Which Barriers Prevent Seniors from Accessing Transportation Network Company (TNC) Services? Identifying Ways Forward for a Gendered Policy Approach
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Manish Shirgaokar*
Assistant Professor
Urban and Regional Planning Program
1-26 Earth Sciences Building, Department of Earth & Atmospheric Sciences, University of Alberta, Edmonton, AB, Canada T6G 2E3
Phone: 780-492-2802
Fax: 780-492-2030
E-mail: shirgaokar@ualberta.ca

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ABSTRACT

North America is ageing as baby boomers begin to enter the senior demographic. Seniors today drive more than previous cohorts—particularly older women are driving at higher rates. As driving ceases over time, however, seniors risk social isolation and dependency given their location in suburbs with limited public transit, an un-walkable environment, and few public amenities nearby. This paper investigates if Transportation Network Company (TNC) services present a viable alternative for seniors' mobility. Relying on mixed methods including in-person structured interviews (n=76; women:men = 44:32) and four gender-separated focus groups (n=24; women:men = 15:9) conducted during 2015-16, this research uncovers gender-specific aversion to using—and barriers to accessing—TNC services in seniors from Edmonton, Canada. This exploratory study is designed to cover both warm and winter months to examine seasonal variation.

The findings indicate two principal barriers: ambiguity and risk averseness about TNC services and financial transactions, and technology challenges for online hailing. Older women are more likely to seek training and try TNC services than older men. Both genders express greater willingness for riding incumbent services including transit, taxis, and paratransit when mobility issues increase. Stated responses analyzed across seasons indicate self-censoring of driving and fewer trips during winter months, suggesting the need for higher supply of mobility tools for colder seasons and locations. This investigation indicates a need for outreach and seniors' training at the local level. TNC providers can overcome barriers with senior-specific operator training, visually identifiable branding, and partnering with public/private agencies working with seniors.

Keywords: Gender; Mixed methods; Mobility tools; Senior; Transportation Network Company (TNC)

"Well, it's a taxi. You can call it apparently and they'll pick you up. The costs are really reasonable. But I think that they don't have insurance, so if you're in an accident or something... That's probably what would concern me. I don't think I would ever use it. I would just use a regular cab because I take them so little."

"The thing that bothers me is you have to pay online, and number one I refuse to do that with anything. Somebody said to me once 'well one day you're going to have to bank online' and I thought 'well not in my lifetime.'"

– Senior Female (active)

1. INTRODUCTION: SENIORS AND THE NEED FOR TRANSPORTATION SERVICES

The first group of baby boomers (born 1946-64) became seniors in 2011 indicating the start of a significant demographic shift in the developed world. Given the policy implications of an ageing population in OECD countries, there has been a concerted effort to understand the needs of this large and growing demographic (*1*). Scholars have come up with methods of categorizing the senior population based on various attributes such as mobility tool usage (private car, transit, walking, bicycling), (dis)ability, health, income, gender, and attitudes (*2*, *3*). This paper relies on a more direct age-based classification (*4*), specifically focusing on three age categories, namely, active seniors (age $\geq$ 65 but <75), stable seniors (age $\geq$ 75 but <85), and frail seniors (age $\geq$ 85)—divided further across gender. Anecdotal evidence suggests that older women are impacted differently than older men as they age, particularly with reference to transportation-based needs—hence, the focus on women in this investigation.

Research indicates that the baby-boomer generation is more likely to be outgoing (*3*, *5*)—though scholars caution that there is considerable heterogeneity in the senior population (*1*, *2*). Baby-boomer seniors will likely engage in more pursuits including utilitarian and discretionary activities such as clubs and social group meetings in coffee shops or food courts (*6*, *7*). This will require transportation beyond the walking zone of the home location, which is likely to be in a suburban setting. There is some likelihood that not just the baby-boomer active seniors but also some stable (and even frail seniors) today are gradually shifting to other modes of transportation as they stop driving automobiles. These alternative modes go beyond relying on family and friends for rides, and can be classified as technology-enabled services (*8*).

Communities aware of the growing demands in senior populations are already investing in programs. Existing best practices, however, do not cater to all segments of the senior population and often target those with disabilities (*3*). Arguably self-driving vehicles may change the nature of auto-dependability for seniors over time. This investigation, however, grapples with current possibilities; the objective is to investigate if Transportation Network Companies (TNC) services such as Lyft and Uber are realistic options to enhance seniors' mobility. This paper asks: which enabling policies have the capacity to make TNC services a viable mobility tool for seniors *today*?

1.1 Ageing-in-Suburbia and Seniors' Travel Behaviors

Scholars caution that the idea of seniors downsizing and moving back to cities is unreasonable (*5*). The decision to remain in a location for seniors is contingent on feeling at home—a

phenomenon Stafford (*7*) argues is based on memory and sociability, which establish a deeper relationship between seniors and their neighborhood environment. For much of North America, given its preference for suburban development, this means aging-in-suburbia both for seniors today and those who are not yet seniors (*9*). Smith et al. (*10*, Table 4) estimate that 19% of suburban households will have one disabled senior by 2020; a finding that has important implications for the transportation needs of North Americans. Many seniors, particularly those who cease driving, are therefore likely to face social isolation, high levels of dependency, and risk of depression. Further health impacts from suburban living are also likely to impact seniors due to obesity and limited access to physical activities (*11*).

Suburban locations result in transportation deficiency for seniors, especially for non-driving seniors. Greater diversity of activity locations, however, reduces this effect according to analysis on survey data collected by the American Association of Retired Persons (*12*). Trends analysis shows that seniors have been driving longer both in terms of time and distance, and making more trips as drivers and passengers (*5*, Table 4.2). Seniors travel farther distances to engage in various activities due to poor modal accessibility; a function of the land use patterns in the National Capital Region of Canada (*13*). Network path buffers based on activity diaries, however, show that seniors have smaller activity zones overall compared to working adults—zones are even smaller for those not driving and for low-income individuals (*14*).

In the North American senior population, there is a higher percentage whose mode of travel is automobile-related—about 90% for drivers and 65% for non-drivers, while most others rely on transit and walking (*15*, Table 2). Shaheen (*8*) presents an overview of how transit is an unlikely option for many seniors given their location in suburbs, unfamiliarity with system characteristics, physical challenges, safety concerns, and unwillingness to ride on transit—reasons often limiting the general population from using transit. Seniors, specifically, do not prefer walking long distances to transit—drivers more than non-drivers—and a lack of knowledge about the system brings down transit use significantly (*16*). Many seniors depend on family and friends for rides, with those in rural geographies relying almost entirely on their personal network since there are few transit services. Seniors without access to transportation options, including the inability to drive, often have a lower quality of life; as do seniors with low incomes and those from minority racial groups (*12*).

1.2 Focus of this Investigation

The future may not be bleak, however, since research shows that access to varied travel alternatives, information about these options, and independence with respect to mobility improves the quality of life for seniors (*17*). There have been changes in transportation supply that can be leveraged to fill the gaps in the mobility needs of seniors in the near future. A diverse array of alternatives with intelligent transportation services and dynamic ridesharing platforms (*8*)—some similar to a taxi model when analyzed as TNC services—may have the potential to extend mobility to seniors at a relatively low cost to providers and affordable price to consumers. Given the burst of technology-enabled alternatives, this paper asks two interlinked research questions: What is the nature of current demand for TNC services in the senior demographic? What are the barriers to using TNC services in the senior population today? To answer these questions, a mixed methods research strategy is employed using in-person structured interviews and focus groups with seniors in Edmonton, Canada.

2. LITERATURE: RECENT RESEARCH PROGRESS

This review is not intended to summarize the extensive scholarship on seniors and transportation, but to focus on recent developments in key areas that are relevant to this investigation. In contrast to research on seniors' travel needs there is limited scholarship on TNC services currently. The objective, therefore, is to gain insights from combining TNC services with taxis and ridesharing—likely candidate modes for increasing seniors' mobility. The category of suburbs and transportation gaps is used as a frame for the paper; three other areas of research are summarized below.

Driving and Seniors: Research suggests that seniors limit driving because of fewer places to go to and self-censoring rather than needing to stop driving (*4*). Dobbs (*11*) distinguishes between the general perception that seniors need to stop driving due to diminishing "sensory, motor, or cognitive abilities"—which is true at the extreme end (also *4*)—and diminishing functional abilities resulting from age-based health conditions and medications used. There is emerging consensus among researchers about letting seniors drive as long as possible (*2*, *11*, *12*, *14*). Recent investigations, however, show that though seniors' tendency to drive goes down as they retire their leisure trips increase (*18*). Yet seniors tend to spend less time traveling out of home, going less frequently, and to a fewer diverse locations as they age—particularly lower income has a negative impact (*4*, *19*). Seniors also tend to make more utilitarian stops, with older women making more complex shopping tours than older men (*20*).

Older Women: There are differences between older women's and older men's transportation needs linked to safety (*15*). Research shows that almost as many baby-boomer older women drive as men, though older men drive more overall (*5*). Older women are likely to need mobility not just for leisure but also for maintenance tasks for their own households and those of their parents and children (*18*). Yet trip rates are higher for older men who drive, and higher for older women who are non-drivers (*5*). Women who choose not to retire end up driving more, but older women overall report less driving due to lower confidence (*4*, *18*). Older women are also more dependent on their partners for trips if they do not drive (*15*)—with large negative impacts when their partner ceases driving (*21*). A review of existing practices found that most programs for seniors are not designed for specific sub-groups. For example, transit education is geared to women (*21*) but programs that encourage maintenance of driving skills for older women are rare (*3*).

Alternatives to Driving: Demand responsive transport services (DRT) or flexible transport services (FTS) using smaller car-like vehicles present options to increase door-to-door transportation for specific populations including seniors in rural geographies (*22*, *23*). Institutional and financial challenges, however, have limited the growth of these services. Ridesharing is another alternative that has been around since the 1940s (*24*), and locations with high common origin-destination trip pairs can have sizeable markets (*25*). A shared taxi model, changing some of the rules within the heavily regulated industry—a legacy of the post-depression era (*26*)—could also increase travel options in low-demand geographies (*27*).

Furuhata et al. (*28*) provide a conceptual framework of unorganized and organized forms of ridesharing, with a focus on prearranged rides made possible by technology. TNC services are not ridesharing services based on this framework since, similar to a taxi, matching is one-sided;

yet researchers show that there are significant differences between TNC services and taxis (*29*). Technology has made it possible for TNC providers to overcome multiple challenges including lag-time in ride matching and thin markets—scaling up one-sided ridesharing and making it more efficient than taxis (*28*, *30*). Researchers caution that new technology-enabled hailing can lead to monopoly and collusion in this market (*26*). Whether TNC services should be regulated or not, unfortunately, remains an ideological rather than an evidence-based debate given the lack of data (*31*).The TNC mode today represents a feasible option for the mobility of many groups, yet remains largely attractive to those comfortable with technology including younger college-educated individuals making discretionary trips (*29*).

The value of TNC services is still largely up for debate and scholars are struggling with understanding this mode in a data vacuum. TNC services may offer a promising way forward but given their recent arrival there is a gap in linking the needs of specific sub-groups with TNC services—a gap this paper addresses for the senior population.

3. CASE: EDMONTON AND TNC SERVICES

Edmonton, a city of about 880,000 according to a recent municipal census (*32*), is located in the province of Alberta in Canada—12.4% of the city population is seniors ($\geq$ 65 years). Edmonton Transit System, the local public transit agency, runs LRT, buses, and paratransit services in the city, with three kinds of discounted passes for seniors: monthly passes for C$ 14.50, annual passes for C$ 128.75, and annual low-income senior passes for C$ 55.75. A monthly adult pass is C$ 91.50 in comparison; no annual adult passes are available. The paratransit service, dubbed Disabled Adult Transit Service (DATS), is for all adults with physical or cognitive disabilities—a ride can be booked three days in advance and up to the day until noon. DATS services cost C$ 3.25 per ride, C$ 24.75 for 10 ticket booklets, and C$ 91.50 for a monthly pass. A variety of other options exist for seniors who do not drive including services by public agencies (e.g., Canadian Cancer Society for medical appointments only), private vendors (e.g., Driving Miss Daisy), and seniors organizations (e.g., Seniors Outreach Network Society). Five taxi companies also offer transportation services—three have wheelchair accessible vehicles (*33*).

Two TNC services currently operate in Edmonton: TappCar and Uber. TappCar is a small local company with more visually recognizable branding on their operator vehicles; in comparison Uber is a global company with little brand identification on its vehicles. TappCar has been in operation since March 2016 in Edmonton, while Uber has been operating since December 2014—barring some gaps in provision due to legal challenges. Similar to many cities globally, Edmonton has struggled with legislating TNC services, amid vigorous lobbying against the services by incumbent taxi operators. Following the California Public Utilities Commission (*34*) decision to regulate TNC services, several North American governments—both local and provincial/state—have enacted similar laws. The Province of Alberta recently enacted the *Transportation Network Companies Regulation*, which focuses on insurance liability minimums, licensing, and police information check along with a vulnerable sector search (*35*). The *Vehicle for Hire Bylaw* (*36*) in Edmonton has also been updated recently to equalize regulatory burdens on taxis and TNC services. These laws focus on licensing, easily visible display of information, driver conduct, fares, and numerous other obligations (*36*).

4. RESEARCH METHODOLOGY AND SAMPLE CHARACTERISTICS

Interviews and focus groups have been used as research methods by investigators studying seniors' needs, choices, and behaviors (*6*, *21*). The present study proceeded in two stages with in-person structured interviews (n=76; women:men = 44:32) conducted between September 2015 and March 2016 in the first stage covering both the warm and winter months. This instrument had questions in the following categories: general travel behavior, opinions about travel modes, Likert-scale items about comfort using technology and online financial tools, socio-economics, and open-ended questions. Four focus groups (n=24; women:men = 15:9) were conducted in May 2016 in the second stage—two each with men and women. The focus group instrument was designed to elicit wide-ranging responses specifically about barriers to using TNC services. The focus groups enabled confirmation of responses regarding TNC services from the interviews and the addition of a thick description about the mode of interest for this investigation (*37*). Validation was achieved by comparing responses from warm and winter months on many questions and through peer review.

Before the interviewing began, the Edmonton Seniors Coordinating Council put out an announcement about this study in its weekly newsletter. The researchers also put up flyers with the team's contact information at locations such as senior centers. In the following weeks researchers approached individuals directly in local senior centers, food courts, and coffee shops, and contacted senior family members who participated in this study—after giving informed consent—often referring the interviewer to other seniors they knew. Thus, a combination of intercept and snowball methods was used to recruit interviewees and focus group participants. The criterion for participant inclusion was age ($\geq$ 65 years) and the recruitment procedure was adjusted as the study proceeded to enable quota sampling across the primary gender groups and age cohorts (see Table 1). The team discovered that older women were more willing to participate in the study compared to older men. Therefore, during the latter half of the interview stage the team's primary recruitment focus was on older men in the three age cohorts. During the informed consent procedure for the interviews, seniors were asked if they would be willing to participate in a focus group discussion. No payments or gifts were provided during the interview stage; lunch was provided for participants who attended the focus group sessions. Readers should note that the convenience sampling used limits generalizing the findings of this research to the population. Nevertheless, this exploratory study sets up a basis for more rigorous future investigations.

Table 1 Gender across Age Cohorts in the Population and Interview Sample

	Active Seniors (age ≥ 65 but < 75)	Stable Seniors (age ≥ 75 but < 85)	Frail Seniors (age ≥ 85)	Total Seniors
Population Characteristics				
Older women	25,819	16,208	7,713	49,740
Older men	23,057	12,526	4,537	40,120
W/M	1.1	1.3	1.7	**1.2**
Interview Sample Characteristics				
Older women	21	14	6	41
Older men	20	9	3	32
W/M	1.1	1.6	2.0	**1.3**
Distribution across seasons				
Warm months (W/M = 1.2)				
Older women	11	10	2	23
Older men	11	7	1	19
Winter months (W/M = 1.4)				
Older women	10	4	4	18
Older men	9	2	2	13

Notes: (1) Population figures are from city census 2014 (*32*); non-responses are not included. (2) Three interviewees did not report age; total interviewees, hence, are 41 + 32 + 3 = 76.

The research was designed along three dimensions: age cohorts, genders, and seasons. Table 1 compares the interview sample to Edmonton's population. Overall the ratio of women to men interviewees (1.3) is close to the population ratio (1.2). This ratio increases as age goes up in the sample, which is also reflected in the general population. Women, however, are slightly over-represented in both the interview and focus group samples, as well as in the winter months. 58% of the interviewees and 63% of the focus group participants were older women.

In the interview sample, 54% were active seniors, 30% were stable seniors, and 12% were frail seniors—4% were undeclared. Of the sample, 54% lived alone, 36% lived with a partner/friend, and 5% each lived with family or in an assisted senior facility. Three interviewees indicated that they were primary care givers for their spouse. Households were small (mean=1.4; SD=0.1) and average monthly costs were about C$ 1,110 (SD = C$ 120)—mean monthly cost breakdown was 54% rent, 23% food, 11% utilities, 6% transportation, 4% medical expenses, and 2% miscellaneous costs.

5. DISCUSSION OF FINDINGS

5.1 Differences between Sub-groups

Fewer older women (39%) drove an automobile than older men (69%) [χ^2 (1, 76)=5.57, p=0.02]. Half the number of interviewees drove in the winter (32%) compared to the warm months (64%) [χ^2 (1, 76)=6.38, p=0.01]. Overall, paratransit (8%) and TNC services (1%) were not preferred travel modes based on stated use. 97% older men and 86% older women interviewees said they had heard about TappCar and Uber in Edmonton. Yet only one senior man reported riding a TNC service set up by a family member when visiting another city, while another senior man said he had created an account but never used the service.

Table 2 lists independent sample t-tests conducted across gender groups for the interview sample. Examining average driving confidence across gender groups shows that older men drivers' stated confidence was higher than women drivers' in winter months; mean driving

confidence levels between genders did not differ in the warm months. Average weekly trip frequency as car driver was different and statistically higher for older men in both warm and winter months compared to older women. Mean weekly trip frequency as car passengers, however, was comparatively low for both genders; though statistically not different between the two sexes in either warm or winter months. Reported average weekly taxi rides were even lower though statistically speaking older women used taxis more than older men. Average reported transportation costs were higher for older men than older women, though these differences were not statistically different on the t-test.

Stated mean comfort level with using technology on all items except phone banking was lower for older women. This may be a function of under-stating by older women in the sample; this finding agrees, for example, with the finding of lower confidence levels reported by older women for driving (*4*). Alternatively this may be due to more older men in the sample having been active working adults with access to some forms of technology; more so than women in these particular age cohorts. Independent sample t-tests showed that older men were statistically more comfortable with online banking ($p=0.066$), paying bills online ($p=0.049$), and using a smart mobile phone with apps ($p=0.013$).

Word frequency analysis of responses to open-ended interview questions across age cohorts, gender, and seasons validated many of the quantitative findings—other salient findings are reported below.

- Travel mode: Across both seasons older women reported traveling by transit more often than older men. Walking was frequently stated as a travel mode across all age, gender, and seasonal divides.
- Trip purpose: Active seniors reported a large set of trip purposes including utilitarian (e.g., appointments and shopping/groceries) and discretionary (e.g., social/friends and indoor/outdoor recreation). Stable seniors also reported utilitarian but fewer discretionary trip purposes; frail seniors largely made utilitarian trips. Older women reported a slightly greater diversity in trip purposes including family, volunteering, visiting, and more maintenance trips (e.g., shopping). Trip purposes were more varied in the warm seasons as expected.
- Taxi use: Taxi use was limited; interviewees stated using taxis to access the airport—Edmonton's airport is 30 kilometers south of the city center and has little transit connectivity—and some late evening intra-city use. Among older women who reported using taxis, trip purposes included general appointments, doctor visits, and grocery runs during inclement weather. There were 27 word instances of older women using taxis for various trip purposes and 10 occurrences by older men for airport and night-time trips. Interviewees generally stated that taxis were expensive for longer trips and off hours, but services were reliable and drivers were professional. Older women had fewer positive comments than older men but reported feeling safe in taxis.

Table 2 Independent Samples T-tests Across Gender

	Female			Male			Levene's Test for Equality of Variances		t-test for Equality of Means		
	N	**Mean**	**Std. Dev.**	**N**	**Mean**	**Std. Dev.**	**F**	**Sig.**	**t**	**df**	**Sig. (2-tailed)**
Transportation											
How confident do you feel when driving in warm months?[1](only drivers)	17	4.650	0.606	23	4.740	0.449	1.761	0.192	-0.552	38	0.584
How confident do you feel when driving in winter months?[1](only drivers)	16	3.630	0.885	23	4.350	0.775	0.084	0.773	-2.703	37	**0.010**
Weekly trip frequency - Car Driver (Warm months)	42	1.601	2.126	32	3.281	2.797	4.778	0.032	-2.831	56	**0.006**
Weekly trip frequency - Car Driver (Winter months)	41	1.470	2.034	31	3.323	2.701	4.978	0.029	-3.196	54	**0.002**
Weekly trip frequency - Car Passenger (Warm months)	42	0.795	1.666	32	0.760	1.387	0.028	0.867	0.096	72	0.924
Weekly trip frequency - Car Passenger (Winter months)	41	0.747	1.455	31	0.657	1.346	0.040	0.843	0.267	70	0.790
Weekly trip frequency - Taxi (Warm months)	42	0.071	0.186	32	0.008	0.044	14.642	0.00	2.144	47	**0.037**
Weekly trip frequency - Taxi (Winter months)	41	0.146	0.311	31	0.008	0.045	27.271	0.00	2.807	42	**0.008**
Transportation Cost Per Month (C$)	41	55.98	89.24	31	82.58	131.86	4.487	0.038	-0.968	50	0.338
Technology Use											
How comfortable are you with online banking?[1]	44	2.180	1.674	32	2.940	1.831	3.003	0.087	-1.868	74	**0.066**
How comfortable are you with online credit card use?[1]	44	2.300	1.692	32	2.810	1.768	0.291	0.591	-1.291	74	0.201
How comfortable are you with paying bills online?[1]	44	2.140	1.733	32	2.970	1.875	2.434	0.123	-1.997	74	**0.049**
How comfortable are you with phone banking?[1]	44	2.360	1.881	32	2.220	1.755	1.559	0.216	0.341	74	0.734
How comfortable are you with searching for something on the internet?[1]	44	3.160	1.584	32	3.500	1.566	0.084	0.773	-0.931	74	0.355
How comfortable are you with using a smart mobile phone with apps?[1]	44	1.730	1.188	32	2.560	1.664	9.346	0.003	-2.425	53	**0.019**

Notes: (1) Interviewees responded on 5-point Likert scale where least confident/comfortable=1 and completely confident/comfortable=5 (2) Bolded values are for $p \leq 0.10$. (4) F tests for one-way ANOVA (analysis of variance) across age cohorts were insignificant for the variables in the left-most column (not reported).

5.2 Findings about TNC services

Opinions about TNC services were collected through open-ended questions during interviews and through focus groups. The emergent themes reveal barriers that seniors—a demographic that tends to reject new technologies (*1*)—face for accessing TNC service. Quotes reported here have been edited marginally for grammar and unclear referents, which are reported in brackets. Since TappCar was not offering services for most of this study, the instruments focused on Uber.

Ambiguity about TNC Services*:* Seniors said Uber was a private or independent taxi service and were unclear about the differences between taxis and Uber. Confusion ranged from thinking that Uber is a free service to assuming that other passengers could book a ride on the same trip as you (cab-sharing). Some seniors thought on-street hailing was allowed and that the driver was to be paid directly at the end of a ride. Other seniors were unsure of how to figure out fares in advance, uncertain if the tip was extra, and perturbed with the idea of surge pricing.

Trust and Risk Averseness*:* Trust was an important theme in the interviews and focus groups; Uber was consistently viewed as being controversial. Issues raised included Uber being "unlicensed and unregulated" and having "drivers without proper qualifications." Some discussion focused on reports of surge pricing during New Year's Eve in Edmonton and sexual assaults by drivers. Seniors reported wanting to be sure of the cost of the ride by checking a meter. Lack of visual identification of service was mentioned by several older women in interviews and focus groups with specific comments that drivers should have a tag on their front window to help identify the vehicle.

"I would not feel safe; some strange guy coming to pick me up. At least when you're in a licensed taxi you've got the company. Well, I phone and make my appointments so I talk with the dispatcher. I've used the same company for a while now so when I phone they know me by name. So if I ever had a problem I'd feel comfortable going to the company with the problem, whereas with Uber there are just too many unknowns." – Senior Female (active)

Mistrust with Online Financial Transactions*:* Most seniors reported being wary of using credit cards for online transactions citing reasons related to security and possible fraud. Seniors were uncomfortable with paying for services in advance and reported that they felt safe paying for services using credit cards if they were at a store—or paying in cash—and preferred to keep a paper trail.

"I would not do it [pay for Uber]. Not even on the computer. I'm not comfortable about using my credit card on a computer... I'm not comfortable giving it [credit card] to an unauthorized taxi company." – Senior Female (undeclared age)

"The only thing that bugs me is when you pay it online I'm wondering about all these people sort of tapping into my computer. So you wonder… there's always this feeling in the back of your head 'how secure is this?'" – Male focus group participant

Technology Challenges*:* Many seniors reported having a basic cellphone for reasons related to costs—with no data but text capability—to be used in emergencies. On using computers some

said that a computer or tablet is more "a toy than a tool." Visibility challenges with screens were mentioned by some seniors. A call-based system would work better reported some seniors especially since the number could be programmed into the phone just like a taxi company, and calling provided a feeling of personal contact. On using technology-based services, a woman senior reported feeling frustration and panic. Some seniors had tried using applications on smartphones but were not comfortable with these, and reported even lower confidence with technology to hail a taxi using an application.

"Is it that they [Uber] have a number I can call? But the person doing this, must be registered for that? I'm not comfortable with it because I don't use that [smart]phone. This [basic] phone [that I have], number one I don't use too much [and] number two if I have to pay that amount of money [for a smartphone], it's not worth it." – Senior Female (stable)

"My vision isn't as strong as it used to be. When you're trying to use your cell phone outside, you can't see the darn thing. You're trying to cover it... And young people... I don't know whether they can see it or not, or whether they use radar!" – Male focus group participant

"I don't have any apps. I tried to get one…. I didn't realize Uber was an app! I'm quite interested in it… but I don't know anything about it. I listen on the news... and I'm curious as heck! And I mean they're the future in my view. The insurance issue is somewhat worrying. But I have thought to myself that I don't care about that and maybe you just take Uber."– Senior Female (stable)

Training for Using Smartphones and Applications*:* Half of the seniors in both gender groups said that they would not seek training and would not trust someone else to book a ride for them. The other half, however, indicated that they would consider training if senior centers helped with workshops on information and technology. Some reported that it would be okay the second time when booking a ride, if not the first time, and they would prefer to learn on a computer first and then on a smartphone. Participants strongly refused to pay a small fee for having someone book a ride for them citing the reason that there were fees for everything and the price of services already incorporated fees.

"Stuck with taxis, don't care if they cost more. If you don't trust them [Uber] with your information, you wouldn't want a friend or family member to give their credit card number either. Taxis are safer and regulated; the risks are too high [with Uber]." – Female focus group participant

"If the steps and procedure were set up and easy to follow, I wouldn't feel uncomfortable at all in a process like that. As long as it's laid out in front of you, like registering for any other service online. I would use a tablet… " – Senior Male (active)

"I don't know how to get to Uber. I don't have one of them smart iPhones! If I had somebody to teach me or show me, I think I would be reasonably comfortable. If I could call them on my regular phone, possibly I would use them." – Senior Male (active)

Possible TNC Service Use and Resulting Mobility Changes*:* Though many seniors reported not being interested and/or being intimidated by the technology for using TNC services, some did say that they would consider using TNC services. Seniors reported that they would learn how to book a TNC ride if needed, and it would be easier to learn with someone else teaching them. The seniors who were not interested in TNC services said they would rely on buses, and if they ceased driving or had other health issues limiting their mobility they would rely on paratransit. Some seniors said that failing mobility might incentivize them to consider TNC services; other senior drivers reported that they would consider taking TNC services for after-dark trips. A few senior women said they might consider TNC services in inclement weather for the convenience especially if they needed to carry heavy things from a store. Some respondents recognized the advantages for consumers given the widening of choices in the marketplace.

"… from a consumer's point of view, I think some forms of competition from within the industry will allow the consumer to get a fairer deal. So if these guys can be properly insured and I feel like I can get a safe trip for a little less money, then why not?" – Senior Male (active)

An analysis of responses across age cohorts and genders revealed that technology barriers and misunderstandings about what TNC services are higher with stable and frail seniors. Frail seniors and some stable seniors revealed a lack of tools—smartphone and credit cards—to access the TNC services. Older men were more comfortable with technology and online financial transactions. For some respondents, the technology barrier is not as big as the financial barrier due to exposure of hacking of personal information and credit cards fraud. Older women were somewhat more keen to learn about TNC services overall.

6. POLICY IMPLICATIONS

Alternative transportation services for seniors need to mimic the private car as closely as possible, since this demographic has been used to driving in a private car most of their adult lives. Self-censoring of automobile driving occurs in many seniors; more in older women than men and more in winter than in warm months. This indicates that in locations with cold climates and/or during the winter, demand for travel alternatives goes up in the senior demographic. Cities may consider having a different system of season-specific vehicle-for-hire licenses that are only active part of the year; thus, increasing supply in the market.

Technology-enhanced services such as TNC with the appropriate minimum standards and operators trained as senior escort service providers will likely see increased demand from the senior cohort. Evidence suggests that age cohorts going forward will be more comfortable in using technology-based services such as TNC. At present, however, the stable and frail groups need support to break down barriers, as do many of the active seniors.

- Training for use of transit and TNC services could be offered as behavioral nudges for seniors who are renewing licenses (*2*). Such training for seniors to access TNC services in the form of classroom or one-on-one training—similar to transit and paratransit (*2*)—has the potential to break the technology barrier.
- TNC providers could have decals that are easily readable, a way for a rider to see the cost on a meter either on their smartphone and/or a tablet installed in the vehicle, and provide a printed receipt of fare if requested. Visually identifiable branding on vehicles (*22*) has the potential to reduce trust issues.

- Some focus group participants identified having a separate credit card with a smaller limit just for TNC service booking as a way to reduce financial risk exposure. TNC providers might consider providing such a tool for seniors, thus, reducing the barrier for mistrust with online financial transactions.

This study and others show that older women tend not to drive as much as older men, and they ride taxi services more than men. Older women generally also report lower confidence using technology and, on average, live longer than men. These outcomes indicate that older women may be the target demographic for outreach with educational programs focused on technology in general, and TNC use training in particular. Older women may be more open to training in the use of technology for TNC ride hailing given the findings from this study. Higher levels of comfort with phone banking suggest that older women may also benefit from phone-based booking services, which could be provided by local governments, non-profit/advocacy groups, or TNC service providers.

7. CONCLUDING REMARKS

At every level of government there is a need to recognize the benefits from growth in supply of technology-enabled transportation services for the senior demographic. It is likely that with more active lifestyles and social engagement overall senior support costs could be lower for society. The likelihood of seniors leaving suburbs to live in denser urban locations is low, as is the probability that public investments will be focused on retrofitting suburbia to suit the needs of a senior population. In this milieu, autonomous cars may indeed increase mobility for seniors; meanwhile TNC services are a realistic option that can help many seniors move towards active lifestyles and social engagement. Achieving this will take concentrated effort with policies and supporting services designed from the TNC side (e.g., operator training) and/or the local government side (e.g., booking and training services)—arguably this is low-hanging fruit with large societal benefits. Not all seniors, however, will start using TNC services even with training and support services. Further studies, therefore, need to explore heterogeneous choice preferences among seniors to identify likely adopters.

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