengths. The large multi-state sample enabled identification of conditions of relatively low prevalence that nevertheless commonly resulted in reduced driving. Our study also examined a wide variety of health conditions affecting diverse organ systems. As the AAA LongROAD Study progresses, longitudinal data will build on baseline analysis to further explore issues around health conditions, driving, and driving self-regulation.

CONCLUSION

This study’s findings highlight that older adults may reduce driving for certain health conditions, especially those affecting the musculoskeletal, neurologic, and ophthalmologic systems. Future research should further consider the effects of such health conditions on older adult driving habits. Such research may help health professionals talk about driving reduction with older adults with certain diagnoses and ensure they receive referrals to appropriate services. These steps may help to ensure that older adults do not compromise their independence and mobility and that, given the time to prepare, they may cope better with driving reduction (Betz et al., 2016). As we collect data from this cohort over time, we hope to identify patterns in health condition diagnosis versus driving reduction that may help researchers and health professionals better address this issue in the future.

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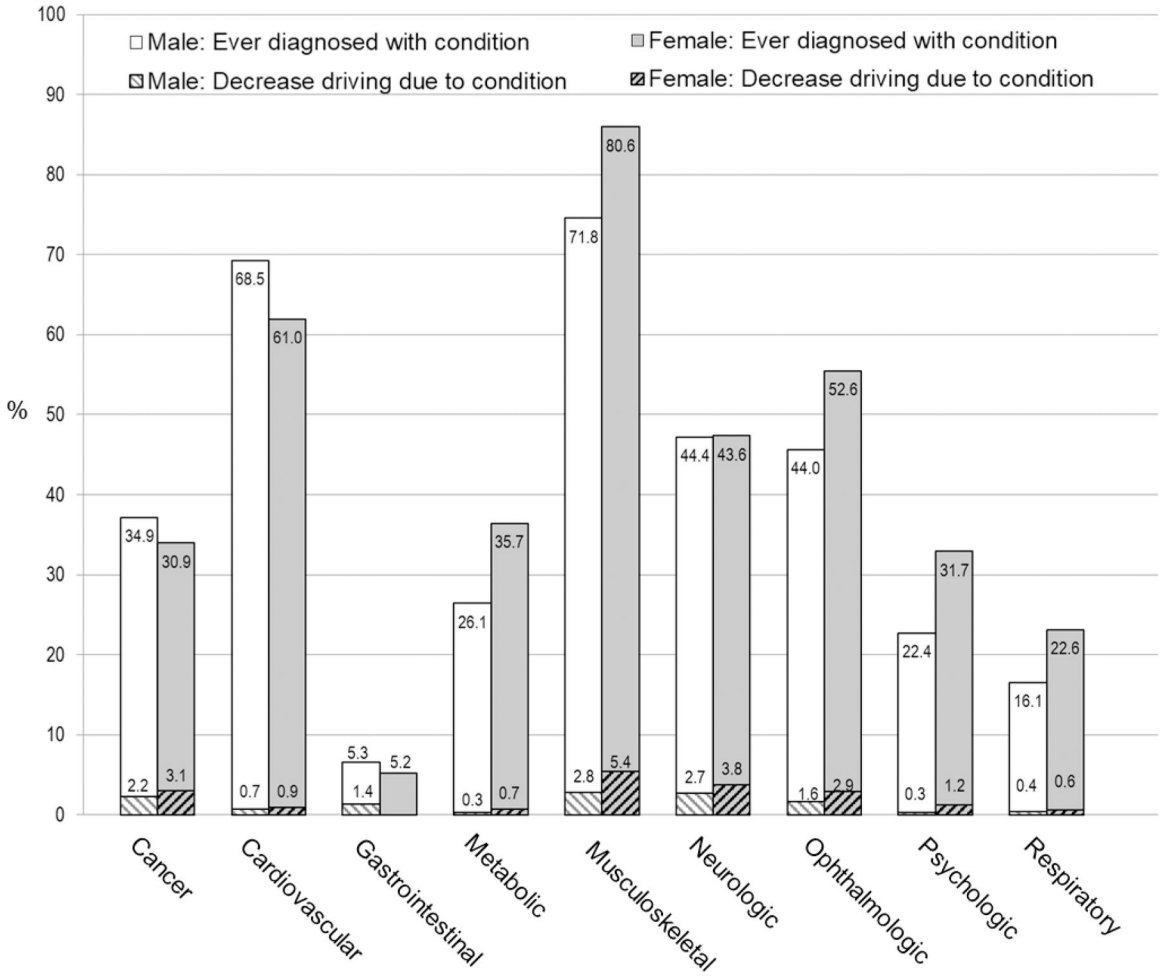

Figure 1.

Proportion of participants reporting prior diagnoses (lifetime) and reduced driving (past 12 months), by diagnosis category gender

Condition categories with zero reported reduced driving are not shown.

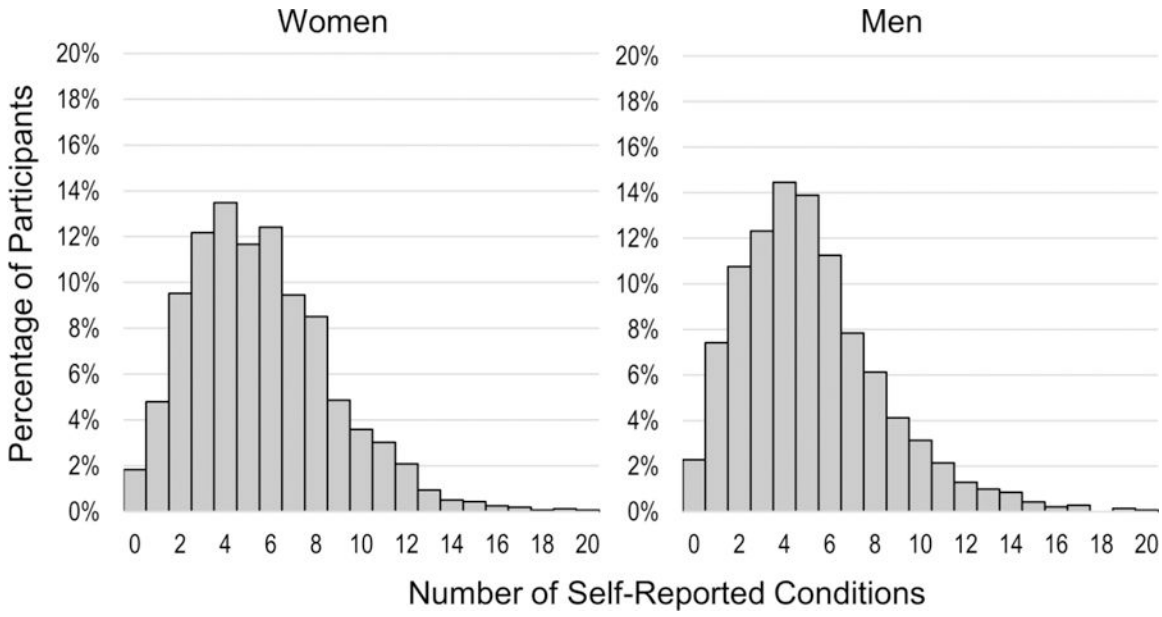

Figure 2.
Number of lifetime self-reported health conditions per participant, by gender

Table 1.

Demographic and health characteristics, by reported self-reduction of driving for any health condition in the past 12 months (N = 2990)

	Reduced Driving For Any Condition								
Characteristic	**Total**		**Yes**			**No**			***p***
	n	%	n	%	95% CI	n	%	95% CI	
Total	2990	100	337	11.3	10.2–12.5	2657	88.7	87.7–90.0	--
Age									
65–69	1243	41.6	138	11.1	9.4–13.0	1105	88.9	87.0–90.6	0.864
70–74	1037	34.7	115	11.1	9.3–13.2	922	88.9	86.8–90.7	
75–79	710	23.7	84	11.8	9.6–14.5	626	88.2	85.5–90.4	
Gender									
Male	1404	47.0	112	8.0	6.6–9.6	1292	92.0	90.4–93.4	<0.001
Female	1586	53.0	225	14.2	12.5–16.0	1361	85.8	84.0–87.5	
Race									
White	2616	87.5	291	11.1	10.0–12.4	2325	88.9	87.6–90.0	0.480
Black	213	7.1	22	10.3	6.7–15.4	191	89.7	87.6–93.3	
Asian	72	2.4	11	15.3	8.2–26.1	61	84.7	73.9–91.8	
Other	76	2.5	10	13.2	6.8–23.3	66	86.8	76.7–93.2	
Don’t Know/Refused/NA	13	0.4	3	23.1	6.2–54.0	10	76.9	46.0–93.8	
Hispanic									
Yes	83	2.8	17	20.5	12.7–31.0	66	79.5	69.0–87.3	0.008
No	2794	93.4	310	11.1	10.0–12.3	2484	88.9	87.7–90.0	
Education									
≤Some College	1062	35.5	121	11.3	9.5–13.3	941	88.7	86.7–90.5	0.870
Bachelors	698	23.3	82	11.7	9.4–14.1	616	88.3	85.9–90.7	
≥Masters	1221	40.8	134	11.0	9.3–12.9	1087	89.0	87.1–90.7	
Living Situation									
Owned Home	2599	86.9	290	11.2	10.0–12.4	2309	88.8	87.6–90.0	0.564
Rented Home	275	9.2	37	13.5	9.8–18.2	238	86.5	81.8–90.2	
With Family Member	60	2.0	5	8.3	3.1–19.1	55	91.7	80.9–96.9	
Other	53	1.8	5	9.4	3.5–21.4	48	90.6	78.6–96.5	
Marital Status									
Married/Living with Partner	1974	66.0	215	10.9	9.6–12.4	1759	89.1	87.6–90.4	0.383
Other	986	33.0	118	12.0	10.0–14.2	868	88.0	85.8–90.0	
Income									
≤$49,999	775	25.9	106	13.7	11.4–16.3	669	86.3	83.7–88.6	0.020
$50,000-$79,999	719	24.0	69	9.6	7.6–12.0	650	90.4	88.0–92.4	
$80,000-$99,999	431	14.4	57	13.2	10.2–16.9	374	86.8	83.1–89.8	
≥$100,000	959	35.7	95	9.9	8.1–12.0	864	90.1	88.0–91.9	

Table 2.

Self-reported health condition groups and related decreases in driving among those with the condition and among all who had reduced driving for any condition

	Lifetime diagnosis			Decreased driving in past 12 months				
Self-Reported Condition Groups	**n**	**%**	**95% CI**	**n**	**%[a]**	**95% CI**	**%[b]**	**95% CI**
Musculoskeletal	2286	76.5	74.9–78.0	96	4.2	3.4–5.0	28.5	23.6–33.3
Neurologic	1315	44.0	42.2–45.8	43	3.3	2.3–4.2	12.8	9.2–16.3
Ophthalmologic	1447	48.4	46.6–50.2	34	2.3	1.6–3.1	10.1	6.9–13.3
Cancer	980	32.8	31.1–34.5	26	2.7	1.6–3.7	7.7	4.9–10.6
Cardiovascular	1930	64.5	62.8–66.3	15	0.8	0.4–1.2	4.5	2.2–6.7
Psychologic	817	27.3	25.7–28.9	7	0.9	0.2–1.5	2.1	0.5–3.6
Metabolic	933	31.2	29.5–32.9	5	0.5	0.1–1.0	1.5	0.2–2.8
Respiratory	584	19.5	18.1–21.0	3	0.5	0.0–1.1	0.9	0.0–1.9
Gastrointestinal	156	5.2	4.4–6.0	1	0.6	0.0–1.9	0.3	0.0–0.9
Miscellaneous	141	4.7	4.0–5.5	1	0.7	0.0–2.1	0.3	0.0–0.9
Ear, Nose, & Throat	33	1.1	0.7–1.5	0	0.0	-	0.0	-
Genitourinary	37	1.2	0.8–1.6	0	0.0	-	0.0	-
Hematologic	94	3.1	2.5–3.8	0	0.0	-	0.0	-
Renal	75	2.5	2.0–3.1	0	0.0	-	0.0	-

[a]Proportion that have decreased driving in the past 12 months due to each condition, among all persons with that condition.

[b]Proportion that have decreased driving in the past 12 months due to each condition, among those that had reduced their driving due to any health condition (n = 337).

Table 3.

Self-reported health conditions and related decreases in driving among those with the condition and among all who had reduced driving for any condition

	Lifetime diagnosis			Decreased driving in past 12 months				
Self-Reported Condition(s)	**n**	**%**	**95% CI**	**n**	**%**[a]	**95% CI**	**%**[b]	**95% CI**
Musculoskeletal								
Joint pain or joint swelling	1583	52.9	51.1–54.7	48	3	2.3–4.0	14.2	10.8–18.5
Other arthritis	1555	52	50.2–53.8	36	2.3	1.6–3.2	10.7	7.7–14.6
Knee replacement	309	10.3	9.3–11.5	26	8.4	5.7–12.2	7.7	5.2–11.2
Hip replacement	194	6.5	5.6–7.4	17	8.8	5.3–13.9	5	3.1–8.0
Fracture of the hip or forearm	217	7.3	6.4–8.3	8	3.7	1.7–7.4	2.4	1.1–4.8
Peripheral neuropathy	249	8.3	7.4–9.4	5	2	0.7–4.9	1.5	0.5–3.6
Deep vein thrombosis	110	3.7	3.1–4.4	3	2.7	0.7–8.4	0.9	0.2–2.8
Gout	239	8	7.1–9.0	3	1.3	0.3–3.9	0.9	0.2–2.8
Osteoporosis	453	15.2	13.9–16.5	3	0.7	0.2–2.1	0.9	0.2–2.8
Peripheral artery surgery	30	1	0.7–1.5	2	6.7	1.2–23.5	0.6	0.1–2.4
Rheumatoid arthritis	147	4.9	4.2–5.7	2	1.4	0.2–5.3	0.6	0.1–2.4
Other musculoskeletal problem	30	1	0.7–1.5	1	3.3	0.2–19.1	0.3	0.0–1.9
Degenerative bone/joint disease	12	0.4	0.2–0.7	0	0	--	0	--
Edema	3	0.1	0.0–0.3	0	0	--	0	--
Knee problem	9	0.3	0.2–0.6	0	0	--	0	--
Lymphedema	3	0.1	0.0–0.3	0	0	--	0	--
Neck/back problem	72	2.4	1.9–3.0	0	0	--	0	--
Shoulder Problem	26	0.9	0.5–1.3	0	0	--	0	--
Other lower extremity problem	22	0.7	0.4–1.1	0	0	--	0	--
Other upper extremity problem	35	1.2	0.8–1.6	0	0	--	0	--
Neurologic								
Vertigo	385	12.9	11.7–14.1	14	3.6	2.1–6.2	4.2	2.4–7.0
Migraine headaches	360	12	10.9–13.3	8	2.2	1.0–4.5	2.4	1.1–4.8
Movement disorder	118	3.9	3.3–4.7	8	6.8	3.2–13.3	2.4	1.1–4.8
Sleep disorders	598	20	18.6–21.5	7	1.2	0.5–2.5	2.1	0.9–4.4
Stroke	143	4.8	4.1–5.6	7	4.9	2.3–9.9	2.1	0.9–4.5

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	Lifetime diagnosis			Decreased driving in past 12 months				
Self-Reported Condition(s)	**n**	**%**	**95% CI**	**n**	**%[a]**	**95% CI**	**%[b]**	**95% CI**
Traumatic brain injury	59	2	1.5–2.6	4	6.8	2.2–17.3	1.2	0.4–3.2
Parkinson’s disease	22	0.7	0.5–1.1	2	9.1	1.6–30.6	0.6	0.1–2.4
Multiple sclerosis	19	0.6	0.4–1.0	1	5.3	0.9–25.0	0.3	0.0–1.9
Seizure disorder	31	1	0.7–1.5	1	3.2	0.2–18.5	0.3	0.0–1.9
Amyotrophic lateral sclerosis	1	0	--	0	0	--	0	--
Brain aneurysm	5	0.2	0.1–0.4	0	0	--	0	--
Brain surgery	3	0.1	0.0–0.3	0	0	--	0	--
Brain tumor	24	0.8	0.5–1.2	0	0	--	0	--
CNS infection	4	0.1	0.0–0.4	0	0	--	0	--
Cognitive impairment	11	0.4	0.2–0.7	0	0	--	0	--
Dystonia	2	0.1	0.0–0.3	0	0	--	0	--
Headache	2	0.1	0.0–0.3	0	0	--	0	--
Intracranial hemorrhage	1	0	--	0	0	--	0	--
Neuralgia	4	0.1	0.0–0.4	0	0	--	0	--
Tourette’s syndrome	1	0	--	0	0	--	0	--
Other neurologic problem	24	0.8	0.5–12.1	0	0	--	0	--
Ophthalmologic								
Cataracts	1332	44.5	42.8–46.4	29	2.2	0.0–4.4	8.6	5.9–12.3
Glaucoma	255	8.5	7.6–9.6	5	2	0.7–4.8	1.5	0.5–3.6
Diabetic retinopathy	54	1.8	1.4–2.4	1	1.9	1.5–3.2	0.3	0.0–1.9
Cornea problem	7	0.2	0.1–0.5	0	0	--	0	--
Macular problem	26	0.9	0.5–1.3	0	0	--	0	--
Other visual problem	20	0.7	0.4–1.1	0	0	--	0	--
Retinal problem	17	0.6	0.3–0.9	0	0	--	0	--
Cancer	980	32.8	31.1–34.5	26	2.7	1.8–3.9	7.7	5.2–11.2
Cardiovascular								
Myocardial infarction	198	6.6	5.8–7.6	5	2.5	0.9–6.1	1.5	0.5–3.6
Fainting	166	5.6	4.8–6.4	4	2.4	0.8–6.4	1.2	0.4–3.2
High blood pressure	1688	56.5	54.7–58.2	4	0.2	0.1–0.6	1.2	0.4–3.2
Coronary bypass surgery	114	3.8	3.2–4.6	3	2.6	0.7–8.1	0.9	0.2–2.8

	Lifetime diagnosis			Decreased driving in past 12 months				
Self-Reported Condition(s)	**n**	**%**	**95% CI**	**n**	**%[a]**	**95% CI**	**%[b]**	**95% CI**
Atrial fibrillation	304	10.2	9.1–11.3	2	0.7	0.1–2.6	0.6	0.1–2.4
Coronary angioplasty	185	6.2	5.4–7.1	1	0.5	0.0–3.4	0.3	0.0–1.9
Valve disorder/replacement	18	0.6	0.4–1.0	1	5.6	0.8–26.5	0.3	0.0–1.9
Arrhythmia	39	1.3	0.9–1.8	0	0	--	0	--
Cardiomyopathy	14	0.5	0.3–0.8	0	0	--	0	--
Carotid artery surgery	49	1.6	1.2–2.2	0	0	--	0	--
Coronary heart disease	14	0.5	0.3–0.8	0	0	--	0	--
Heart surgery	3	0.1	0.0–0.3	0	0	--	0	--
Hypercholesterolemia	10	0.3	0.2–0.6	0	0	--	0	--
Vasculitis	1	0	--	0	0	--	0	--
Vessel stenosis/dissection/aneurysm	17	0.6	0.3–0.9	0	0	--	0	--
Other cardiovascular problem	13	0.4	0.2–0.8	0	0	--	0	--
Psychologic								
Depression	584	19.5	18.1–21.0	7	1.2	0.5–2.6	2.1	0.9–4.4
Anxiety disorder	336	11.2	10.1–12.4	3	0.9	0.2–2.8	0.9	0.2–2.8
Attention deficit disorder	31	1	0.7–1.5	1	3.2	0.2–18.5	0.3	0.0–1.9
Post-traumatic stress disorder	89	3	2.4–3.7	1	1.1	0.1–7.0	0.3	0.0–1.9
Psychotic disorder	19	0.6	0.4–1.0	1	5.3	0.9–25.0	0.3	0.0–1.9
Attention deficit hyperactivity disorder	57	1.9	1.5–2.5	0	0	--	0	--
Eating disorders	1	0	--	0	0	--	0	--
Personality disorder	5	0.2	0.1–0.4	0	0	--	0	--
Substance abuse/alcohol dependency	81	2.7	2.2–3.4	0	0	--	0	--
Other mental health problem	1	0	--	0	0	--	0	--
Metabolic								
Diabetes mellitus	483	16.2	14.9–17.5	3	0.6	0.0–2.0	0.9	0.2–2.8
Thyroid imbalance	533	17.8	13.5–19.3	2	0.4	0.1–1.5	0.6	0.1–2.4
Adrenal problem	1	0	--	0	0	--	0	--
Diabetes insipidus	2	0.1	0.0–0.3	0	0	--	0	--
Other metabolic problem	11	0.4	0.2–0.7	0	0	--	0	--
Respiratory								

	Lifetime diagnosis			Decreased driving in past 12 months				
Self-Reported Condition(s)	**n**	**%**	**95% CI**	**n**	**%[a]**	**95% CI**	**%[b]**	**95% CI**
Asthma	368	12.3	11.2–13.5	2	0.5	0.0–2.2	0.6	0.1–2.4
Chronic obstructive pulmonary disease	142	4.7	4.0–5.5	1	0.7	--	0.3	0.0–1.9
Autoimmune Disease	2	0.1	0.0–0.3	0	0	--	0	--
Pulmonary embolism	114	3.8	3.2–4.6	0	0	--	0	--
Other respiratory problem	27	0.9	0.6–1.3	0	0	--	0	--
Gastrointestinal								
GI injury/surgery	47	1.6	1.2–2.1	1	2.1	0.1–12.7	0.3	0.0–1.9
Liver disease	21	0.7	0.4–1.1	0	0	--	0	--
Other GI problem	94	3.1	2.5–3.9	0	0	--	0	--
Ear, Nose, and Throat								
Ear/Hearing problem	19	0.6	0.4–1.0	0	0	--	0	--
Sinus problem	5	0.2	0.1–0.4	0	0	--	0	--
Other ENT problem	8	0.3	0.3–0.4	0	0	--	0	--
Genitourinary								
Bladder problem	7	0.2	0.1–0.5	0	0	--	0	--
Endometriosis	2	0.1	0.0–0.3	0	0	--	0	--
GU infection	2	0.1	0.0–0.3	0	0	--	0	--
Ovarian problem	4	0.1	0.0–0.4	0	0	--	0	--
Prostate problem	17	0.6	0.3–0.9	0	0	--	0	--
Other GU problem	6	0.2	0.1–0.5	0	0	--	0	--
Hematologic								--
Anemia	5	0.2	0.1–0.4	0	0	--	0	--
Coagulation disorder	84	2.8	2.3–3.5	0	0	--	0	--
Neutropenia	1	0	--	0	0	--	0	--
Thrombocytosis	2	0.1	0.0–0.3	0	0	--	0	--
Other hematologic problem	2	0.1	0.0–0.3	0	0	--	0	--
Renal								
Chronic renal failure	47	1.6	1.1–2.1	0	0	--	0	--
Other kidney disease	32	1.1	0.7–1.5	0	0	--	0	--
Miscellaneous								

	Lifetime diagnosis			Decreased driving in past 12 months				
Self-Reported Condition(s)	**n**	**%**	**95% CI**	**n**	**%**[a]	**95% CI**	**%**[b]	**95% CI**
Allergies	9	0.3	0.2–0.6	0	0	--	0	--
Chronic pain	4	0.1	0.0–0.4	0	0	--	0	--
Scleroderma	6	0.2	0.1–0.5	0	0	--	0	--
Skin problem	14	0.5	0.3–0.8	0	0	--	0	--
Systemic lupus erythematosus	6	0.2	0.1–0.5	0	0	--	0	--
Other infectious condition	22	0.7	0.5–1.1	0	0	--	0	--
Other systemic problem	11	0.4	0.2–0.7	0	0	--	0	--
Other miscellaneous problem	36	1.2	0.9–1.7	0	0	--	0	--

[a] Proportion that have decreased driving in the past 12 months due to each condition, among all persons with that condition.

[b] Proportion that have decreased driving in the past 12 months due to each condition, among those that had reduced their driving due to any health condition (n = 337).