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E-hail (Rideshare) Knowledge, Use, Reliance, and Future Expectations among Older Adults

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Abstract

The goals of this study were to explore e-hail (e.g., Uber/Lyft) knowledge, use, reliance, and future expectations among older adults. Specifically, we aimed to identify factors that were related to e-hail, and how older adults view this mode as a potential future transportation option.

Data were collected from a sample of older adults using a pencil-and-paper mailed survey. Univariate, bivariate, and regression techniques were used to assess the relationships among e-hail and several demographic and other factors.

Almost three-quarters of the sample (74%) reported no e-hail knowledge. Only 1.7% had used e-hail to arrange a ride,andonly 3.3% reported that they relied on e-hail for any of their transportation needs. Younger age, male gender, more education, higher transportation satisfaction, and discussing transportation options with others were all independently associated with greater e-hail knowledge. Male gender also predicted e-hail use. E-hail was the mode least relied upon by older adults. Current e-hail knowledge was the biggest predictor of anticipated future use.

E-hail may be a viable future option for older adults who have limited or stopped driving. More exposure to e-hail and continued evolution of these services is required to overcome older adults' lower internet/smartphone use. Policies could be implemented at departments of motor vehicles to pair information or training on transportation alternatives (like e-hail) with elimination of driving privileges, or at doctors' offices, senior centers, or hospitals. Potential underlying reasons for the findings are also discussed.

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Keywords

Aging; Driving; Technology; Uber/Lyft

1. Introduction

The term e-hail refers to a transportation service where people use an application on a smartphone to “electronically hail” a vehicle for a ride. Drivers typically use their own vehicles and transactions are handled electronically (Uber Technologies Inc., 2016). Use of e-hail, sometimes called “ridesharing” has grown dramatically since the founding of Uber in 2009 (Kalanick, 2010) and Lyft in 2012 (Gallagher, 2013). This growth has increased markedly over the last several years, particularly since 2015 (Hathaway & Muro, 2017), with an expansion into new markets and an increasing number of people who use these services for trips (Dogtiev, 2017; Schneider, 2017).

Much of this growth, however, has been observed among young adults, the group most likely to have heard of e-hail services, and to have actually used them(Smith, 2016). Data show that only 15% of adults in the United States (US) have used e-hail, and 33% have never even heard of this transportation option (Smith, 2016). Adults age 18-29, and those with a college education, are the groups most likely to have used an e-hail service, with rates of 28% and 29%, respectively (Smith, 2016). Among US adults age 65 or older, only 4% report having used e-hail.

Transportation alternatives to driving (such as e-hail) will become increasingly important in the coming years for several reasons. For the next several decades, estimates suggest that the number of older adults and the percentage of the US population that they comprise are expected to continue to increase, with a particular increase among the oldest-old (those 85 and older). The oldest-old will number about 6.7 million (2% of the population) in 2020, but will grow to 17.9 million (4.5%) by 2050 (Ortman, Velkoff, & Hogan, 2014). A much higher percentage of older adults are also licensed to drive now than in the past. In 1983, 55% of Americans age 70 or older were licensed drivers, while 79% were licensed in 2014 (Sivak & Schoettle, 2016).

These factors have important public health implications, because the physical and cognitive changes associated with growing older can result in a decline in the ability to safely drive (see Anstey, Wood, Lord, & Walker, 2005, for a review). Data show that exposure-adjusted crash risk is known to increase beginning around age 75 (Insurance Institute for Highway Safety, 2016). When older adults experience a decline in their driving abilities, they often avoid difficult driving situations, and drive less overall, a process called driving self-regulation (see e.g., Molnar et al., 2013). Eventually, many older adults cease driving completely, and must rely on others for their transportation needs (see e.g., Chihuri et al., 2016; Foley, Heimovitz, Guralnik, & Brock, 2002). Estimates suggest that men and women have about 7 and 10 years, respectively, of unmet mobility need (Foley et al., 2002).

Even when older adults can no longer drive themselves, their strong preference remains taking a ride in a car, compared to public transit and other options (Dickerson et al., in press). Most rides are provided by family or friends, but older adults often report a wish to avoid becoming a burden on others (Kostyniuk, Connell, & Robling, 2009; Ritter, Straight, & Evans, 2002). E-hail services could help reduce some of this transportation burden often faced by older adults' families. E-hail matches people's preference for receiving a ride in a personal vehicle, while also eliminating the feelings of burden associated with relying on family.

The primary purpose of the current study was to explore e-hail knowledge, use, reliance, and future expectations among older adults, to create a profile of older adult e-hail users. Specifically, we aimed to describe which sociodemographic factors are related to e-hail, and how older adults view this mode as a potential future transportation option, if they could no longer drive themselves. The following hypotheses were explored in this study: 1) demographic patterns related to e-hail would be similar among older adults as among the general population; in particular, those with more e-hail knowledge and experience would be younger men with more education and income; 2) reporting greater satisfaction with current transportation mobility would be associated with lower e-hail knowledge and use; and 3) current e-hail knowledge would be the strongest predictor of future expectations about e-hail.

2. Material and methods

2.1 Data source

Prior to data collection, the University of Michigan (U-M) Health Sciences and Behavioral Sciences Institutional Review Board reviewed and granted approval to the project. Data were collected between April and August, 2015, using a pencil-and-paper questionnaire that was mailed to potential participants between the ages of 55 and 84. The focus of this manuscript is older adults, so only those age 65 or older were included here. The sampling frame was developed from two registries of older adults in the southeastern Michigan area who had agreed to be contacted to be potential participants in research projects. One of the lists is maintained by Wayne State University (WSU) and is part of U-M and WSU's Michigan Center for Urban African American Aging Research (MCUAAR), a National Institutes of Aging Grant Program, called the Healthier Black Elders Center (HBEC). The other is part of the Claude D. Pepper Older American Independence Center, which is supported by The Human Subjects and Assessment Core (HSAC), and maintained by U-M.

The questionnaire was mailed to each potential participant (1,322 total: 185 from U-M, 1,137 from HBEC). A cover letter, a postage-paid return envelope, and a small pre-incentive (a $2 bill) were also included in the mailing. For those who returned the questionnaire, a $20 gift card was provided. After accounting for incorrect address information (n=33) and those with missing ID numbers (n=2), the overall response rate was 67.8% (872/1287), with a 63.2% response rate from HBEC, and a 94.1% rate from the Claude D. Pepper list at U-M. The original contact information for potential respondents did not include their birthdates, which precluded calculating a specific response rate for those 65 and older studied here. It is also unclear why there was a difference in the response rates between participants in the two registries. It may be that respondents from the U-M list are more likely to participate in research if it is more frequently used, given its availability to a much larger research university.

2.2 Measures

2.2.1 Dependent variables—E-hail knowledge was determined by asking: How much do you know about *"E-Hail" apps (such as Uber or Lyft) for smartphones or tablets that can arrange rides?* Response choices included *none, a little, some*, and *a lot*.

E-hail use was assessed similarly, by asking: *How much have you used "E-Hail" apps (such as Uber or Lyft) on a smartphone or tablet to arrange rides?* Response choices were again *none*, *a little*, *some*, and *a lot*. Very few respondents reported differences in e-hail experience, so this variable was recoded to be binary: no experience and any experience.

Reliance on e-hail was determined by asking: *How much are your current transportation needs being met using each of the following transportation methods?* Modes included *driving yourself*, *rides with other drivers*, *buses*, *taxis/cabs*, *mass transport*, *specialized transport*, *walking*, *e-hail apps*, and *other*. Participants indicated their response to each mode on a five-point scale anchored by *none* and *all*. Responses indicating one's use of the various modes were not required to be mutually exclusive. Very few respondents reported relying on e-hail, so this variable was also recoded to be binary: no reliance versus any.

Three additional variables evaluated future perceptions of e-hail among participants who were current drivers. The first item assessed individuals' perceptions about their future reliance on each of the same modes listed earlier, excluding *driving yourself*. That item asked: *If you were no longer driving yourself, how well could your future transportation needs be met using each the following transportation methods?* Participants indicated their response using a five-point scale, but this time the anchors were *not well at all* and *very well*. The second item assessed future comfort with e-hail by asking: *How comfortable would you be using each of the following transportation methods in the future if you were no longer driving?* The modes remained the same, and responses were once again measured on a five-point scale, but anchored by *not at all comfortable* and *completely comfortable*. The third item asked participants about their future likelihood of using e-hail by asking: *How likely would you be to use each of the following transportation methods if you were not driving in the future?* The modes remained consistent, but the response categories were now anchored by *not at all likely* and *very likely*. These items were highly correlated with one another (Cronbach's α=0.90), so a composite variable about **future e-hail expectations** was created by taking the average score of these items.

2.2.2 Independent variables—Overall **satisfaction** with current transportation mobility was measured by asking: *How satisfied are you with your current transportation mobility? In other words, how easily can you get where you need or want to go?* A five-point scale anchored by *not at all satisfied and very satisfied* was used to measure responses.

Discussing transportation with others was assessed with two items. Both items used the stem: *How much or often have you talked to friends or others…* The first item asked about getting ideas or information for one's own possible future transportation needs, and the second item asked about how others get around without driving. Responses for both items were measured using the same five-point scale anchored by *not at all* and *a lot*. Responses to these items were averaged together to create a single variable.

Questions regarding **sociodemographic factors** were adapted from items used in the Health and Retirement Study (Institute for Social Research, 2017). Participants were asked: *What is your current age?*, *What is your gender?*, *What is the highest grade of school or year of college you completed?*, *What race do you consider yourself to be?*, *Do you consider yourself to be Hispanic or Latino?*, and *What is your current relationship status?* The age and gender items were open-ended. The educational categories included *less than high school*, *high school diploma*, *some college*, *some graduate/professional school*, *master's/ professional degree*, and *doctorate*. Categories for race included *White/Caucasian*, *Black/ African American*, and *Other*, and response choices for ethnicity included *yes* and *no*. Choices for relationship status included *single (never married)*, *married/domestic partnership*, *divorced/separated*, and *widowed*.

Finally, we assessed **household income** by asking: Which best describes your yearly household income? Response choices included *less than $10,000*; *$10,000-14,999*; *$15,000-24,999*; *$25,000-49,000*; *$50,000-99,999*; *$100,000-149,999*; *$150,000-199,999*; and *$200,000 and above*. For ease of interpretation and to combine groups with low numbers of participants, these categories were recoded into the following groups: *less than $25,000*; *$25,000-99,999*; and *$100,000 and above*.

2.3 Data management and analysis procedures

Data were read into SAS, cleaned, and checked for any out-of-range errors. As noted earlier, the analyses for the current study were focused only on older adults, so a subset of respondents age 65 and older was created. Several variables were recoded for ease of analysis, to collapse categories with very low numbers of participants, and to simplify interpretation. The means, frequencies, and distributions of the variables of interest were calculated to determine the appropriate statistical tests to use in the analyses.

Independent samples t-tests, Pearson product-moment correlations, chi-square tests (and Fisher's exact tests), and one-way analysis of variances (ANOVAs) were conducted to explore the relationships between the variables in the bivariate context. The results of these tests also helped inform the multivariable regression models.

Finally, we used multivariable regression techniques to assess several of the outcomes. E-hail knowledge and future use of e-hail were assessed using linear regression. Due to the lack of variability within e-hail use and reliance on e-hail, the binary versions of these variables were analyzed using logistic regression.

3. Results

3.1 Participants

A total of 712 respondents age 65 or older completed the questionnaire. Respondents' average age was 74.4 with a range of 65 to 92.[1] Over 84% of the sample were female, 78.5% (554) identified as Black, 17.4% (123) as White, and 4.1% (29) as another category. Nearly the entire sample identified as non-Hispanic (99%). In terms of education, 2.5% had less than a high school diploma, 16.3% had a high school education, 33.4% had attended some college, 15.2% graduated from college, 9.0% had attended some graduate or professional school, and 23.6% had a graduate degree. More than one-third of the participants (36.6%, 236) had an income less than $25,000, 57.2% (369) had an income between $25,000-99,999, and 6.2% (40) had an income over $100,000. A nearly equal percentage of participants were married/partnered (32.2%, 224) and divorced/separated (31.6%, 220), followed closely by widowed (28.6%, 199). Only 7.6% (53) of the sample were single/never married. In terms of overall satisfaction with transportation mobility, an average of 4.45 on a 5-point scale was reported (where 5 represented being *very satisfied*).

3.2 Findings

3.2.1 Univariate and bivariate results—Respondents had very low knowledge of, experience with, and reliance on e-hail. As expected, participants reported greater knowledge of e-hail services than actual use or reliance. Table 1 shows overall e-hail *knowledge*, as well as the distribution of e-hail knowledge across the categorical variables. Overall, 26% of the sample reported at least a little knowledge of e-hail services. Younger age ($r(701)=-0.20$ $p<0.001$), male gender ($\chi^2(3)=10.7$, $p<0.05$), more education ($r(701)=0.17$ $p<0.001$), being in a married/partnered relationship ($\chi^2(9)=17.8$, $p<0.05$), and higher income (Fisher's exact test, $p<0.001$) were all significantly associated with greater knowledge of e-hail. In terms of race, a higher percentage of respondents who identified as Black reported no e-hail knowledge ($\chi^2(6)=12.7$, $p<0.05$) than those who identified as White or another race. Reporting higher satisfaction with one's current transportation mobility was also weakly, but statistically significantly related to greater e-hail knowledge ($r(605)=0.13$ $p<0.01$).

As noted earlier, the categories for e-hail use greater than *none* were combined together due to low cell counts. Only 1.7% of the participants had used an e-hail app to arrange a ride. Of the demographic characteristics, only gender was significantly related to use ($\chi^2(1)=7.5$, $p<0.01$), with older men reporting more use than older women (4.7% compared to 1.1%, respectively). Age, education, relationship status, income, race, and transportation satisfaction were all assessed, but were not found to be significantly related to actual e-hail use.

When asked about the extent to which they rely on various transportation modes (including e-hail) to meet their current transportation needs, only 3.3% of participants indicated anything higher than “none” for e-hail. Using the original 5-point scale on which reliance was measured, that corresponds to an average of 0.07 (0=None, 4=All), the lowest of all the modes assessed (see Table 2). Driving was by far the most popular mode choice ($M=3.06$, $sd=1.46$), followed by rides with others ($M=1.84$, $sd=1.41$), walking for transportation ($M=0.45$, $sd=0.99$), using buses ($M=0.37$, $sd=0.91$), specialized transport ($M=0.34$,

[1]Although contact information was requested only for potential respondents up to 84 years old, we received data from one respondent who reported an age of 92. This may have been due to an error in their birthdate on the registry, or someone other than the intended respondent may have filled out the questionnaire.

sd=0.95), taking taxis (*M*=0.27, *sd*=0.78), and using mass transit (*M*=0.27, *sd*=0.80). Differences in demographics and other factors were also assessed between those who rely on e-hail to meet at least *a little* of their transportation needs and those who do not, but no statistically significant differences were observed.

Current drivers were also asked about using various transportation modes (including e-hail) in the future when they can no longer drive. When asked about how well e-hail could meet their future transportation needs, how comfortable they would be using it, and how likely they would be to use it, respondents averaged 0.6, 0.8, and 0.7, respectively, using the 5-point scale (that ranged from 0-4). Getting rides with other drivers was the most popular choice by far (averaging between 2.6 and 3.2 on the three questions), compared to all the modes assessed.

As described earlier, the three items assessing future e-hail expectations were combined into a single variable, and its relationships with the predictors of interest, as well as current e-hail knowledge, were assessed. Current e-hail knowledge ($r(517)=0.45$ $p<0.001$) and current e-hail use ($r(531)=0.21$ $p<0.001$) were both statistically significantly associated with future expectations about e-hail. In addition, older age was significantly related to lower future e-hail expectations ($r(539)=-0.17$ $p<0.001$), while education ($r(539)=0.11$ $p<0.01$)and discussing transportation with others ($r(533)=0.10$ $p<0.05$) had weak but significant positive associations. Income and future e-hail expectations were statistically significantly related to each other($F(2,496)=4.27$ $p<0.05$), with participants in the highest income group reporting higher future e-hail expectations than respondents in the middle and low income groups. No significant differences were observed between future e-hail expectations and gender, race, relationship status, or current transportation satisfaction.

3.2.2 Multivariable findings—Several regression models were fit regressing each of the outcome variables on the predictors of interest. Initial models included age, gender, race, education, income, relationship status, driving status, discussing transportation with others, and current transportation satisfaction (the model about future expectations also included current e-hail knowledge). The results of the model assessing predictors of current *e-hail knowledge* are shown in Table 3.

The table includes parameter estimates, standard errors, *t*-values, and significance levels for each variable. Age, gender, education, transportation satisfaction, and discussing transportation with others were all independently associated with e-hail knowledge, while income was marginally significant in the model. Race, relationship status, and driving status had very large *p*-values and were not retained in the final model.

The results suggest that for every five-year increase in age, e-hail knowledge was 0.10 points lower, after controlling for the other variables in the model. Compared to older women, older men's e-hail knowledge was 0.26 points higher ($p<0.01$). There were also significant differences by education; respondents with some college ($\beta=0.25$, $p<0.01$), a college degree ($\beta=0.29$, $p<0.01$), and more than a college degree ($\beta=0.28$, $p<0.01$) all had significantly more e-hail knowledge compared to those with a high school diploma or less. Current transportation satisfaction had a small but significant positive relationship with e-hail knowledge (β=0.07, p<0.05), as did discussing transportation with others (β=0.08, p<0.01). Income was marginally significant, showing greater knowledge for those in the highest income group, compared to the lowest (β=0.22, p=0.09).

Logistic regression was used to assess current *e-hail use* and *reliance on e-hail* for transportation. For e-hail use, only gender showed a significant relationship (β=1.94, odds ratio=7.01, p=0.01). This finding suggests that the odds of older men using e-hail were about seven times higher than older women. In the model with e-hail reliance as the outcome, gender was once again the only predictor that reached the significance level cutoff (β=1.19, odds ratio=3.29, p=0.02). It is likely that the lack of variability in the dependent variables in both of these models played a role in these limited findings.

Finally, a model was fit regressing *future e-hail expectations* on all the factors described earlier, with current e-hail knowledge as an additional predictor. In the final model (R^2=0.23), only age and current e-hail knowledge were significant. For every five-year increase in age, scores on the future expectation scale (which ranged from 1-5) decreased by 0.09 points (p=0.02). Current e-hail knowledge was assessed as a categorical variable, using *no knowledge* as the reference group. Compared to that group, having a little knowledge (β=0.78, p<0.001), some knowledge (β=1.19, p<0.001), and a lot of knowledge (β=2.10, p<0.001), were all highly related to large differences in future e-hail expectations.

4. Discussion

The primary goals of this study were to assess older adults' e-hail knowledge, use, reliance, and future expectations, by testing several hypotheses related to those issues. Specifically, we wanted to determine 1) whether demographic patterns related to e-hail and older adults would follow similar patterns as observed within the general population; 2) whether greater satisfaction with current transportation mobility was associated with lower e-hail knowledge and use; and finally, 3) whether current e-hail knowledge would be the strongest predictor of future expectations about e-hail. The findings provided support for the first and third hypotheses, but did not support the second.

Both previous research (Smith, 2016) and findings from the current study suggest that the vast majority of older adults do not currently use e-hail as a regular mode of transportation. Depending on how the question was asked, between 1.7 and 3.3% of older adults in this sample had used e-hail, and almost 75% of the sample reported no knowledge of this transportation mode. Although both of our estimates suggest that very few older adults use e-hail services, the estimates of 1.7% and 3.3% are not identical. The estimate of 1.7% resulted from specifically asking whether respondents had used e-hail to arrange a ride; the 3.3% estimate was for reported reliance on e-hail as a transportation mode, and was asked along with several other modes. The question wording used to measure the latter may have resulted in more of an approximation of use and *potential* use combined. Nevertheless, our low overall estimates of use were fairly consistent with the national estimate of e-hail use by older adults (4%) reported by the Pew Research Center (Smith, 2016). The lack of awareness reported among older adults in our sample (75%) was much higher than the 33%

reported among *all age groups* in previous research (Smith, 2016), but that study did not report those results for older adults specifically.

The low use of e-hail among our respondents could be related to a difference in access, rather than a preference for other modes. Until recently, Uber and Lyft required use of a smartphone and internet access to arrange a ride. However, estimates for 2016 suggest that only 64% of older adults use the internet (Pew Research Center, 2017a), and only 42% have a smartphone (Pew Research Center, 2017b). By contrast, 74-92% of middle-aged and young adults have a smartphone. Without access to this technology, older adults may not have the opportunity to learn about e-hail or use it if they wished to try it.The cost of e-hail may also play a role in limiting access. Although using e-hail is often less expensive than a traditional taxi service (Ride Guru, 2017), it may still be cost-prohibitive for some older adults. Future research should continue to assess changes in knowledge and use, and also explore the underlying reasons for lack of use.

Unsurprisingly, a greater number and percentage of older adults reported knowledge of e-hail than actual use. The results of the regression model found that younger age, male gender, higher education, higher income, reporting higher satisfaction with one's current transportation mobility, and discussing transportation with others all predicted more e-hail *knowledge*, echoing research on all age groups, and supporting our first hypothesis. Male gender was also significantly related to e-hail *use*. Several of these factors may be explained by differences in access, as suggested above. People with higher educations and incomes, for example, report more internet access (Pew Research Center, 2017a), and are likely to have more disposable income to spend on smartphones. Indeed, research on older adults specifically has found a positive association between socioeconomic status and technology use (Elliot, Mooney, Douthit, & Lynch, 2014).

It is well established that older age is related to less use of technology, even within the older adult subgroup (see e.g., Anderson & Perrin, 2017). Older age is also associated with taking fewer trips per day away from one's home (Federal Highway Administration, 2009). Either of these factors could explain the age differences observed here. The relationship observed between gender and e-hail may also have multiple explanations. Men take more trips per day than do women (Federal Highway Administration, 2009), particularly in older adulthood, which could increase their likelihood of using (and needing to use) e-hail. Men also tend to have somewhat more favorable attitudes toward technology than women (Cai, Fan, & Du, 2017; Goswami & Dutta, 2016), which could also explain this difference. Given that using e-hail involves taking a ride with a stranger in an environment than may be perceived as less regulated than a taxi service, safety concerns about this mode have been cited (Feeney, 2015; Rogers, 2015), which could affect women more than men.

Consistent with previous research on people of all ages (Smith, 2016), we did not find a difference in e-hail knowledge, use, or future expectations by race, in any of our adjusted regression models. Respondents who identified as Black/African American comprised a large proportion of our sample, and we would argue that this group may one of the most important groups to study when it comes to e-hail knowledge and use. Older adults who identify as Black are more likely to reduce and stop driving than older White adults (see e.g., Choi, Mezuk, Lohman, Edwards, & Rebok, 2012; Vivoda, Heeringa, Schulz, Grengs, & Connell, 2017), which can leave them with limited forms of available transportation options. Given that e-hail is often less expensive than a traditional taxi service (Ride Guru, 2017), African Americans in an area like Detroit may actually be a group that could benefit most from such a service, particularly given that our study assessed future expectations about using e-hail.

Transportation satisfaction was also significantly related to e-hail knowledge. Contrary to our second hypothesis, reporting greater transportation satisfaction was associated with greater e-hail knowledge. Having more knowledge about different modes of transportation (like e-hail) may make people more comfortable with their potential options, and thus more satisfied with their transportation mobility overall.

4.1 Conclusions

A key focus of research on older drivers has been to assess crash and injury risk, driving reduction, and driving cessation. Too little focus has been on understanding viable alternatives for older adults who can no longer safely drive themselves. Continuing to develop and understand such alternatives is important, particularly since autonomous vehicles will likely not be readily available and affordable for many decades to come (Jeon et al., 2016; Milakis, Snelder, van Arem, Homem de Almeida Correia, & van Wee, 2017).

In order for e-hail services to become a more viable driving alternative for older adults, their continued evolution, like Lyft's Concierge program (Lyft, Inc., 2016) and Uber's new feature that allows an individual to schedule a ride for someone else (Hartmans, 2017), will be necessary. Pairing those changes with other novel transportation programs like GoGoGrandparent (GoGoGrandparent, 2017), ITNAmerica (ITNAmerica, 2017), and Liberty Mobility Now (Liberty Mobility Now, 2016), will all help reduce the transportation burden faced by older adults and their families.

The results of this study also have policy implications. Such a low use rate overall suggests that potential clearly exists for this mode to help with older adult mobility. At the organizational level, state departments of motor vehicles could provide information to older adults about e-hail as a transportation option. Policies could require the elimination of one's driving privileges to be paired with providing information or training about a reasonable alternative, like e-hail use. Some public organizations may be reluctant to provide training for private services, but we believe that any viable mode of transportation, public or private, should be considered, to fill the mobility gap older adults experience, particularly if there is no reasonable public transportation alternative available. Providing such training could be enough to make a difference in older adults' use, given that current knowledge strongly predicted future e-hail expectations (which provided support for our third hypothesis). Information and/or training could also be provided at doctors' offices, senior centers, or hospitals. Overall, e-hail services will not be able to immediately or completely meet the transportation needs faced by older adults, but may be one important way to begin filling some of that gap.

4.2 Limitations and strengths

There are some limitations to this study that must be acknowledged. It was cross-sectional and therefore only associations between factors could be assessed, not causality. Additionally, using participant registries to develop the sampling frame did not allow for a sample to be drawn that was representative of the total population. The list registries were housed at universities in Detroit and Ann Arbor, Michigan, which resulted in respondents from those areas. To provide some context for these areas, Detroit is an urban city, the largest in Michigan. It has a population of about 707,000 people, with a racial composition that is approximately 82% Black, 8% White, and 7% Hispanic (Statistical Atlas, 2015a). Ann Arbor is more suburban, with a population of about 115,000 people, about 70% of whom are White, 14% Asian, 8% Black, and 4% Hispanic (Statistical Atlas, 2015b). Using respondents from these specific areas limits the generalizability of the results, thus future research should assess e-hail in another part of the country, or where the transportation environment differs (e.g., more public transit options). In addition, the registries could have introduced some self-selection bias, and may have contributed to a conflation of factors like race, income, or urbanicity. Finally, this study was only able to determine rates of knowledge, use, etc. of e-hail, but could not assess the underlying reasons for the observed differences.

This study also has several key strengths that should not be overlooked. The sample contained a relatively large number of older adults, with an excellent overall response rate. Using the participant registries allowed for underrepresented racial minorities to comprise a large proportion of the sample, which is less common in research. Although the racial composition of our sample is not typical of most research, national estimates among all age groups suggest essentially no difference in e-hail use by race (Smith, 2016). Finally, to our knowledge, this study represents the first to assess differences in e-hail use among older adults, a necessary first step toward assessing the potential of this transportation mode in the lives of older adults.

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Table 1

Frequencies and percentages of e-hail knowledge by demographic characteristics

	None		A Little		Some		A Lot	
Variable	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
E-hail knowledge	519	74.0	127	18.1	42	6.0	13	1.9
Age***								
65 to <70	100	64.9	37	24.0	14	9.1	3	2.0
70 to <75	147	68.7	40	18.7	20	9.4	7	3.3
75 to <80	135	77.6	32	18.4	5	2.9	2	1.2
80+	137	86.2	18	11.3	3	1.9	1	0.6
Gender*								
Female	435	76.3	95	16.7	31	5.4	9	1.6
Male	66	61.7	27	25.2	10	9.4	4	3.7
Race*								
Black	418	76.8	84	15.4	32	5.9	10	1.8
White	78	63.9	33	27.1	9	7.4	2	1.6
Other	19	65.5	8	27.6	1	3.5	1	3.5
Income***								
<$25,000	192	82.1	27	11.5	12	5.1	3	1.3
$25,000-99,999	259	71.8	74	20.5	24	6.7	4	1.1
≥$100,000	23	57.5	11	27.5	3	7.5	3	7.5
Relationship status*								
Married/partner.	146	66.1	54	24.4	14	6.3	7	3.2
Divorced/separ.	163	75.5	31	14.4	18	8.3	4	1.9
Widowed	156	80.0	30	15.4	7	3.6	2	1.0
Single	39	73.6	11	20.8	3	5.7	0	0.0

Notes: n = sample size; % = percentage; due to rounding, some rows may not total 100%.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

Table 2

Reliance on various modes for current transportation need

Variable	*n*	Mean	*sd*	95% CI	
				Lower	Upper
Driving	695	3.06	1.46	2.95	3.17
Rides with others	676	1.84	1.41	1.73	1.94
Walking	677	0.45	0.99	0.37	0.52
Buses	673	0.37	0.91	0.30	0.44
Specialized (paratransit)	676	0.34	0.95	0.27	0.42
Taxis/cabs	673	0.27	0.78	0.21	0.33
Mass transport (e.g., rail)	676	0.27	0.80	0.21	0.33
E-hail	670	0.07	0.43	0.03	0.10

Notes: values ranged from 0-4; n = sample size; sd = standard deviation; CI = confidence interval

Table 3

Regression results for e-hail knowledge

Variable	*β*	SE	*t*-value
Age (5-year increments)	-0.10	0.03	-4.16***
Gender (ref=female)			
Male	0.26	0.08	3.24**
Education (ref=HS or less)			
Some college	0.25	0.09	2.87**
College degree	0.29	0.10	2.92**
> college degree	0.28	0.09	3.14**
Income (ref=<$25,000)			
$25,000-99,999	0.02	0.07	0.23
≥$100,000	0.22	0.13	1.71†
Transportation satisfaction	0.07	0.03	2.42*
Discuss transportation	0.08	0.03	3.10**

Notes: β = parameter estimate; SE = standard error.

† $p < 0.10$.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.