RESEARCH BRIEF

The Role of Driving Comfort in Self-Regulation Among a Large Cohort of Older Drivers:

AAA LongROAD Study

November 2019

This research brief used data from the AAA Longitudinal Research on Aging Drivers (LongROAD) study to examine the role of driving comfort in the self-regulation of driving by older adults. Self-regulation is the process by which individuals modify or adjust their driving patterns by driving less, or intentionally avoiding situations considered challenging. The process of self-regulation is complex and myriad individual factors influence it, including age, sex and perceived driving-related abilities (Molnar et al., 2018). However, one of the most consistent findings in the literature has been that drivers' confidence — referred to here as comfort — in specific driving situations are closely related to their likelihood to self-regulate their driving (Molnar et al., 2015).

The purpose of this study was to examine the direct effects of driving comfort on self-regulation and the role of driving comfort combined with age, sex and perceived abilities in predicting four of the most common self-regulatory driving situations: at night, during rush hour traffic, on the freeway and in unfamiliar areas. Results of this study indicate that all variables examined, both alone and in combination, generally predicted driving in the four situations. Most significantly, this study confirms that perceived driving comfort influences older adults' driving behaviors in several driving situations often considered challenging and subject to self-regulation. Understanding driving comfort is important because, unlike fixed demographic characteristics, comfort is something that can potentially be influenced through education and training.

METHODS

Data came from 2,792 participants in the AAA LongROAD study (Li et al., 2017). LongROAD is a multisite prospective cohort study of drivers enrolled in five study sites in the U.S. (Ann Arbor, Michigan; Baltimore, Maryland; Cooperstown, New York; Denver, Colorado; and San Diego, California). Study participants were 65-79 years of age at enrollment. Data for this study included subjective questionnaire data on various aspects of driving and functioning, as well as objective driving measures derived from GPS/datalogger data, following procedures described in previous research (Molnar et al., 2013; see Table 1). Questionnaire items were assessed at a single point in time at baseline, but the objective data were collected continuously throughout the study. To account for differences in exposure and seasonality, the analysis only included participants' first 12 months of driving, with the GPS variables averaged across the 12-month period.

The independent variables examined in this analysis included age, sex, perceived driving-related abilities and self-reported driving comfort in four driving situations commonly avoided as part of self-regulation — at night, in rush hour traffic, on the freeway and in unfamiliar areas.

Perceived driving-related abilities were measured through the following items (with each rated from 1 being poor to 7 being excellent):

- Ability to see during the day
- Ability to see at night
- Ability to remember things
- Ability to concentrate on more than one thing at once
- Strength, flexibility or general mobility

For this analysis, we used the mean rating of these five ratings as a measure of average, perceived driving-related ability.

Self-reported driving comfort, in the four driving situations of interest, was measured on a 7-point scale (1 – not at all comfortable; 7 – completely comfortable).

The dependent variables examined in the analysis included objective measures of the four driving situations using data from a datalogger installed in the vehicle (with rush hour traffic broken out into morning and afternoon peak traffic; see Table 1).

Table 1. List of objective driving outcome measures

Measure	Description
Average monthly % of trips at night	Percent of all trips during which at least 80% of trip was during night-time (solar angle greater than 96 degrees)
Average monthly % trips in a.m.	Percent of trips during 7-9 a.m. on weekdays (rush hour periods)
Average monthly % trips in p.m.	Percent of trips during 4-6 p.m. on weekdays (rush hour periods)
Average monthly % trips on high-speed roads (proxy for driving on freeway)	Percent of trips where 20% of distance traveled was at a speed of 60 mph or greater
Average monthly % trips < 25 miles from home (proxy for driving in unfamiliar areas)	Percent of trips traveled within 25 miles of home

Note: A trip is defined as a nonzero distance between vehicle engine on-to-off time.

RESULTS

The mean age of participants was 75.5 years. Men accounted for 47.1% of the participants, women 52.9%. Most participants were white non-Hispanic (86.0%), followed by black non-Hispanic (6.8%), Hispanic (2.5%) and Asian (2.1%). Participants were well educated: 13.6% had a high school/trade degree or less, 21.1% had some college or an associate degree, 23.6% had a bachelor's degree and 41.4% had an advanced college degree. The majority were married or living with a partner (66.5%). Annual household incomes were relatively high: 4.2% reported less than $20,000; 21.2% reported $20,000–$49.999; 24.4% reported $50,000–$79,999; 14.4% reported $80,000–$99,999 and 32.4% reported $100,000 or more.

Perceptions of driving comfort across the driving situations of interest were relatively high among the sample, ranging from 5.5 for driving at night to 6.3 for driving on the freeway (Table 2). However, there were statistically significant differences by age and sex. The oldest age group reported lower levels of driving comfort than younger drivers (either the 65–69 or 70–74 age group or both, depending on the driving situation). Across all driving situations, women consistently reported lower levels of comfort than men did.

Relationship between driving comfort and self-regulation

Table 3 shows Pearson correlations between the set of independent variables (age, sex, perceived ability and driving comfort) and the dependent driving outcomes. Of particular interest are the correlations between driving comfort in a specific situation and the percent of trips in that same situation (e.g., comfort driving at night and percent of trips at night). In every case, there are statistically significant, albeit modest, correlations (with the correlation for morning peak being marginally significant). In addition, the correlations for the comfort variables are generally stronger than the correlations for age, sex and perceived driving ability.

Table 2. Driving comfort and perceived driving ability by age and sex

	Age			Sex		Total
	65-69 n=1,165 mean(SD)	70-74 n=959 mean(SD)	75-79 n=668 mean(SD)	Male n=1,316 mean(SD)	Female n=1,476 mean(SD)	N=2,792 mean(SD)
Comfort driving at night[a,b]	**5.5(1.4)**	**5.5(1.4)**	**5.3(1.4)**	**5.8(1.2)**	**5.2(1.5)**	5.5(1.4)
Comfort driving in rush hour traffic[a]	**5.8(1.3)**	**5.7(1.3)**	**5.6(1.4)**	**5.8(1.2)**	**5.6(1.4)**	5.7(1.3)
Comfort driving on the freeway[a]	**6.3(1.1)**	**6.3(1.1)**	**6.2(1.3)**	**6.5(0.9)**	**6.1(1.3)**	6.3(1.2)
Comfort driving in unfamiliar areas[a,b]	**5.8(1.1)**	**5.7(1.2)**	**5.6(1.3)**	**6.0(1.1)**	**5.5(1.3)**	5.7(1.2)
Average perceived driving ability[a,b]	**6.0(0.6)**	**5.9(0.7)**	**5.8(0.7)**	5.9(0.7)	5.9(0.6)	5.9(0.7)

Bold = significant at the 0.05 level
[a] = 65–69 significantly different than 75–79
[b] = 70–74 significantly different than 75–79.

For data shown in Tables 4–7, age, sex and perceived ability were first examined on their own as a predictor of self-regulation. Each of these three variables was combined with the appropriate driving comfort variable to predict driving in that specific situation, using multiple linear regression models. Age and sex were significant predictors of driving at night, during rush hour (with sex significant for morning rush hour and age significant for afternoon rush hour), on high-speed roads and within 25 miles from home. In every case, the percentage of trips in these situations was lower among women than men, and decreased with age.

Perceived abilities were a significant predictor for driving at night (Table 4) and on high-speed roads (Table 7); the percentage of trips in these situations decreased as perceived abilities decreased. In almost all cases, adding the comfort variable resulted in increasing the amount of variance explained by the variables of interest (with greater comfort leading to more driving in the four situations). Comfort had by far the strongest effect for driving on the freeway; the comfort variable increased the R-square by a factor of 8 for age and 7 for sex (Table 7); that is, 8% and 7%, respectively, of the variance in percentage of trips driven during nighttime.

Table 3. Correlation matrix of age, sex, perceived ability and driving comfort by driving situation

	Percent of trips at night	Percent of trips during a.m. peak	Percent of trips during p.m. peak	Percent of trips on high speed roads	Percent of trips less than 25 miles
Measure	Correlation p value	Correlation p value	Correlation p value	Correlation p value	Correlation p value
Age categories	-0.13 <0.0001	-0.02 0.19	-0.08 <0.0001	-0.11 <0.0001	0.08 <0.0001
Sex	-0.11 <0.0001	-0.06 0.002	0.01 0.63	-0.10 <0.0001	0.10 <0.0001
Average perceived driving ability	0.08 <0.0001	0.03 0.08	0.04 0.05	0.13 <0.0001	-0.005 0.78
Comfort driving at night	0.18 <0.0001	0.03 0.18	0.11 <0.0001	0.16 <0.0001	-0.10 <0.0001
Comfort driving in rush hour traffic	0.08 <0.0001	0.04 0.06	0.06 0.0005	0.17 <0.0001	-0.08 <0.0001
Comfort driving on the freeway	0.08 <0.0001	0.03 0.14	0.08 <0.0001	0.26 <0.0001	-0.14 <0.0001
Comfort driving in unfamiliar areas	0.07 0.0003	0.02 0.24	0.05 0.005	0.17 <0.0001	-0.13 <0.0001

p-value = probability value but we have not done this in previous briefs and it has also been noted in previous briefs.

Table 4. Regression results for predicting the percentage of trips during nighttime hours

	Single Variable Models			Multiple Variable Models			
	Age	Sex	Perceived ability	Age and comfort	Sex and comfort	Perceived ability and comfort	All predictor variables
Age categories	**-0.89**			**-0.82**			**-0.86**
Sex		**-1.16**			**-0.78**		**-0.84**
Perceived driving ability			**0.62**			-0.14	-0.10
Comfort driving at night				**0.63**	**0.60**	**0.70**	**0.59**
R-square	0.02	0.01	0.01	0.04	0.04	0.03	0.05

Bold = regression coefficients significant at the 0.05 level

Table 5. Regression results for predicting the percentage of trips during morning rush hour traffic

	Single Variable Models			Multiple Variable Models			
	Age	Sex	Perceived ability	Age and comfort	Sex and comfort	Perceived ability and comfort	All predictor variables
Age categories	-0.15			-0.13			-0.13
Sex		**-0.55**			**-0.52**		**-0.56**
Perceived driving ability			0.23			0.15	0.16
Comfort driving in rush hour traffic				0.12	0.11	0.09	0.07
R-square	0.001	0.003	0.001	0.002	0.004	0.002	0.01

Bold = significant at the 0.05 level

Table 6. Regression results for predicting the percentage of trips during afternoon rush hour traffic

	Single Variable Models			Multiple Variable Models			
	Age	Sex	Perceived ability	Age and comfort	Sex and comfort	Perceived ability and comfort	All predictor variables
Age categories	**-0.44**			**-0.42**			**-0.41**
Sex		0.08			0.14		0.13
Perceived driving ability			0.23			0.06	0.02
Comfort driving in rush hour traffic				**0.20**	**0.22**	**0.20**	**0.20**
R-square	0.01	0.0001	0.001	0.01	0.004	0.004	0.01

Bold = significant at the 0.05 level

Table 7. Regression results for predicting the percentage of trips on high-speed roads

	Single Variable Models			Multiple Variable Models			
	Age	Sex	Perceived ability	Age and comfort	Sex and comfort	Perceived ability and comfort	All predictor variables
Age categories	**-1.55**			**-1.38**			**-1.39**
Sex		**-2.23**			**-1.38**		**-1.55**
Perceived driving ability			**2.07**			**0.73**	**0.68**
Comfort driving on the freeway				**2.36**	**2.32**	**2.27**	**2.13**
R-square	0.01	0.01	0.02	0.08	0.07	0.07	0.08

Bold = significant at the 0.05 level

Table 8. Regression results for predicting the percentage of trips within 25 miles of home

	Single Variable Models			Multiple Variable Models			
	Age	Sex	Perceived ability	Age and comfort	Sex and comfort	Perceived ability and comfort	All predictor variables
Age categories	**1.87**			**1.72**			**1.87**
Sex		**3.65**			**2.80**		**2.71**
Perceived driving ability			-0.14			**1.65**	**1.60**
Comfort driving on the freeway				**-1.95**	**-1.81**	**-2.36**	**-2.08**
R-square	0.01	0.01	0.00003	0.02	0.02	0.02	0.03

Bold = significant at the 0.05 level

DISCUSSION

A major strength of this study was that it examined driving comfort among a large cohort of older drivers in relation to objectively measured, real-world driving. Previous studies on driving comfort have relied on subjective self-reports of driving behavior or involved relatively small samples of drivers. Data from the AAA LongROAD cohort indicated that perceived driving comfort influences older adults' driving in several driving situations often considered challenging and subject to self-regulation.

Further analyses should include other factors that may play an important role in other driving contexts, such as the employment status of participants, having someone who depends on them for rides, having someone available to provide transportation and/or objectively measured functional abilities. These additional variables may contribute to changes in driving because of self-regulation (e.g., declines in abilities) or simply changes in lifestyle (e.g., retiring from work).

A limitation of the study is that the sample may not be representative of all older drivers across the United States. However, the study sites do represent a wide range of communities with diverse geography, population density, and racial, ethnic, and socioeconomic distribution (Li et al., 2017), and the longitudinal cohort design will allow us to follow these participants over time to assess changes in driving as their health and functioning change with age. This should provide additional insights on the role of comfort in driving

behavior. Another limitation was that while we used the measures of driving behaviors as proxies for self-regulation, individuals' driving in the situations examined might have reflected lifestyle changes or preferences (such as retirement leading to less need to driving in specific situations) rather than self-regulation per se.

We consider perceived driving comfort to be central to a sound understanding of self-regulation among older adults, and strategies for keeping them safely mobile. An important benefit of continued research on perceived driving comfort is that it may serve as an indication of declines in abilities that can compromise safe driving. It is likely that many older drivers who are not able to recognize the fact that their driving-related abilities have declined, are nevertheless able to recognize that they no longer feel comfortable in certain driving situations that have become more challenging to them.

As we learn more about how perceived driving comfort changes with declines in health and functioning, there may be opportunities to use education and training to influence drivers' comfort in a way that is most conducive to safe driving. Thus, older drivers may be more responsive to discussions and educational materials framed within the context of driving comfort, rather than specific declines in abilities or loss of functioning.

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